Guidelines for Ecosystem-based Approaches to Climate Change Adaptation and Disaster Risk Reduction

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Abbreviations

CBD	Convention on Biological Diversity
CCA	Climate change adaptation
EbA	Ecosystem-based adaptation
Eco-DRR	Ecosystem-based disaster risk reduction
EC	European Commission
ES	Ecosystem services
EURAC	EURAC Research, European Academy of Bozen-Bolzano
FAO	Food and Agricultural Organization of the United Nations
FEBA	Friends of EbA
IIED	International Institute for Environment and Development
(I)NDC	(Intended) Nationally Determined Contributions
IPCC	Intergovernmental Panel on Climate Change
IUCN	International Union for the Conservation of Nature
GIZ	Deutsche Gesellschaft für Internationale Zusammenarbeit
DRR	Disaster risk reduction
M&E	Monitoring and Evaluation
NAP	National Adaptation Plan
NBSAP	National Biodiversity Strategy and Action Plan
NOAA	National Oceanic and Atmospheric Administration (U.S. Department of Commerce)
PEDRR	Partnership for Environment and Disaster Risk Reduction
UNCCD	United Nations Convention to Combat Desertification
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme
UNEP-WCMC	United Nations Environment Programme - World Conservation Monitoring Centre
UNFCCC	United Nations Framework Convention on Climate Change

Preface

The impacts of climate change on society are occurring earlier and more frequently than predicted (IPCC 2012). Climate change impacts such as floods, drought, heat waves and increased intensity and frequency of storms have been the major cause of long-term increases in economic losses (IPCC 2012). Projected population increases and urbanization are increasing vulnerability and disaster risk by placing additional development pressures in zones that are most sensitive to climate change impacts, including coastal systems and low-lying areas (Field et al. 2014).

Ecosystems and biodiversity provide services essential for helping people adapt to the impacts of climate change and disaster risks. In recent years, "ecosystem-based adaption" (EbA) and "ecosystem-based disaster risk reduction" (Eco-DRR) have gained increasing attention in risk management. These approaches emphasize the importance of ecosystems in effective climate change adaptation (CCA) and disaster risk reduction (DRR) measures, and build on other practices such as conservation and ecosystem restoration that seek to increase the resilience of ecosystems. EbA and Eco-DRR have gained traction because they provide multiple benefits for people, ecosystems and biodiversity, enable planning for CCA and DRR on longer time scales, are cost-effective compared to traditional engineered infrastructure, and emphasize community participation and the use of traditional and local knowledge systems. Due to their participatory nature and cross-sectoral approaches to adaptation and disaster risk reduction, EbA and Eco-DRR can achieve multiple policy objectives, including local, regional and national strategies for climate change, disaster risk reduction, and sustainable development, among others.

Major international agreements such as the Paris Agreement and the Sustainable Development Goals have called for enhancing the resilience of ecosystems and societies to the impacts of climate change and disaster risk. Increasingly, countries are integrating ecosystem-based approaches into national plans and strategies to reduce the risk of climate impacts and hazards – examples have been synthesized in CBD Technical Series No. 85 (Lo 2016). However, there remains a gap between policy development and implementation. The objective of these guidelines is to support and enable the design and implementation of EbA and Eco-DRR strategies as part of an overall climate change adaptation or DRR strategy, on multiple scales - short, medium and long-term, and local, sub-national and national.

Mandate

The CBD Conference of the Parties (COP), in decision XIII/4, requested the Executive Secretary to prepare, subject to the availability of resources, in collaboration with relevant organizations, in particular the United Nations Framework Convention on Climate Change and the United Nations Office for Disaster Risk Reduction, voluntary guidelines for the design and effective implementation of ecosystem-based approaches to climate change adaptation and disaster risk reduction, for consideration by the Subsidiary Body on Scientific Technical and Technological Advice prior to the fourteenth meeting of the Conference of the Parties.

These guidelines build on a synthesis report on experiences with ecosystem-based approaches to climate change adaptation and disaster risk reduction (CBD Technical Series No.85 (Lo, 2016)) developed pursuant to decision XII/20. The report identifies lessons learned as well as gaps and challenges with the implementation of ecosystem-based approaches to climate change adaptation and disaster risk reduction.

Framework for the guidelines

The guidelines are organized into three main components (Figure 1):

Section A: Summary for Policy-Makers

Section A provides high-level policy guidance for focal points to the CBD, UNFCCC, UNCCD and UNISDR, and other relevant agencies and organizations, including the private sector, researchers, donors, and advocates of EbA/Eco-DRR (such as within NGOs, CSOs, governments, etc.). Section A highlights the advantages of EbA/Eco-DRR, including how they promote multiple benefits, and demonstrates how they can be integrated into adaptation and DRR strategies and development frameworks. This information can be used to encourage key decision-makers to implement EbA and Eco-DRR across different sectors and in polices and strategies addressing climate change, disaster risk reduction and development. Policy-makers and influencers are also encouraged to make use of the mainstreaming section in Section B and Section C: Outreach into sectors.

Section B: Guidelines for Practitioners

Section B provides guidance on operationalizing EbA and Eco-DRR at the programme and project level. Section B outlines:

- Twelve principles of EbA and Eco-DRR, which are key considerations throughout the process of designing and implementing EbA and Eco-DRR;[1]
- Nine safeguards to prevent maladaptation, ensure that rights are respected, and prevent harm to, or enhance, biodiversity and ecosystem services;
- Suggested steps involved in planning and implementing adaptation and DRR with a focus on EbA and Eco-DRR.
- Toolboxes which provide examples of existing tools and guidance for each step. These lists of tools are not exhaustive; users of these guidelines are encouraged to consult more comprehensive databases of tools, such as the 'Inventory of tools and methodologies relevant for EbA practitioners.'[2]

Section C: Outreach into Sectors

Section C will provide key considerations for encouraging the integration of EbA and Eco-DRR into relevant sectoral policies and plans. More comprehensive considerations of sectoral outreach and linkages to additional knowledge products will be provided as a future supplement to these guidelines.

Audience

[1] These principles are in alignment with the Ecosystem Approach developed under the CBD https://www.cbd.int/ecosystem/

[2] A draft inventory currently containing more than 200 tools related to EbA planning and implementation is available at https://www.iied.org/call-for-feedback-inventory-tools-support-ecosystem-based-adaptation, developed as part of the International Climate Initiative (IKI) funded global projects: Ecosystem-based adaptation (EbA): strengthening the evidence and informing policy implemented by IIED, IUCN and UNEP-WCMC.

While the main audience for these guidelines are policy-makers and practitioners, the guidelines can be consulted when implementing related practices, such as community-based adaptation with an ecosystem focus. The guidelines may also be useful for different sectors in planning and implementing ecosystem-based solutions, and can be applied in other contexts, such as the application of ecosystem-based approaches into the development, humanitarian, aid, disaster relief, water management, construction, health and other fields.

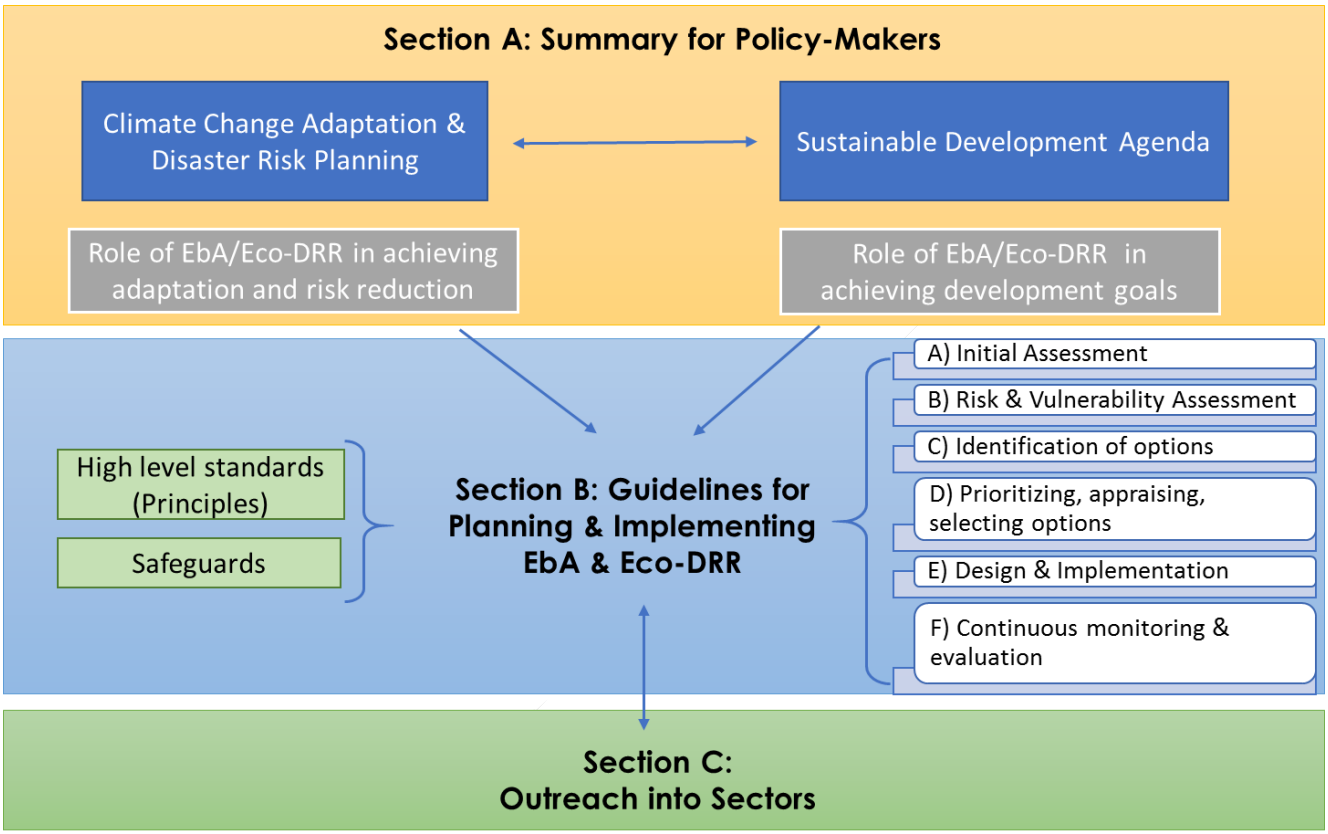

Figure 1: Conceptual framework for the guidelines for the design and effective implementation of ecosystem-based approaches to climate change adaptation and disaster risk reduction

These guidelines build on the progressive work on EbA and Eco-DRR, including existing guidelines, frameworks and principles spanning the adaptation, disaster risk reduction, conservation, development and humanitarian fields. An overview of existing guidelines, on which these guidelines are based, is provided in the literature review (Annex II). The guidelines were developed in consultation with experts from governments, academia, indigenous peoples and local communities, NGO's, and inter-governmental organizations. An informal meeting with experts was convened in collaboration with BirdLife International and UNEP-WCMC for developing a framework for the guidelines (July 2017, Cambridge), and a technical workshop was conducted with country-nominated and other experts in order to review a draft version of the guidelines

(November 2017, Bonn).[3] Definitions of key terms in these guidelines are based on an updated glossary in the CBD Technical Series No. 85 (Annex I).

A. Summary for Policy Makers

Introduction

- Ecosystem-based approaches to climate change adaptation (EbA) is the use of biodiversity and ecosystem services to help people to adapt to the impacts of climate change, and ecosystem-based approaches to disaster risk reduction (Eco-DRR) is the sustainable management, conservation and restoration of ecosystems to reduce disaster risk.
- EbA & Eco-DRR generate multiple benefits for the environment, societies and the economy.
- EbA & Eco-DRR have strong policy support, including within the framework of the Sustainable Development Goals, the Strategic Plan for Biodiversity 2011-2020 under the CBD, and the Paris Agreement under the UNFCCC.

The impacts of climate change on society are occurring earlier and more frequently than predicted (IPCC 2012). Climate change impacts such as floods, drought, heat waves and increased intensity and frequency of storms have been the major cause of long-term increases in economic losses (IPCC 2012). The economic cost of weather and climate disasters in the USA in 2017 is an estimated 306 billion USD (NOAA 2018). At the same time, direct and indirect drivers are placing further pressure on life-sustaining ecosystems and their capacity to provide a buffer from climate change impacts and disasters. The most important direct drivers of change in ecosystems are habitat change (land use change and physical modification of rivers or water withdrawal from rivers), overexploitation, invasive alien species, pollution, and climate change (Millennium Ecosystem Assessment 2005). Responding to these changes and reducing the risk of disasters are some of the greatest challenges that nations, especially the most vulnerable developing countries, are currently facing.

Policy-makers can choose from a wide range of interventions to adapt to climate change and reduce disaster risk, including 'soft' options such as policy frameworks, 'hard' options such as built infrastructure, 'green' options including those based on conserving, managing or restoring ecosystems that provide services critical to reducing risks and impacts, and 'hybrid' options, which integrate ecosystem-based options with other approaches (Figure 2). Hybrid approaches could include nature-based solutions, green infrastructure, grey-green options, and building with nature solutions, among others. Among these options, infrastructure-based options have been by far the most common approach to reducing risk of climate impacts and disasters. However, there is increasing support in the policy forum for implementing ecosystem-based or hybrid approaches as evidence of their effectiveness and the multiple co-benefits they provide is increasing.

[3] Technical workshop for review of the voluntary guidelines for the design and effective implementation of ecosystem-based approaches to climate change adaptation and disaster risk reduction. 20-22 November, Bonn, Germany. https://www.cbd.int/meetings/CCBWS-2017-01

Box 1: What are EbA and Eco-DRR?

Ecosystem-based adaptation (EbA) is the use of biodiversity and ecosystem services as part of an overall adaptation strategy to help people to adapt to the adverse effects of climate change. EbA aims to maintain and increase the resilience and reduce the vulnerability of ecosystems and people in the face of the adverse effects of climate change." (SCBD 2009)

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

Figure 2: Adaptation and disaster risk reduction options within an overall adaptation strategy (GIZ 2015)

Multiple benefits from EbA and Eco-DRR implementation

EbA, Eco-DRR and related approaches generate additional environmental, economic, and social benefits beyond adaptation and disaster risk reduction. They are often referred to as low-regrets or no-regrets options as they can generate benefits regardless of uncertainties in climate projections. For example, mangrove restoration can stabilize sediments and protect coastlines, and through increasing habitat for fish and other species, also support livelihoods and contribute to carbon storage. In this way, EbA and Eco-DRR also enhances biodiversity conservation, among other multiple benefits. In disaster risk management, in particular, the post-disaster reconstruction period offers an opportunity to "build back better." In other words, such occasions provide new opportunities to conserve and restore biodiversity to strengthen the resilience of ecosystems and decrease vulnerability to disasters. As biodiversity underpins the services provided by ecosystems, investing in approaches that enhance biodiversity is similar to broadening a risk reduction investment portfolio to provide long-term returns for the future.

Several examples of how EbA and Eco-DRR in landscapes and seascapes can address the Aichi Biodiversity Targets under the Convention for Biological Diversity and the Sustainable Development Goals are shown in Figure 3.

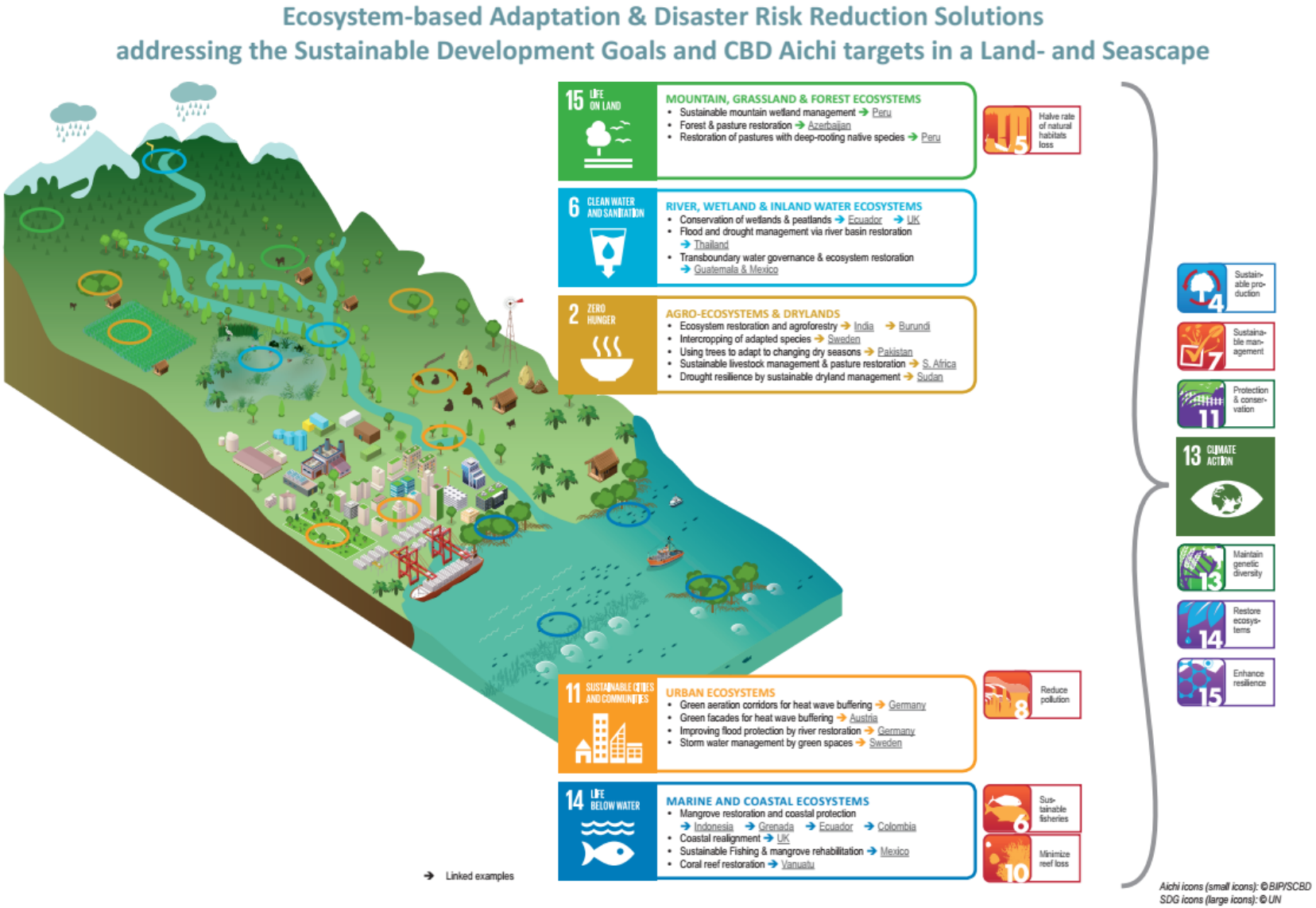

Figure 3: Examples of EbA and Eco-DRR in a landscape/seascape that help achieve the CBD Aichi Biodiversity Targets and the Sustainable Development Goals (graphic by GIZ 2018)

Some of the multiple benefits of EbA and Eco-DRR include:

- Enhancing more expensive infrastructure investments, such as prolonging the lifetime of engineered flood protection measures (Munang et al. 2013; Temmerman et al. 2013).
- Providing adaptation and disaster risk reduction solutions that deliver on multiple commitments by supporting national development and adaptation goals such as coastal protection, conservation of natural resources, sustainable development and social well-being (WWF 2013).
- Contributing to climate change mitigation targets via: i) conservation or restoration of forests, coastal vegetation, or peatlands, which enhance carbon sequestration (Duarte et al. 2013), and ii) prevention of deforestation and land degradation, which aids in limiting further greenhouse gas emissions (Busch et al. 2015).
- Improve the quality of life and mental and physical health of people, for example, through providing urban green spaces which also provide relief from heat (Kabisch et al., 2016).
- Engaging people and communities, helping to build trust and responsibility while maintaining livelihoods and providing potential business opportunities (EC Discussion Paper 2009).
- Address underlying key drivers of climate and disaster risk, generating more robust solutions for coping with future challenges and uncertainty due to climate change.

Case studies and literature have demonstrated that EbA can be a flexible, cost-effective and broadly applicable approach for reducing the impacts of climate change (Munang et al. 2013).

Box 2: EbA and Eco-DRR are cost-effective solutions for adaptation and disaster risk

- In comparison to the economic loss caused by loss of ecosystem services, the cost-benefit ratio of return of investment of appropriate restoration of ecosystems may be as high as 3 to 75, depending on the ecosystem context and the measures taken (UNEP 2010)
- Mangrove rehabilitation at the village level is generating significantly higher wealth benefits from risk reduction and natural resource utilization (2.3 million USD over 20 years) compared to dyke construction (only 0.5 million USD), according to a case study in Vietnam (Köhler andMichaelowa 2013).
- A cost-benefit analysis indicates a significant higher revenue (a net present value of 841,902 USD over 20 years) under an EbA scenario, including the low impact grassland management in a community with wild llamas, compared to a business as usual scenario (Net Present Value of 486,571 USD over 20 years) with intensive domestic cattle management (UNEP-IUCN-UNDP Mountain EbA Programme in Peru (Rossing, T. et al. 2015)
- Early investment in climate resilience has been found to be more cost-effective than post-disaster relief. For example, a case study found that Barbados could cost-effectively avoid more than 30% of expected losses by implementing risk mitigation initiatives such as beach nourishment .

(Examples from www.AdaptationCommunity.net and http://panorama.solutions)

The role of biodiversity and ecosystems in adaptation to climate change and reduction of disaster risk

Biodiversity and ecosystems provide crucial services to society, particularly regulating and supporting services that help people adapt to the adverse effects of climate change and reduce disaster risk. For example, coral reefs and coastal vegetation can dissipate wave action and protect shorelines, wetlands accommodate flood flows, and forested mountains and slopes can stabilize sediments, protecting from landslides (Hale et al. 2009, Ferrario et al. 2016, Renaud et al. 2013). Ecosystems can also prolong the sustainability and lifetime of built infrastructure, thus protecting investments in engineered defenses – for example, restoring salt marshes adjacent to sea walls (Temmerman et al. 2013).

However, loss of biodiversity, due to many drivers including climate change, alters ecosystem functioning across temporal and spatial scales, diminishing the supply of ecosystem services (Isbell et al. 2017). Thus, investing in actions to conserve or restore biodiversity and ecosystems is a sound approach for maintaining the supporting and regulating ecosystem services critical for climate change adaptation and disaster risk reduction. According to the latest assessment report of the IPCC (AR5), "successful adaptation will depend on our ability to allow and facilitate natural systems to adjust to a changing climate, thus maintaining the ecosystem services on which all life depends" (IPCC 2014).

Water-related ecosystems are a key example, providing critical regulating ecosystem services such as buffering of storm waves and floods by peatlands, marshes, floodplains, coastal protection by salt marshes and mangroves, and provisioning services through the supply of fresh water. Water-related disasters (including floods, droughts and windstorms) account for an estimated 90% of the most disastrous events since 1990, affecting 4.2 billion people and causing USD 1.3 trillion in damage (United Nations 2015). However, water-related ecosystems are fast-declining around the world; thus it is crucial to enhance resilience of water resources and ecosystems including wetlands, watersheds, basins, coastal and marine ecosystems, and drylands.

EbA and Eco-DRR draw from, and share similarities with, other fields of practice. The concept of ecosystem-based approaches to adaptation (EbA) and to disaster risk reduction (Eco-DRR) is one of several that promote the conservation, wise use of, enhancement, and restoration of biodiversity and ecosystems as a means to adapt to change (Kabisch et al. 2016). For example, conservation practices, such as protected areas or ecological restoration, aim to maintain or enhance biodiversity and ecosystem services. EbA and Eco-DRR specifically aim to reduce current and future impacts of climate change and disaster risk, based on the ongoing identification or assessment of risks and vulnerabilities of a socio-ecological system that includes both people and ecosystems (Figure 4). However, one clear difference with the traditional conservation practices is that EbA and Eco-DRR address the adaptation of both people and ecosystems to climate change as equally significant aims. Nevertheless, conservation practices can provide an important complement to adaptation and disaster risk reduction efforts, although they have a different main objective.

Other approaches related to EbA and Eco-DRR include community-based adaptation, natural water retention measures, integrated water resources management, green/blue infrastructure, ecological restoration, and others. EbA and Eco-DRR can also be considered under

the wider umbrella concept of nature-based solutions (NbS)[4] (Cohen-Shacham et al. 2016). These approaches are complementary and focus on developing holistic, integrated approaches to enhance the resilience of socio-ecological systems, reduce disaster risk, and/or help people adapt to change through using ecosystems and biodiversity in a sustainable manner. They often place emphasis on participatory processes and community engagement, which are crucial to improving community resilience, enhancing adaptive capacity, and ensuring local benefits are realized.

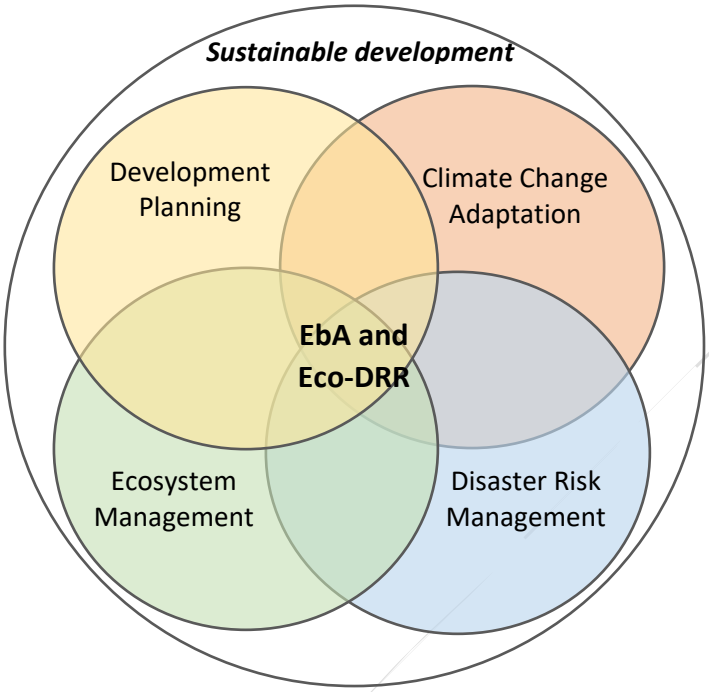

Figure 4: Ecosystem-based approaches to adaptation and disaster risk reduction (EbA and Eco-DRR) utilize ecosystems and biodiversity to integrate climate change adaptation, disaster risk management and development planning. This will provide benefits for people and nature beyond adaptation and disaster risk reduction within the overall framework of sustainable development (adapted from Midgley et al., 2012, DEA and SANBI 2017, and Sudmeier and Ash 2009)

The policy context for EbA and Eco-DRR

Support for EbA and Eco-DRR has been embedded in major agreements and taken up by the international arena in other ways in recent years, which are highlighted below and in Figure 5, and summarized in more detail in Annex II.

- The **Paris Agreement** recognises protecting 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

[4] Nature-based Solutions (NbS) are actions to protect, sustainably manage and restore natural or modifed ecosystems, which address societal challenges (e.g. climate change, food and water security or natural disasters) effectively and adaptively, while simultaneously providing human well-being and biodiversity benefits (IUCN)

adaptation into relevant environmental policies and actions, where appropriate, as well as for building resilience of ecosystems through sustainable management of natural resources.

- Several of **the Sustainable Development Goals** (SDGs) adopted by the UN General Assembly are related to EbA and Eco-DRR, including SDG 13 on urgent action to combat climate change and its impacts and SDG 11 to make cities and human settlement inclusive, safe, resilient and sustainable, in addition to SDGs 1 (end poverty), 2 (end hunger), 3 (ensure healthy lives and well-being), 6 (access to water and sanitation), 14 (conserve oceans), and 15 (sustainably manage forests and halt biodiversity loss) (see Figure 5 and Annex II for other relevant SDGs).
- The **Sendai Framework for Disaster Risk Reduction** 2015-2030, building on the Hyogo Framework for Action 2005-2015, outlines seven global targets to be achieved over the next 15 years, prioritizing "ecosystem-based approaches…to build resilience and reduce disaster risk".
- One of the **Ten Essentials for Making Cities Resilient,** building on the Sendai Framework, is to safeguard natural buffers to enhance the protective functions offered by natural ecosystems. It is encouraged to consider natural buffers in the rural hinterland of the city and the wider region, and take a regional resilience approach, that is, resilience building through trans-boundary cooperation with other municipalities (Essential #5).
- Ecosystem-based approaches for adaptation are encouraged in decisions X/33, XII/20 and XIII/4, of the Conference of the Parties to the **Convention on Biological Diversity** and are also referred to in other recent decisions, XI/15, XI/19, XI/21.
- The **IPCC Special Report on Extreme Events** (SREX) recommends investing in ecosystems, sustainable land management and ecosystem restoration and management (IPCC 2012).
- **Land Degradation Neutrality** targets and synergies identified between desertification, climate change and biodiversity under the **United Nations Convention to Combat Desertification**
- **UNGA resolutions** (RES/70/195, RES/71/219, and RES/72/220) highlight the importance of sustainable land management for sand and dust storms which are among the emerging concerns of the global community.
- The **Fifth Assessment Report of the IPCC** (AR5) notes that "successful adaptation will depend on our ability to allow and facilitate natural systems to adjust to a changing climate, thus maintaining the ecosystem services on which all life depends" (IPCC 2014).
- **The Ramsar Convention** Resolution XII.13 on Wetlands and Disaster Risk Reduction encourages Parties to integrate wetland-based disaster risk management and climate change adaptation into development policies and planning at all levels of government, including integration in vulnerability analysis, poverty reduction strategies and natural resource management plans and sectors, and in multi-sector policies and plans
- Eco-DRR has also been endorsed in the outcomes of **regional DRR platforms** of Asia, Africa, Latin America and Arab states, and of the European Ministerial meeting on DRR.
- The **World Humanitarian Summit** commits the UN Member countries to core responsibilities of humanitarian aid and disaster risk preparedness.
- The **New Urban Agenda** adopted at the UN Conference on Housing and Sustainable Urban Development (Habitat III) contains three transformative commitments: leaving no one

behind and fighting against poverty; urban prosperity and opportunities for all; and ecological and resilient cities and human settlements

- The **Cancun High-Level Communiqué** adopted at the fifth session of the Global Platform for Disaster Risk Reduction 2017 emphasizes the close nexus between climate change and water-related hazards and disasters and highlights Integrated Water Resources Management (IWRM) as an effective instrument for enhancing resilience and serving both DRR and CCA goals.

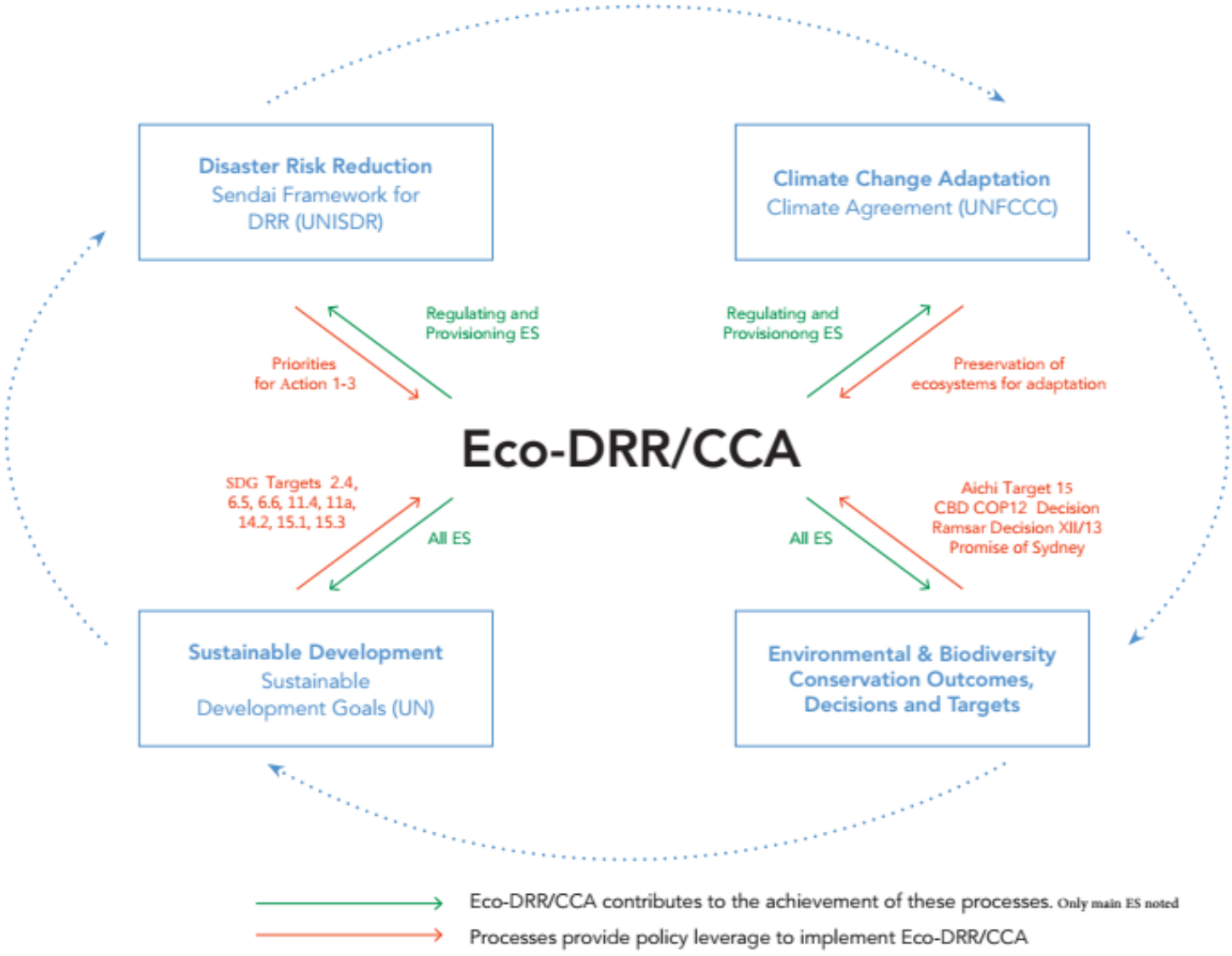

Figure 5: Linkages between major international agreements and EbA/Eco-DRR (ES: Ecosystem services. Modified with permission from Renaud, F.G. et al. 2016)

B. Guidelines for the design and implementation of EbA and Eco-DRR

1. Introduction

Ecosystem-based approaches to climate change adaptation (EbA) and disaster risk reduction (Eco-DRR) often address climate change adaptation and DRR on a landscape scale. As such, they address risk (and its components of hazards, vulnerability, and exposure) in an integrated and comprehensive manner, present more options to address adaptation and DRR, and enable broader considerations for assessment of potential trade-offs. In selecting adaptation/disaster risk reduction options, ecosystem solutions are usually more adaptive and cost-effective and easier to maintain. Most importantly, they focus on a whole suite of services the ecosystem/landscape provides, providing more value to society (including economic value), compared to conventional solutions such as built infrastructure.

While the many benefits of implementing EbA and Eco-DRR are clear, there may be a need to combine EbA and Eco-DRR with grey solutions (such as hybrid or grey-green solutions, or green infrastructure) when environmental expertise and civil society issues are brought to the table in the early stages of planning. Furthermore, as with any adaptation or disaster risk reduction activity, trade-offs in the implementation of EbA and Eco-DRR, need to be identified, considered in different timescales together with other risk management measures, and managed if possible. In light of potential limits and trade-offs, EbA, Eco-DRR, and indeed any climate change adaptation or DRR measure should always be integrated within overall adaptation and disaster risk reduction planning and aligned with national policies and strategies. They should also be implemented alongside other measures of risk reduction, including avoidance of high risk zones, improved building codes, early warning and evacuation procedures.

EbA, Eco-DRR and related practices span a spectrum of naturalness, from “wild to mild” covering a wide range of natural to man-made or artificial ecosystems. For example, protected areas designed to reduce socio-economic vulnerability through enhancing the resilience of ecosystems are on the “wild” end of the spectrum, while green spaces, green roofs and walls in cities reduce the risk of heat shocks, or rainwater storage to alleviate water shortages can be considered “mild”. Whether wild or mild, however well-intentioned, there are risks that some adaptation/DRR activities that employ an ecosystem-based approach can result in maladaptation. For example, the use of non-native species or monocultures to protect the coastline can decrease resilience and increase risk of disaster, especially when the species is not well-suited to the environment, can be uprooted easily or can outcompete native species. Additionally, it can be challenging to track changes and impacts over time for some ecosystem services, including cultural ecosystem services that may result from adaptation or DRR responses. Full consideration of risks to ecosystems and ecosystem services over time must be in place when planning and implementing EbA and Eco-DRR.

There are thus multiple issues that need to be considered when planning and implementing EbA and Eco-DRR, including addressing trade-offs and limitations, ways to realize multiple benefits

and enhance synergies, and addressing solutions across appropriate temporal and geographical scales. There is also a need to build capacity (such as technical, human, financial and legal capacity), enhance political will for implementation, and communicate the value of using EbA and Eco-DRR as part of overall integrative adaptation and disaster risk reduction strategies. Thus, key principles are needed to avoid maladaptation and enhance co-benefits for people, biodiversity and ecosystems, recognizing that EbA and Eco-DRR strategies are context-specific, and will vary in size and scope in response to the needs of communities, countries and regions.

Many frameworks and tools exist separately for EbA, Eco-DRR and related practices; however, there is comparably less guidance integrating both approaches together, including guidelines for implementing EbA and Eco-DRR within a broader adaptation and disaster-risk planning framework. Global guidelines should not repeat, but rather coherently integrate existing guidelines, as well as principles for EbA and Eco-DRR. At the same time, a balance must be struck between articulating principles that are broad enough to encompass the full range of possible EbA and Eco-DRR interventions across scales with guidance that is practical and specific enough to be operational. These guidelines provide both high level principles that can be used by policy-makers to influence decision-making processes (Sections A and C) and technical guidance for practitioners (Section B) that can aid in the design and implementation of EbA and Eco-DRR in accordance with the principles and safeguards.

2. Principles and Safeguards for EbA and Eco-DRR

The guidelines for EbA and Eco-DRR are based on key principles and safeguards. The principles serve as high-level standards that provide a starting point and reference for guiding, planning and implementing EbA and Eco-DRR. The social and environmental safeguards are measures taken to avoid unintended consequences of EbA and Eco-DRR to people, ecosystems and biodiversity; they also facilitate transparency in planning and implementation, and promote the realization of benefits.

The principles and safeguards build upon and complement other principles, guidelines and tools[5] including:

- the Ecosystem Approach;
- Addis Ababa Principles and Guidelines for the Sustainable Use of Biodiversity;
- the Akwé:Kon guidelines;
- Tkarihwaié:ri Code of Ethical Conduct; and
- the Plan of Action on Customary Sustainable Use of Biological Diversity .

Other relevant guidelines include principles for ecological restoration and guidance for integrating biodiversity considerations into ecosystem restoration, outlined in CBD decision XIII/5, and the United Nations Declaration on the Rights of Indigenous Peoples. These other guidelines and principles should always be referred to, when appropriate.

[5] https://www.cbd.int/guidelines/

The principles were developed by reviewing existing literature and guidelines on EbA and Eco-DRR, and the following section describes the rationale for the development of the principles in these guidelines.

Principles

Ecosystem-based approaches to climate change adaptation (EbA) and disaster risk reduction (Eco-DRR) should consider principles that are core to adaptation and DRR practice. Climate change adaptation and disaster risk reduction have several areas of overlap, both in practice and in principle. Enhancing the resilience of socio-ecological systems is the basic aim of EbA, and it has been recognized as fundamental to DRR: "the importance of a good quality healthy environment", and "measures to safeguard and rehabilitate the environment" are highlighted as ethical principles for DRR (Prieur, Michel, 2012).

The transboundary nature of climate change impacts and disasters have also prompted both adaptation and DRR communities to call for cross-sectoral co-operation between governments and local and regional authorities (Andrade Pérez, A. et al., 2010). Other areas of commonality in EbA and Eco-DRR principles include the need for inclusive participation and prioritization of groups most vulnerable to climate change and disaster risks, (UNFCCC 2017, Andrade et al. 2011, CARE International 2009, IIED). Both EbA and Eco-DRR place special emphasis on the rights of indigenous peoples and local communities and their customs, cultures and relationship with the environment. These relationships make them more vulnerable to the risks of disaster, but their unique local and traditional knowledge is important in informing adaptation, risk prevention and reconstruction (Prieur 2012).

The principles proposed here integrate elements of EbA and Eco-DRR practice and serve as high-level standards for guiding, planning and implementing EbA and Eco-DRR in line with the four cornerstones presented under the first principle. The principles are clustered into themes: building resilience and enhancing adaptive capacity, inclusivity and equity, consideration of multiple scales, and effectiveness and efficiency. The guidelines in Section 3 provide suggested steps and methodologies to implement actions on EbA and Eco-DRR according to the principles.

	Principles for building resilience and enhancing adaptive capacity through EbA and Eco-DRR
1	Four cornerstones[6] lay the foundation for EbA and Eco-DRR planning and implementation: EbA and Eco-DRR, i. Result in enhanced resilience and decreased vulnerability of people and ecosystems to climate change and disaster risk ii. Respond to current and future impacts of climate change and disaster risk, contributing to incremental and transformative adaptation and disaster risk reduction; iii. Use biodiversity, ecosystem services and landscapes without harming their functioning; iv. Generate societal benefits and ideally enhance biodiversity, contributing to sustainable development using equitable, transparent and participatory approaches.
2	Consider a full range of ecosystem-based approaches to enhance resilience of socio-ecological systems as a part of overall adaptation and disaster risk reduction strategies.
3	Use disaster response as an opportunity to build back better for enhancing adaptive capacity and resilience[7] and integrate ecosystem considerations throughout all stages of disaster management.
4	Consider the precautionary approach[8] in planning and implementing EbA and Eco-DRR interventions.
	Principles for ensuring inclusivity and equity in planning and implementation
5	Ensure that EbA and Eco-DRR interventions are fully participatory, particularly ensuring participation of indigenous peoples and local communities, and transparency and accountability throughout all stages of EbA and Eco-DRR planning and implementation.
6	Prioritize and target EbA and Eco-DRR interventions to prevent and avoid the disproportionate impacts of climate change and disaster risk on vulnerable groups, indigenous peoples and local communities, and ecosystems.
	Principles for achieving EbA and Eco-DRR on multiple scales
7	Design EbA and Eco-DRR interventions at the appropriate spatial and temporal scales, recognizing that some EbA and Eco-DRR benefits are only apparent at larger temporal and spatial scales.
8	Ensure that EbA and Eco-DRR are sectorally cross-cutting and involve collaboration, coordination, and co-operation of stakeholders and rights holders.
	Principles for EbA and Eco-DRR effectiveness and efficiency
9	Ensure that EbA and Eco-DRR interventions are evidenced-based and supported by the best available science, research, data and practical experience, and diverse knowledge systems including traditional knowledge of indigenous peoples and local communities.
10	Incorporate mechanisms that facilitate adaptive management and active learning into EbA and Eco-DRR, including continuous monitoring and evaluation at all stages of planning and implementation.
11	Identify and assess limitations and minimize potential trade-offs of EbA and Eco-DRR interventions.
12	Maximize synergies in achieving multiple benefits, including for biodiversity, conservation, sustainable development, gender equality, adaptation, and risk reduction.

[6] Adapted from SANBI & DEA 2017. Guidelines for Ecosystem-based Adaptation (draft version)

[7] The use of the recovery, rehabilitation and reconstruction phases after a disaster to increase the resilience of nations and communities through integrating DRR measures into the restoration of physical infrastructure and societal systems, and into the revitalization of livelihoods, economies and the environment. (UNISDR 2017)

[8] The precautionary approach is stated in the preamble of the Convention on Biological Diversity: "Where there is a threat of significant reduction or loss of biological diversity, lack of full scientific certainty should not be used as a reason for postponing measures to avoid or minimize such a threat."

Safeguards

Safeguard policies have traditionally been viewed as tools or policies to prevent and mitigate undue harm to people and their environment from development projects (FAO 2017). Environmental and social safeguard policies underpin the operations of multilateral development banks (including the World Bank and regional development banks), the Global Environment Facility and major NGOs (including World Wildlife Fund). In recent years, the notion of safeguards has expanded to not only avoid unintended negative impacts, but to facilitate transparency and consistency and promote the realization of benefits (Epple, C. et al., 2011). This has mainly been in response to the Reducing Emissions from Deforestation and Land Degradation (REDD+) mechanism to provide incentives to countries to slow and/or reverse the loss of forest carbon. A set of seven governance, social and environmental safeguards was adopted by the UNFCCC as part of the Cancun Agreements to prevent any undue harm to people and biodiversity from REDD+ activities (UNFCCC, 2010). The ensuing Warsaw Framework, adopted at COP 19, builds upon the Cancun Agreements.

In the same vein, people and ecosystems are also susceptible to unintentional harm from climate change adaptation and disaster risk reduction interventions. For example, adapting to impacts of climate-related water shortages upstream may have negative impacts on communities and ecosystems downstream. Thus, it is critical to integrate a landscape or systems perspective together with environmental and social safeguards in planning and implementation of EbA and Eco-DRR activities. In the planning phase, safeguards can help assess possible environmental and social risks and the impacts associated with EbA and Eco-DRR interventions. In addition, they provide an opportunity for stakeholder engagement, enhancing the quality of project proposals and increasing ownership. During project implementation, safeguards help define measures and processes to effectively manage risks and enhance positive impacts (FAO, 2017).

The safeguards proposed here may apply to all Eco-DRR and EbA interventions, and to conventional approaches such as those applied to water infrastructure and coastal defence that place pressure on ecosystems and biodiversity.

Safeguards for effective planning and implementation of EbA and Eco-DRR	
Biodiversity and Ecosystem Safeguards	
Environmental impact assessments and robust monitoring and evaluation	EbA and Eco-DRR should be subject to environmental impact assessments at the earliest stage of project design, and subject to robust monitoring and evaluation systems, ensuring that (i) any possible social and environmental impacts have been clearly identified and assessed (ii) appropriate measures have been taken to avoid, and if not possible, mitigate these risks throughout implementation, (iii) the measures taken to avoid/mitigate risks are themselves monitored and reported throughout project lifecycles. This should include a social and cultural assessment (See the Akwé: Kon guidelines) within an environmental impact assessment.
Prevention of transfer of risks and impacts	EbA and Eco-DRR should not result in unintended adverse impacts on biodiversity or people, EbA and Eco-DRR should not result in the displacement of risks or impacts from one area or group to another as a result of project implementation.
Prevention of harm to biodiversity, ecosystems and ecosystem services	EbA and Eco-DRR, including disaster response, recovery and reconstruction activities should not result in the degradation of natural habitat, loss of biodiversity or the introduction of invasive species, should not create or exacerbate vulnerabilities to future disasters. EbA and Eco-DRR should promote and enhance biodiversity and ecosystem services, including through rehabilitation/restoration and protection measures as part of post-disaster needs assessment and recovery and reconstruction plans.
Sustainable resource use	EbA and Eco-DRR should not result in unsustainable resource use nor enhance the drivers of climate change and disaster risks, and should meet applicable international and national standards for maximising energy efficiency and minimising material resource use.
Inclusiveness safeguards	
Promotion of active and inclusive participation	EbA and Eco-DRR promote active participation of women and men from local communities, and indigenous peoples, including the provisioning of adequate opportunities for informed involvement.
Use of best available evidence including local knowledge	EbA and Eco-DRR projects integrate appropriate indigenous and local knowledge where available to complement robust science. This will ensure that interventions reflect both the best available evidence and current local and indigenous understanding in order to minimise unintended consequences of implementation.
Fair and equitable access to benefits	EbA and Eco-DRR promote fair and equitable access to benefits and should not exacerbate existing inequities, particularly with respect to marginalised or vulnerable groups. EbA and Eco-DRR interventions should meet national labour standards, protecting participants against exploitative practices, discrimination and work that is hazardous to well-being.
Rights safeguards	
Transparent governance and access to information	EbA and Eco-DRR promote transparent governance by supporting rights to access to information, providing all stakeholders and rights holders, particularly indigenous peoples and local communities, with information in a timely manner, and supporting the further collection and dissemination of knowledge.

Respecting rights of indigenous peoples and local communities	EbA and Eco-DRR projects respect the rights of women and men from indigenous peoples and local communities, including access to and use of physical and cultural heritage.

3. EbA and Eco-DRR Implementation Guidelines

This section describes guidance for planning and implementing climate change adaptation and disaster risk reduction activities and programmes with an EbA and Eco-DRR focus. In developing a conceptual framework for this process, various climate change adaptation and disaster risk reduction processes were reviewed, in addition to broader problem-solving approaches such as the landscape[9] and systems approach frameworks. It employs a broad perspective on all ecosystems: "from ridge to reef", or "tropics to temperate zones", while providing a process guidance to mainstream EbA and Eco-DRR considering suitable tools to facilitate and inform this process. These approaches and processes are briefly reviewed below as they form the basis of the framework developed for these guidelines.

National Adaptation Plans (NAPs) are the main framework under the UNFCCC for countries to undertake adaptation planning on a national level. The adaptation process and formulation of NAPs is an iterative process with four key stages: (i) assessments of impacts, vulnerability and risk; (ii) adaptation planning; (iii) implementation of adaptation actions; and (iv) monitoring and evaluation (UNFCCC 2016). Mainstreaming adaptation in development processes begins with characterizing the development context and identifying collections of systems for analysis, using the main development process for a country as the entry point for assessing climate risks and vulnerability (UNFCCC 2015). Strengthening of technical and institutional capacity, learning and sharing of good practices and experiences, and adaptive management, are integral to each stage of the adaptation process.

An example of an EbA framework at the sub-national level is the WWF Operational Framework for Ecosystem-based Adaptation (WWF 2013), which begins with a vulnerability assessment of socio-ecological systems. Other steps include the identification and prioritization of EbA responses, implementation and monitoring, and mainstreaming EbA in national and local climate change planning. The adaptation mainstreaming cycle proposed by GIZ, another framework example, focuses on EbA options to maintain functionality of ecosystems, and begins with using a climate and ecosystem lens to define the problem (e.g. lack of water), and identifying the system of interest (e.g. a watershed, sector or policy) (GIZ 2016a).

The disaster risk management cycle is comprised of the key stages of risk assessment (including risk identification, analysis and evaluation), risk prevention (through planning and policy), preparedness (early warning, emergency planning and education), and, following a disaster, response and recovery (rescue, recovery and rehabilitation, risk transfer). (European Environmental Agency 2016). This theoretical framework has been modified in recent years to integrate ecosystem considerations, given their crucial role for prevention and post-disaster

[9] See FAO (2012). http://www.fao.org/land-water/overview/integrated-landscape-management/en/

recovery (Sudmeier-Rieux 2013). With improved development planning, on-going risk reduction and sustainable development, hazard events may be prevented from becoming disasters. Importantly, EbA and Eco-DRR should be considered throughout early post-disaster recovery, reconstruction, risk and vulnerability assessments, and on-going disaster prevention through sustainable development (Sudmeier-Rieux 2013). Similarly, an integrative approach has been developed based on experiences from the Ecosystems Protecting Infrastructure and Communities (EPIC) initiative that promoted the use of EbA to protect communities from disasters and climate change impacts (Monty 2017). In EPIC, step-by-step guidance is proposed for implementing EbA and Eco-DRR, based on existing EbA guidelines.

On a broader scale, the landscape and systems framework approaches encourage problem and solution analysis by considering landscapes and systems and integrating different spatial and temporal scales as an iterative process. They begin with an analysis of the system or landscape, including carrying out an initial assessment of the risk landscape. Building on this, the framework will provide the basis for an in-depth stake-holder analysis and multi-stakeholder processes integrated throughout the process of problem identification and solutions.

Common elements among these frameworks and processes (summarized in Annex II) are addressing risk at the appropriate scales, integrating participatory approaches and multi-stakeholder processes throughout, adaptive management, and monitoring and evaluation. The framework presented for these guidelines integrates these elements with suggested steps to consider in the design and implementation of EbA and Eco-DRR (Figure 6). The process is intended to be flexible and adapted to the needs of a project, programme or country, region, or landscape/seascape. Central to the planning and implementation process are core principles and safeguards for EbA and Eco-DRR. The planning and implementation process comprises of the iterative steps described in detail below. Each step is linked to a toolbox providing a (non-exhaustive) selection of further guidance and tools. Stakeholder engagement, mainstreaming, capacity-building, and monitoring should be conducted throughout the process.

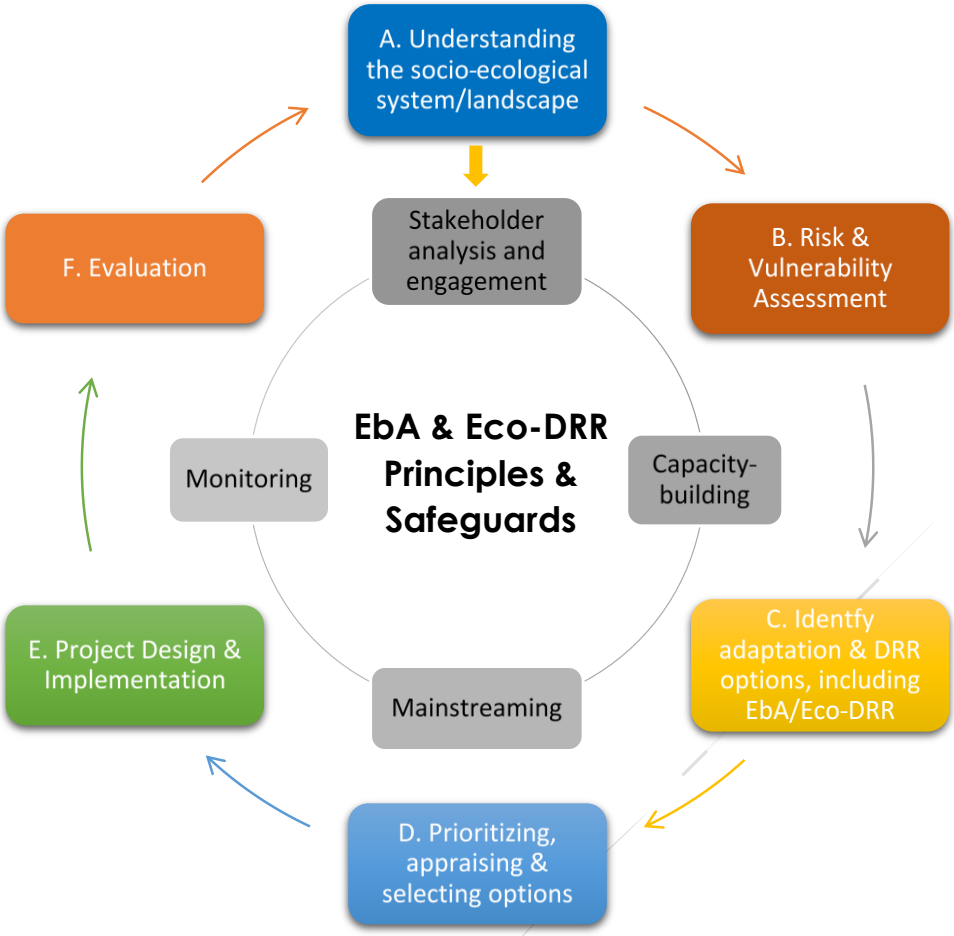

Figure 6: Iterative process for planning and implementing EbA and Eco-DRR as part of overall climate change adaptation and disaster risk reduction strategies. The outer circle describes discrete steps to take, and the inner circle describes ongoing considerations.

A. Initial assessment: Understanding the socio-ecological system or landscape/seascape

Purpose

This exploratory first step aims to enhance the understanding of the socio-ecological system that is targeted for planned adaptation and disaster risk management interventions. This step includes identifying key features of the target ecosystem/landscape, including biodiversity and ecosystem services, and inter-linkages and dependencies on people. This will enable addressing root causes of risk and as a first step in coping with current and future climate change impacts. This step provides baseline information to ensure that EbA/Eco-DRR measures reconcile conservation and development needs, and do not harm biodiversity, cultural diversity or ecosystem services and people and livelihoods who depend on such services (in line with the principles and safeguards) Moreover, this step forms the basis for an in-depth stakeholder analysis and multi-stakeholder and

participatory processes that feed into the subsequent steps in the planning and implementation of EbA/Eco-DRR.

Outcome

- Defined socio-ecological system of interest (ecosystems and services, socio-economic characteristics and dependencies);
- Defined stakeholders; and
- Defined political and institutional entry points for EbA/Eco-DRR within the system.

Key Actions

- Identify the socio-ecological system of interest (for example, a watershed, sector or policy);
- Understand drivers of risk, capacities and assets of communities, societies and economies, and the wider social and natural environment;
- Analyze the problem, determining its scope (geographical and temporal) by defining the boundaries of the system, (more detailed steps on this are provided below) and setting objectives for adaptation and disaster risk reduction without harm to biodiversity or ecosystem services. The spatial scale for risk management should be broad enough to address the root causes of risk and to deliver multiple functions to stakeholders with different interests, and sufficiently small to make implementation feasible (Care Nederland and Wetlands International 2017);
- Identify and map key provisioning, regulating, supporting and cultural services in the system that contribute to resilience. As 90% of disasters are water-related, including drought or floods (United Nations 2015), understanding the hydrology of the landscape is crucial for scoping and designing EbA/Eco-DRR interventions;
- Undertake an organizational self-assessment to understand strengths, weaknesses, capacity and opportunities for partnership. Based on this, a multi-disciplinary team (including but not limited to IPLCs, experts, representatives from relevant sectors, different government bodies) can be organized for planning and implementing EbA and Eco-DRR;
- Conduct an in-depth stakeholder analysis (see detailed steps below);
- Understand the institutional set-up for development, conservation, disaster risk reduction and climate change adaptation, and relevant sectors; and
- Screen relevant entry points for EbA and Eco-DRR particularly in a policy, planning or budgeting cycle at different scales and levels where considerations of climate change risk and adaptation could be incorporated.

In the following sections, further detail is provided on approaches to defining the boundaries of the system of interest and analysis of stakeholders and rights holders.

Defining a system of interest and its boundaries

Climate change and disasters can occur suddenly, such as intense rains and flash floods. In other situations, they can occur gradually (slow on-set impacts), such as ocean acidification-induced death of corals and, in turn, depletion of the fisheries dependent on corals which sustain and support society. Just as there is variability in time, the impacts of climate change and disasters cross local, national and regional boundaries. Thus, while it is necessary to adapt to change at the

local level, long-term planning at different geographical scales is also needed. Implementing a landscape or systems approach and transboundary cooperation into EbA and Eco-DRR planning will assist in addressing the entire system of interest in which climate and disaster risks originate and are manifested.

Systems Approach Framework

The Systems Approach Framework (SAF) is an iterative process in which continuous assessment of the relevant part of the socio-ecological system provides scientifically defendable information with regards to possible and probable future changes given certain scenarios (Hopkins et al. 2012). The SAF was developed as part of the European Union project "Science and Policy Integration for Coastal System Assessment" (SPICOSA) (Hopkins et al. 2012). SAF has mainly been implemented in coastal zones, but the framework can also be applied to other socio-ecological systems. The SAF application entails five steps:

1. Issue Identification - the problem is diagnosed by stakeholders;
2. System Design - a virtual system is conceived;
3. System Formulation - a simulation model is made;
4. System Appraisal - the model is tested and run for several scenarios;
5. System Output - stakeholders deliberate the scenarios.

Landscape Approach

A landscape approach deals with large-scale processes in an integrated and multidisciplinary manner, combining natural resources management with environmental and livelihood considerations. It may include multiple ecosystems. The landscape approach also factors in human activities and their institutions, viewing them as an integral part of the system rather than as external agents, and thus involves multi-stakeholder interventions (FAO, 2012). Landscapes have been defined in various ways, but contain the main elements of interactions between people/societies and geographical areas (WHC, 1996). Examples of landscapes include entire river basins (from mountains to the sea), coastal deltas and their hinterlands. Because the underlying human and natural processes are subject to change and evolution, landscapes are dynamic systems (Washer et al, 1999).

Using a landscape approach helps in understanding risk at the appropriate scale, including factoring in how ecosystems form buffers to help adapt to climate change and reduce disaster risk across a landscape, and to cooperate across different agencies/sectors on a landscape scale to build solutions. Examining processes through a landscape approach also enables a wider perspective in identifying potential trade-offs involved in implementing EbA/Eco-DRR (discussed further in Step D).

The following iterative steps are recommended to integrate the landscape approach into EbA and Eco-DRR [10]:

- Conduct an initial assessment of the landscape
- Conduct an initial assessment of the risks in the landscape
- Conduct an in-depth stakeholder analysis and power mapping

[10] A detailed step-by-step approach is outlined in "A Landscape Approach for Disaster Risk Reduction in 7 Steps" (CARE Netherlands and Wetland International 2017)

- Stimulate multi-stakeholder processes and create coalitions of the willing
- Conduct a collaborative, in-depth problem and solution analysis and scenario planning together with stakeholders
- Carry out collaborative (action) planning
- Organize collaborative implementation
- Promote adaptive management

Stakeholder and rights-holder analysis and establishment of participatory mechanisms

An initial assessment of the system or landscape helps to analyze the problem, define the boundaries for CCA and DRR interventions, and screen for entry points for EbA and Eco-DRR. This information should feed into an in-depth stakeholder analysis before engaging stakeholders throughout the adaptation/DRR process. Prior and informed engagement of stakeholders and rights holders will increase ownership and likely success of any adaptation/DRR intervention. An in-depth stakeholder analysis and development of multi-stakeholder processes and participatory mechanisms are key to achieving the equity and inclusivity principles and related safeguards. The Akwé: Kon Voluntary Guidelines (SCBD 2004) outlines procedural considerations for the conduct of cultural, environmental and social impact assessments, which are widely applicable to EbA and Eco-DRR.[11]

Key Actions

- Identify indigenous peoples and local communities (IPLCs), stakeholders and rights holders likely to be affected by EbA and Eco-DRR interventions, and identification of people or organizations/sectors that have influence over planning and implementation, using transparent participatory processes.
- Ensure effective and efficient participation of all relevant stakeholders and rights holders, including the poor, women, youth and the elderly, ensuring they have the capacity and sufficient human, technical, financial and legal resources to do so.
- Engage with civil society organizations and/or community-based organizations to enable their effective participation.

Table 1.

Step A Toolbox: Initial assessment: Understanding the socio-ecological system/landscape and stakeholder analysis and engagement

Tool/Organization	Description
The Toolkit for Ecosystem Service Site-based Assessment (TESSA)	Piloted in protected areas, TESSA guides non-specialists through methods for identifying which ecosystem services may be important at a site, and for evaluating the magnitude of benefits that people obtain from them currently, compared with those expected under alternative land-use. http://www.birdlife.org/datazone/info/estoolkit

[11] The full version of the Akwé: Kon Voluntary Guidelines is available at https://www.cbd.int/traditional/guidelines.shtml

Integrated Valuation of Environmental Services and Tradeoffs (InVEST)	InVEST is a suite of software models used to map and value the goods and services from nature that sustain and fulfil human life. This tool enables decision makers to assess quantified trade-offs associated with alternative management choices and to identify areas where investment in natural capital can enhance human development and conservation. http://www.naturalcapitalproject.org/InVEST.html
Exploring Nature-Based Solutions: The role of green infrastructure in mitigating the impacts of weather- and climate change-related natural hazards	This report proposes a simple, practical methodology for screening (rather than assessing) ecosystem services in areas where green infrastructure may contribute to reducing current (or future) weather- and climate-related natural hazards. The hazards addressed include landslides, avalanches, floods, soil erosion, storm surges and carbon stabilization by ecosystems. Several case studies at the European level outline the screening process and also summarize recent estimates of the economic value of green infrastructure. http://www.eea.europa.eu/publications/exploring-nature-based-solutions-2014
Stocktaking for National Adaptation Planning (SNAP) Tool (GIZ)	This tool helps assess a country's current national adaptation planning capacities and in identifying strategic goals for NAP that feed into the preparation of a country-specific NAP Roadmap. The publication Stocktaking for National Adaptation Planning – Assessing Capacity for Implementing NDCs showcases the utility and use of the tool and highlights results from its application in various geographical terrains on national and subnational scale.
CliF Reflect Tool to (GIZ)	This tool supports planners and policy-makers in reflecting on the current level of capacities within a country to mobilize and effectively manage climate finance. http://www.adaptationcommunity.net/ndc_adaption_toolbox/clif-reflect/
Tool for Assessing Adaptation in Nationally Determined Contributions ((I)NDCs) (TAAN)	The Tool for Assessing Adaptation in the NDCs (TAAN) addresses policy-makers, decision-makers, national stakeholders, academia and other users interested in following the state of adaptation in the NDCs. TAAN allows users to compare several (I)NDCs' adaptation components, access a singular country's (I)NDC adaptation factsheet and visualize statistics of adaptation-related content mentioned in the (I)NDCs. The tool is a means of improving a comprehensive understanding of the adaptation-related content in the (I)NDCs. http://www.adaptationcommunity.net/nap-ndc/tool-assessing-adaptation-ndcs-taan/
Multi-stakeholder management: Tools for Stakeholder Analysis (GTZ, 2007)	10 building blocks for designing participatory systems of cooperation. Sector Project: Mainstreaming Participation. Report series: Promoting participatory development in German development cooperation. Eschborn: GTZ. https://www.fsnnetwork.org/sites/default/files/en-svmp-instrumente-akteuersanalyse.pdf
Gender Analysis	Tool to help analyze gender roles, activities, assets, needs and available opportunities for men and women. E.g. the CARE Rapid Gender Analysis Toolkit http://gender.care2share.wikispaces.net/CARE+Rapid+Gender+Analysis+Toolkit
Tools to support EbA (in development) (UNEP-WCMC and IIED)	Inventory of available tools to support EbA planning and implementation. https://www.iied.org/call-for-feedback-inventory-tools-support-ecosystem-based-adaptation
Gender and Vulnerable Groups and National	A guidance synthesizing and presenting information and tools for the integration of gender and vulnerable groups considerations into

Adaptation Plan Processes / NDCs – Guidance (GIZ 2017)	adaptation planning. http://www.adaptationcommunity.net/ndc_adaption_toolbox/gender-vulnerable-groups-gvg-national-adaptation-plan-nap-processes-ndcs-guidance/

B. Risk and Vulnerability Assessment

Purpose

Risk and vulnerability assessments are undertaken to identify the main climate change and disaster risks and impacts on the socio-ecological system of interest; for example, taking stock of biodiversity and ecosystem service information to identify any species or ecosystems that are particularly vulnerable to the negative impacts of climate change. The assessments are then used to identify, appraise and select targeted adaptation and disaster risk reduction interventions to be used in planning and design. Risk and vulnerability assessments also aid in the appropriate allocation of resources and the establishment of baselines against which the success of interventions can be monitored (GIZ and EURAC 2017).

Previous adaptation responses have largely been based on the concept of vulnerability in the IPCC's Fourth Assessment report (AR4), which describes the degree to which a natural or social system is susceptible to, and unable to cope with, adverse effects of climate change. In the most recent assessment report of the IPCC (AR5), vulnerability, exposure and hazards together determine impacts and the likelihood of disasters (disaster risk) (Figure 7). Thus, the concept of risk reduction is central to adapting to impacts and preventing disasters from occurring. While they have different definitions and underlying assumptions, both risk and vulnerability assessments follow a similar logic (GIZ and EURAC 2017).

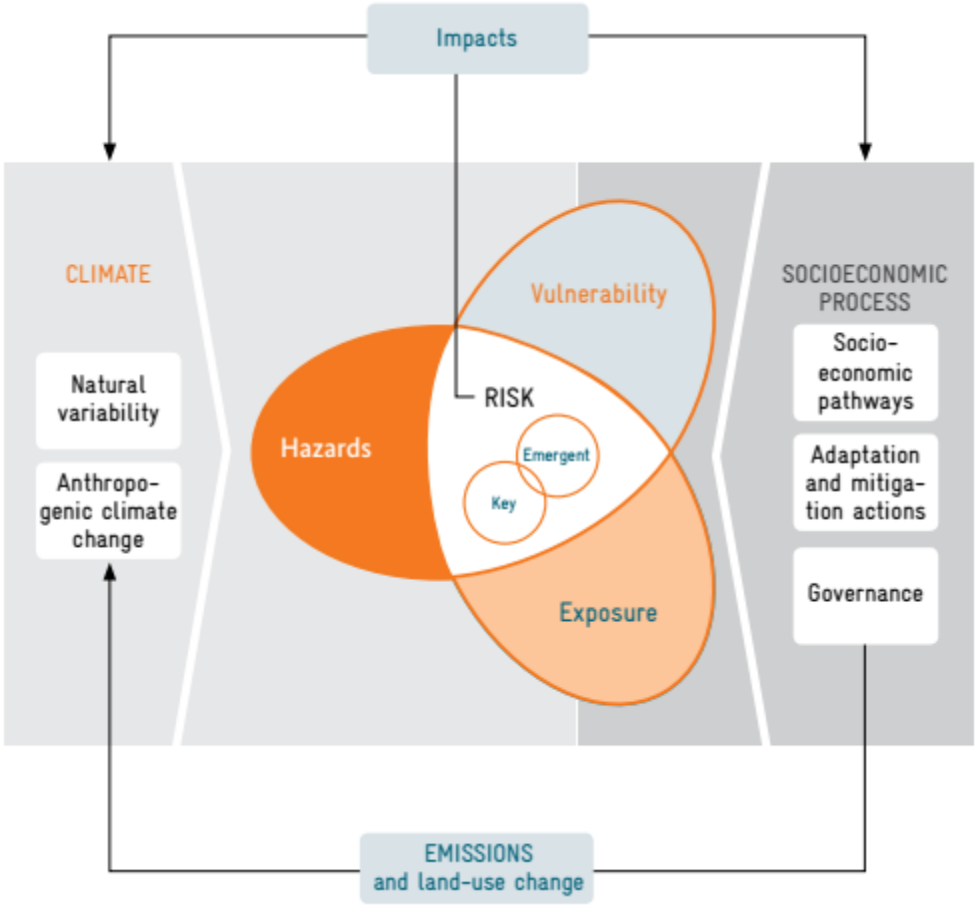

Figure 7: Key concepts in the IPCC Fifth Assessment Report (WGII) (IPCC 2014)

Risk assessments generally consists of three steps: risk identification (finding, recognizing and describing risk), risk analysis (estimation of the probability of its occurrence and the severity of the potential impacts) and risk evaluation (comparing the level of risk with risk criteria to determine whether the risk and/or its magnitude is tolerable) (European Environment Agency 2017). These steps consider both climate and non-climate factors that generate a climate or disaster risk.

The advantage of an integrated risk and vulnerability assessment approach, as opposed to assessing only vulnerability, is that it addresses the large proportion of impacts that are triggered by hazardous events, and that it integrates both CCA and DRR approaches (GIZ and EURAC 2017). A relatively new practice is moving from single hazard approaches to multi-hazard/multi-risk assessments. Such a practice has been adopted by the European Commission, which account for regions or classes of objects exposed to multiple hazards (e.g. storms and floods), and cascading effects, in which one hazard triggers another (European Environment Agency 2017).

Key considerations and general activities for undertaking risk and vulnerability assessments are discussed here. Examples of more detailed step-wise guidance are listed in Table 2, Step B Toolbox.

Outcome

- Risk and vulnerability profile of the socio-ecological system covering hazards, exposure, vulnerabilities (including sensitivities and adaptive capacities); and
- Main drivers of risks and underlying causes

Key Actions

- Consider unifying frameworks and concepts that recognize the linkages between people and ecosystems as integrated socioecological systems, rather than viewing adaptation and risk reduction only through a social or human lens.
- Based on the boundaries defined in Step A, and in consultation with the key stakeholders and rights holders identified, assess past and current climate and non-climate risks to the socio-ecological system with flexible criteria that address the linkages between human and environmental systems.
- Assess future risks based on climate change projections or scenarios that are at the appropriate scale and downscaled to the local level where appropriate.
- Integrate quantitative approaches (based on scientific models) and qualitative approaches, which are grounded in expert judgement and traditional and local knowledge. For example, use participatory rural appraisals to understand local perceptions and past experiences (WWF 2013).
- Develop hazard and risk maps, such as through the use of participatory 3-D modeling of risks.

Identifying the most vulnerable groups, communities and ecosystems

For adaptation and disaster risk reduction efforts to be successful, vulnerability assessments and adaptation planning should identify all relevant stakeholders and rights holders. This should include indigenous peoples and local communities, and historically or politically marginalized groups such as women, youth, the elderly, and the rural poor. Additionally, it is important to identify ecosystems that may be disproportionately impacted by climate change, particularly those that provide critical services. These assessments should examine the underlying social, economic and political drivers of vulnerability, identify the most vulnerable groups, communities and ecosystems and ensure that their needs are addressed effectively and equitably (CARE 2011). There are various ways in which the most vulnerable groups, communities and ecosystems can be identified, including:

- Make use of existing information by consulting previous assessments of climate change impacts on biodiversity and ecosystem services; for example, national impact and vulnerability assessments prepared for the UNFCCC, or vulnerability assessments from forest, agriculture, fisheries or other relevant sectors;
- Conduct gender analyses to determine gender considerations influencing vulnerability to climate change and disaster risk;
- Use geospatial data on poverty and disaster risk to target and prioritize regions for adaptation and disaster risk reduction;

- Conduct socio-economic and ecological field surveys to identify vulnerabilities in both communities and ecosystems (including ecosystems that provide critical services for climate change adaptation or DRR);
- Consult the IUCN Red List of Ecosystems Categories and Criteria[12]or the Climate Change Vulnerability Index for Ecosystems and Habitats[13] for assessing the status of ecosystems at local, national, regional and global levels. Assessments determine whether an ecosystem is vulnerable, endangered, or critically endangered; and
- Identify vulnerable communities, groups and ecosystems on an ongoing basis and in a participatory and inclusive manner to ensure EbA and Eco-DRR interventions are appropriately targeted to the people and ecosystems most in need.

Integrating knowledge, technologies, practices and efforts of indigenous peoples and local communities

Indigenous peoples and local communities (IPLCs) have managed variability, uncertainty and change through multigenerational histories of interaction with the environment (Nakashima et al. 2012). Traditional knowledge and coping strategies can thus form an important basis for climate change and disaster risk reduction responses, complementing science, and bridging gaps in information. Indigenous, traditional and local knowledge systems – and forms of analysis and documentation such as community mapping – can play a significant role in identifying and monitoring climatic, weather and biodiversity changes and impending natural hazards, similar to early warning systems. Ecosystem-based approaches can also bring back abandoned practices, such as the implementation of traditional agricultural practices in Senegal and Burkina Faso (Monty 2017). Integrating the knowledge of IPLCs also involves an appreciation of their cosmovision[14], and an acknowledgement of their role as knowledge holders and rights holders. Ways to incorporate indigenous and traditional knowledge and practices in EbA and Eco-DRR planning and implementation throughout all stages of planning and implementation include the following:

Key actions

- Understand linkages between local, indigenous and traditional knowledge and practices and climate change adaptation and disaster risk reduction;
- Consult multi-stakeholder working groups to facilitate knowledge-sharing across sectors on the role of ecosystems in adaptation;
- Provide communities and civil society organisations that represent them with the space to engage in dialogues with other communities, government units and organisations to identify sustainable and appropriate options for adaptation and risk reduction;
- Put in place participatory and transparent mechanisms to seek the best available evidence; and

[12] https://www.iucn.org/theme/ecosystem-management/our-work/red-list-ecosystems
[13] http://www.natureserve.org/conservation-tools/climate-change-vulnerability-index-ecosystems-and-habitats
[14] Worldview that has evolved over time that integrates physical and spiritual aspects (adapted from the Indigenous Peoples' Restoration Network).

- Integrate traditional knowledge into assessments, after obtaining free prior and informed consent.

Examples of the application of traditional knowledge to adaptation (extracted from the IPCC AR5, IPCC 2014) are listed in Annex V.

Table 2.

Step B Toolbox: Conducting risk and vulnerability assessments

Tool/Organization	Description
Vulnerability Sourcebook (GIZ 2014)	The Vulnerability Sourcebook offers a conceptual framework and step-by-step guidelines for standardised assessments of vulnerability to climate change
Risk Supplement to the Vulnerability Sourcebook (GIZ 2017) & Climate Risk Assessment for EbA - A guidebook for policy makers and practitioners (GIZ 2018)	The risk supplement is a practical guidance on how to apply the Vulnerability Sourcebook's approach using the IPCC AR5 risk concept. The guidebook applies a standardised approach to climate risk assessments in the context of EbA-planning by following the modular sourcebook and risk supplement methodology and using an illustrative application example. http://www.adaptationcommunity.net/vulnerability-assessment/vulnerability-sourcebook/
Operational Framework for EbA (WWF 2013)	Step-by-step guidance for implementing EbA including a chapter on the first step of conducting risk and vulnerability assessments
Adaptation Wizard	Risk and systems' vulnerability framework for adaptation developed in the UK. http://www.ukcip.org.uk/wizard/
CRiSTAL - Community-based Risk Screening Tool – Adaptation and Livelihoods	CRiSTAL is a tool developed by the International Institute for Sustainable Development, Stockholm Environment Institute and the International Union for the Conservation of Nature to help project planners and managers integrate climate change adaptation and risk reduction into community-level projects. https://www.iisd.org/cristaltool/
Scenario Planning for Climate Change Adaptation: A Guidance for Resource Managers	A step-by-step guide to using scenarios to plan for climate change adaptation. The intended audience includes natural resource managers, planners, scientists and other stakeholders working at a local or regional scale to develop resource management approaches that take future possible climate change impacts and other important uncertainties into account. http://scc.ca.gov/files/2013/04/Scenario-Planning.pdf
Quantitative Numerical Impact Assessment Models (IAMs)	Based on large ensembles of different climate models and risk scenarios and can thus identify model inputs that cause significant uncertainty in the output (perform 'sensitivity analyses') and help quantify uncertainty (39). In principle they can also be applied to choose robust risk treatment options (Lempert and Groves, 2010).
Risk Assessment and Mapping for disaster management' (EC 2010)	Multi-hazard and multi-risk perspective approach taking into account regions or classes of objects exposed to multiple hazards (e.g. storms and floods), with or without temporal coincidence. It also aims to consider 'cascading effects', in which one hazard triggers another in a cascading fashion.
Operational Framework for EbA (WWF 2013)	Contains detailed methodology for conducting vulnerability assessments of socio-ecological systems (also taking into account risks and hazards)
Gender-sensitive Climate	Provides a framework for analysing vulnerability and capacity to

Vulnerability and Capacity Analysis (GVCA): Practitioners Guide (Care International, 2009)	adapt to climate change and build resilience to disasters at the community level, with a particular focus on social and in particular gender dynamics, based on experiences of using the approach in Mozambique. http://careclimatechange.org/wp-content/uploads/2016/02/GCVCA_Practitioners-Guide-FINAL-July-2014.pdf
Climate Vulnerability and Capacity Analysis Handbook	Developed by CARE, the handbook assesses hazard impacts on each of the five categories of livelihood resources and provides a framework for community-based adaptation. http://www.careclimatechange.org/index.php?option=com_content&view=article&id=25&Itemid=30
CEDRA - Climate change and Environmental Degradation Risk and Adaptation assessment	Analyses risks posed by climate change and environmental degradation and supports NGOs in understanding communities' experiences of environmental change (Tearfund). http://tilz.tearfund.org/en/themes/environment_and_climate/cedra/
Risk and Vulnerability Assessment Methodology Development Project (RiVAMP) in Jamaica	This training manual was developed by UNEP to provide instruction on how to implement a methodology that helps to quantify the role of ecosystems in DRR and climate change adaptation, based on a pilot project implemented in Jamaica from 2009-2010. http://www.grid.unep.ch/products/3_Reports/RiVAMP_Training_2012.pdf
IUCN Red List of Ecosystems	Tool to evaluate the status of the ecosystems as well as a repeatable method to measure drivers and trends that contribute to ecosystem risks. Helpful to ensure long term functioning of ecosystems.
Database on the application of gender-sensitive approaches and tools	Case studies on the application of gender-sensitive approaches and tools for understanding and assessing impacts, vulnerability and adaptation to climate change as inputs for the technical paper mandated in paragraph 17 of FCCC/SBSTA/2013/3. http://www4.unfccc.int/sites/nwp/pages/Search.aspx
Integrating Landscape Dimensions in Disaster Risk Reduction: A Cluster Planning Approach:	https://link.springer.com/chapter/10.1007%2F978-3-319-43633-3_12. Based on a project by Partners for Resilience: www.partnersforresilience.nl.
Traditional Knowledge and Climate Science Toolkit	Provides articles, videos and various other resources that will assist indigenous peoples, local communities, policymakers and other stakeholders in accessing research on climate change adaptation and mitigation (United Nations University's Traditional Knowledge Initiative (UNU-TKI)).
The Toolkit for Ecosystem Service Site-based Assessment (TESSA)	Piloted in protected areas, TESSA guides non-specialists through methods for identifying which ecosystem services may be important at a site, and for evaluating the magnitude of benefits that people obtain from them currently, compared with those expected under alternative land-use. http://www.birdlife.org/datazone/info/estoolkit
World Overview of Conservation Approaches and Technologies (WOCAT)	Database of practices and technologies, including some based on indigenous and traditional knowledge https://www.wocat.net/projects-and-countries
Climate Resilience Evaluation for Adaptation Through Empowerment (CREATE) –Integrated Vulnerability and	CREATE is designed to integrate existing methods such as CRiSTAL, CARE's CVCA, etc. and provides a broad framework together with general guidelines and suggestions, allowing people to assess and analyse their vulnerability and capacity,

Capacity Assessment Method	identify adaptation options and begin the planning process.
Making Disaster Risk Gender-Sensitive: Policy & Practical Guidelines (UNISDR, UNDP and IUCN, 2009)	Increases understanding of gender concerns and needs in DRR; develop capacity to address gender issues, contains gender mainstreaming policy guidelines including gender-sensitive risk assessments, early warning systems, and gender-sensitive indicators to monitor mainstreaming progress.
Guidance on Integrating Ecosystem Considerations into Climate Change Vulnerability and Impact Assessment (VIA) to Inform Ecosystem-based Adaptation (UNEP-WCMC)	Provides information and advice on how to integrate consideration of ecosystems and their services into a climate change vulnerability and impact assessment. http://www.adaptation-undp.org/resources/training-tools/guidance-integrating-ecosystem-considerations-climate-change-vulnerability

C. Identifying EbA and Eco-DRR options

Purpose

Having defined the boundaries of the socio-ecological system/landscape and identified initial entry points for EbA and Eco-DRR (Step A), potential options are identified by the multi-stakeholder group within an overall strategy of adaptation and disaster risk reduction.

Outcome

- List of available strategies and options to reduce the exposure of socio-ecological systems to climate hazards and sensitivity and enhance adaptive capacity

Key Actions

- Identifying existing coping strategies and responses to climate change and disaster risks, and analysing whether they are viable for future climate impacts and risks.
- Refine the initial entry points identified for EbA/Eco-DRR. Some criteria for choosing and prioritizing entry points can include:
    - High probability of effectiveness from previous experiences in a similar socio-ecological setting;
    - Strong support from stakeholders.
- In collaboration with multi-stakeholder groups, inclusive of stakeholders, rights holders and experts, formulate appropriate strategies within an overall adaptation strategy to address the risks and vulnerabilities identified in Step B.
- Assess specific problems and priorities of the vulnerable groups, sectors, and ecosystems.
- Ensure that EbA and Eco-DRR are planned at local, community and household levels and also landscape or catchment level, as appropriate.
- Identify the EbA and Eco-DRR strategies that meet the objectives defined in Step A.

Table 3.

Step C Toolbox: Identifying EbA and Eco-DRR Strategies

Tool/Organization	Description
Ecosystems Restoration Opportunity Mapping for DRR and CCA (EcoDRR) UNEP/GRID-Geneva and UNEP/PCDMB	New methodology and global interactive tool for mapping areas where ecosystems can reduce disaster risk, crossing human exposure to natural hazards with presence/absence of ecosystems. This enables the prioritization of areas where ecosystems should be protected and areas where ecosystems should be restored. This project will also include capacity building. http://www.grid.unep.ch/index.php?option=com_content&view=article&id=47&Itemid=253&lang=en&project_id=235CE705
PANORAMA	Ecosystem based adaptation solutions. Useful for identifying different targets (Aichi, Sendai Framework, SDGs) and outlining challenges. http://panorama.solutions/en/solution/applying-ecosystem-based-disaster-risk-reduction-eco-drr-sustainable-and-resilient
Selection of nature-based solutions: Good practices in the Basque Autonomous Community (Spain)	Inventory of nature-based projects implemented in the Autonomous Community of the Basque Country (BAC). This selection showcases representative practices for further dissemination s examples for future policies. They are organised into three sections - rivers, coasts and cities - dedicated to iconic measures in each of the provinces of the Basque Country.
Addressing Slow-Onset Events (UNFCCC)	Database that maps 151 organizations working on slow onset events - rising temperatures, desertification, loss of biodiversity, land and forest degradation, glacial retreat and related impacts, ocean acidification, sea level rise and salinization, as defined by COP decision 1/CP.16 and the scope of their current efforts. http://www4.unfccc.int/sites/NWP/Pages/soe.aspx
Options for ecosystem-based adaptation in coastal environments: A guide for environmental managers and planners and decision-support tool (UNEP)	Supports environmental decision-makers in choosing, implementing, monitoring, evaluating and, over time, adaptively managing coastal EBA. Online guide, website and decision-support tool available at https://www.unep-wcmc.org/news/coastal-eba
Database on ecosystem-based approaches to Adaptation (UNFCCC)	An initiative under the Nairobi work programme to provide examples of ecosystem-based approaches to adaptation, supplementing information to FCCC/SBSTA/ 2011/INF.8, mandated by the SBSTA at its thirty-fourth session under the Nairobi work programme. http://www4.unfccc.int/sites/NWP/Pages/soe.aspx

D. Prioritizing, appraising and selecting EbA and Eco-DRR options

Purpose

In this step, the EbA and Eco-DRR options identified in Step C are prioritized, appraised and selected to achieve the goals set out in Step A, as part of an overall adaptation and disaster risk reduction strategy for the system of interest.

Outcome

- List of prioritized options based on selected criteria; and
- Selection of final options for implementation.

Key Actions

- Using participatory approaches (Step A), identify the criteria/indicators to be used to prioritize and appraise the adaptation and disaster risk reduction options identified in Step C. For example, using multi-criteria analysis or cost-effectiveness to evaluate adaptation options (see Table 1 for appraisal methodologies).
- Ensure that trade-offs and limitations of options are part of the appraisal process.
- Assign weights to the criteria, and use the criteria to rank the adaptation and disaster risk reduction options.
- Prioritize and short-list adaptation strategies based on the agreed-upon criteria.
- Make use of the multi-stakeholder group and consult other rights holders to identify the best options and develop a business case.

Key considerations

- Ensure costs, benefits, impacts and trade-offs are analyzed for different risk management scenarios, and that such analyses fully capture gains or losses in ecosystem services provisioning that impact on adaptation and disaster risk reduction and resilience (e.g. consideration for wetlands). The analyses should also consider costs of inaction.
- In appraising options, ensure that costs and benefits of adaptation interventions are considered over the long term, as the time period in economic comparison of various options is important, and consider both upfront capital and longer-term maintenance costs. For example, conventional DRR, such as the construction of dykes, are relatively inexpensive at the investment level but require high maintenance costs. Ecosystem-based approaches such as wetland restoration may be less expensive in the long-term.

Table 4: Methods for appraising the value of EbA and Eco-DRR activities (excerpted from Frontier Economics 2013) (CBA = cost-benefit analysis, NPV=net present value)

Methodology	Brief Description	Advantages	Disadvantages
Multi-criteria analysis (MCA)	Part or wholly qualitative-based approach, which provides a 'ranking' of initiatives based on monetary and non-monetary criteria	Allows appraisal to be conducted in the absence of/ limited amount of quantitative data	Limited to relative assessments of alternative policy options Outputs are appraisal-specific – i.e. cannot be generalised more widely
Cost-effectiveness analysis (CEA)	Quantitative approach which identifies the policy option providing a specific output/benefit at the lowest cost	Useful when a specific output/objective is needed to be met Can be used when comprehensive quantitative cost data is available for monetising costs but not benefits	Not applicable when a single initiative is being appraised, or when considering multiple initiatives providing different levels of the required benefit Implicitly ignores potentially significant co-benefits
Scenario-based cost-benefit analysis (SBCBA)	Quantitative approach which assesses costs and benefits (in monetary form) across different scenarios/states of the world	Accounts for uncertainty surrounding flood risk without being computationally or data intensive Provides numeric outputs, allowing for cardinal comparisons between initiatives Easily understood for non-technical audiences. Allows for the application of risk-based rules	Potentially difficult to gain consensus on the appropriate scenarios to use Risk of not capturing the extent of uncertainty surrounding climate change, especially under 'deep uncertainty'
Robust decision making (RDM)	Quantitative approach which assesses the proposed initiatives across all plausible states of the world, and identifies the initiative most robust across these	Captures deep uncertainty – leaves 'no stone unturned' Provides numeric outputs Provides a clear picture of which initiatives are optimal in different states of the world	Can be computationally and data intensive Potentially difficult to interpret for non-expert audiences Value function for deriving costs and benefits needs to be well calibrated Ranges of plausible parameter values need to be known
Real options analysis (ROA)	Extension of CBA which estimates the 'option value' associated with each initiative i.e. the option to delay or adjust in the future. Calculates the NPV of each initiative given the particular actions that could be taken given different states of the world being realised, and the probabilities of these occurring	Accounts for learning about the nature or extent of flood risk going forward. – captures the value in delaying or adjusting a particular initiative. Useful when comparing large irreversible options with smaller-scale flexible options	Can be computationally or data intensive – requires the assignment of probabilities to scenarios at various future time periods

Evaluating Trade-offs and Limitations

Part of the process of prioritizing, appraising and selecting adaptation/DRR options involves the identification and evaluation of potential trade-offs. Trade-offs may arise when an activity protects one group of people at the expense of another, or favours a particular ecosystem service over another. Some trade-offs are the result of deliberate decisions; others occur without knowledge or awareness. For example, the implementation of adaptation actions upstream may have effects on downstream communities. As ecosystems are subject to climate change impacts, EbA, Eco-DRR and other practices that use ecosystem-based approaches should be designed to be robust to the impacts of climate change. Indeed, it is important to ensure any adaptation or DRR response is robust to climate change impacts and recognize potential limitations of such responses.

Key actions

- Develop indicators of short and long-term changes across various spatial scales to detect potential trade-offs and limitations of EbA and Eco-DRR (see Step F for more detail).
- Consider the full range of infrastructure options from 'green' to 'hybrid' to 'hard' infrastructure and their compatibility, recognizing that different combinations are needed in different situations.
- Ensure that EbA and Eco-DRR are informed by the best available science and indigenous and traditional knowledge to fully account for possible trade-offs and limitations.
- Ensure the integration of EbA and Eco-DRR into overall adaptation or disaster risk reduction strategies, in recognition of potential limitations of ecosystem-based approaches.
- Consider and address trade-offs or unintended consequences of EbA and Eco-DRR throughout all stages of planning and implementation, including accounting for uncertainties in climate projections and for different scenarios.

Table 5.

Step D Toolbox: Prioritizing, appraising and selecting adaptation and DRR options and identifying trade-offs

Tool/Organization	Description
Valuing the Benefits, Costs and Impacts of Ecosystem-based Adaptation Measures: A sourcebook of methods for decision-making (GIZ 2017)	Resource to source to guide the design, delivery and use of EbA valuation studies to inform and influence decision-making, including 40 case studies on EbA-relevant valuations that have been implemented globally, over recent years. http://www.adaptationcommunity.net/download/sec_guides/EbA-Valuations-Sb_2017-Dec_en_online_1-0.pdf
Structured decision-making approach to climate change adaptation	Based on the use of a qualitative matrix which considers trade-offs between strategies and objectives (Ohlson, et al., 2005)
Integrated Valuation of Environmental Services and Tradeoffs (InVEST)	InVEST is a suite of software models used to map and value the goods and services from nature that sustain and fulfil human life. This tool enables decision makers to assess quantified trade-offs associated with alternative management choices and to identify areas where investment in natural capital can enhance human development and conservation. http://www.naturalcapitalproject.org/InVEST.html
Restoration of the sponge function in wetland soils as a measure for integrated river basin management in the Rhine catchment	This report presents the results of the recent study on the costs and benefits of restoration of the sponge function in wetland soils in the middle mountains of the Rhine basin for flood and drought risk reduction.
ROAM (Restoration Opportunities Assessment Methodology)	Restoration and assessment methodology for land use trade-offs at landscape scale https://www.iucn.org/theme/forests/our-work/forest-landscape-restoration/restoration-opportunities-assessment-methodology-roam
OpeNESS	Decision-making tool on Natural Capital and Ecosystem Services www.openness-project.eu
Voluntary guidelines for responsible governance over the tenure of land, forestry and fisheries (FAO 2012)	Provides a forward-looking framework for countries to enhance tenure security and user and access rights over land and natural resources used in agriculture, forestry and fisheries sectors. The voluntary guidelines also provide guidance on how to ensure principles such as transparency, equity, civic engagement, accountability, effectiveness, efficiency and sustainability can be upheld in land administration, management and policy formulation.

E. Project Design and Implementation

Purpose

In this step, the interventions selected in Step D are designed and implemented according to the principles and safeguards. A number of Key Actions are also included in this step. Throughout the design and implementation, it is important to continually revisit the principles and safeguards and

ensure ongoing stakeholder engagement, capacity-building, mainstreaming and monitoring (Figure 6).

Outcome

- A project design and implementation plan (incl. a finance strategy, capacity development strategy, defined actions for institutional and technical support measures)

Key Actions

- Consider the EbA and Eco-DRR principles and safeguards throughout design and implementation, such as using local and traditional knowledge where appropriate (See Step B).
- Apply the qualification criteria and standards for EbA (FEBA 2017).
- Design interventions at the appropriate scale, e.g. land/seascape or local for addressing the goals set out in Step A.
- Ensure that the relevant experts are engaged, and strengthen linkages between the scientific community and project executors to ensure optimal and appropriate use of ecosystems for adaptation and DRR.
- Select the appropriate tools to use, and if needed, plan for the development of new methodologies (see Table 6, Step E toolbox)
- Determine technical and financing requirements and develop a budget accordingly.
- Establish a workplan including timelines of activities, milestones to achieve, multi-stakeholder consultations needed, and allocation of tasks and responsibilities.
- Develop strategies to mitigate identified risks and trade-offs and enhance synergies (Step D).
- Establish linkages between the project and national, sub-national, and/or local development plans, strategies, and policies.
- Consider principles for building resilience in socio-ecological systems (see Box 3).

Box 3: Applying Resilience Thinking in EbA and Eco-DRR Design

A resilience approach to sustainability focuses on building capacity to deal with unexpected change (Stockholm University 2014)– such as the impacts of climate change and the risk of disaster. Applying a resilience lens to designing EbA & Eco-DRR interventions involves managing interactions between people and nature as socio-ecological systems to ensure continued and resilient provisioning of essential ecosystem services that provide adaptation and disaster risk functions. There are seven key principles in applying resilience thinking, distilled from a comprehensive review of different social and ecological factors that enhance resilience of socio-ecological systems and the ecosystem services they provide (Stockholm University 2014):

1. Maintain diversity and redundancy by, for example, maintaining biological and ecological diversity. Redundancy here implies the presence of multiple components that can perform the same function, can provide 'insurance' within a system by allowing some components to compensate for the loss or failure of others.
2. Manage connectivity (the structure and strength with which resources, species or actors disperse, migrate or interact across patches, habitats or social domains in a socio-ecological system), e.g. by enhancing landscape connectivity to support biodiversity and ecosystem services that contribute to adaptation and risk reduction.
3. Manage slowly changing variables and feedbacks (two-way 'connectors' between variables that can either reinforce (positive feedback) or dampen (negative feedback) change.
4. Foster complex adaptive systems thinking by adopting a systems framework approach (Step A)
5. Encourage learning such as by exploring different and effective modalities for communications
6. Broaden participation, such as by dedicating resources to enable effective participation
7. Promote polycentric governance systems, e.g. by cross-sectoral and multi-institutional cooperation across scales.

Transboundary and cross-sectoral cooperation, coordination and policies

Climate change impacts and disaster risks extend beyond political boundaries, and examining problems through an integrated landscape or systems approach can aid in problem-solving across sectors and boundaries. Transboundary cooperation can enable the sharing of costs and benefits of adaptation measures and prevent potentially negative impacts of unilateral adaptation measures. Transboundary cooperation can also provide opportunities for socioeconomic development and the management of issues at appropriate ecosystem scales. For example, in the European Union, disaster risk has been addressed at a transboundary level for Danube River region, which is affected by floods, air pollution and severe weather on both the Bulgarian and Romanian sides of the Danube. Improved collaboration and the development of a joint monitoring and response system have been supported by a cross-border cooperation project, including downstream alerts for floods or water pollution, and improved joint emergency response services.

Transboundary and cross-sectoral considerations can be integrated into EbA and Eco-DRR by:

- Integrating the different scales of critical ecosystem functioning needed for adaptation and disaster risk reduction in EbA and Eco-DRR;
- Setting up a commission or task group with transboundary partners and sector; representatives to develop a joint vision, goals and objectives for EbA and Eco-DRR;
- Developing a common understanding of vulnerabilities at the transboundary scale and for different sectors through the use of common models and scenarios and agreed-on methodologies and sources of information; and
- Adopting an iterative monitoring and evaluation process (see Step F) to ensure that transboundary and cross-sectoral EbA and Eco-DRR strategies continue to meet national adaptation and disaster risk reduction targets and maximize the potential for multiple benefits.

Table 6.

Step E Toolbox: Project design and implementation

Tool/Organization	Description
Implementing nature-based flood protection: Principles and implementation guidance. (World Bank. 2017)	Guidelines including principles and implementation steps for ecosystem-based flood protection.
Water in drylands: Adapting to scarcity through integrated management (Davies et al. 2016)	Guidelines for integrated water resources and management in drylands ecosystems https://portals.iucn.org/library/node/46239
Protected Areas as tools for disaster risk reduction: a handbook for practitioners (Dudley et al. 2015)	Guidelines on using protected areas systems for disaster risk reduction (and climate change adaptation)
Safe Havens: Protected Areas for Disaster Risk Reduction and Climate Change Adaptation (Murti & Buyck 2014)	18 case studies to demonstrate how Protected Areas (PAs) can be better managed for disaster risk reduction (DRR) and climate change adaptation (CCA).
Restoring River Continuity: methods and challenges (Wetlands International – European Association and the Italian Center for River Restoration)	Webinars explaining methods and challenges of river restoration with a specific focus on improving river connectivity https://europe.wetlands.org/event/rivers/
Climate Change Adaptation for World Heritage Sites: A Practical	Guidelines and framework for assessing risk to World Heritage sites and features of contribute to their Outstanding Universal Value (OUV) and identifying and selecting options for adaptation and DRR.

Guide (UNESCO) (Perry, J. and Falzon, C. 2014.) Paris,	http://whc.unesco.org/en/series/
Building with Nature and hybrid approaches	Guidelines on how to introduce and integrate Building with Nature principles into water infrastructure development. https://www.ecoshape.org/en/design-guidelines/ and https://publicwiki.deltares.nl /display/BWN1/Guideline
Mainstreaming Climate-Smart Agriculture into a Broader Landscape Approach (FAO 2012)	Guidance on understanding the different options that are available for planning, policies and investments and the practices that are suitable for making different agricultural sectors, landscapes and food systems more climate-smart. http://www.fao.org/3/a-i3325e.pdf
CBD Decision XIII/5: Ecosystem restoration: short-term action plan	Principles and key activities for short-term action plans on ecosystem restoration https://www.cbd.int/doc/decisions/cop-13/cop-13-dec-05-en.pdf
Gender, Climate Change and Community-Based Adaptation	Guidebook for designing and implementing gender-sensitive community-based adaptation programmes and projects. (UNDP) http://www.undp.org/content/undp/en/home/librarypage/environment-energy/climate_change/gender/gender-climate-change-and-community-based-adaptation-guidebook-.html
Pacific Gender and Climate Change Toolkit: Tools for Practitioners	Toolkit designed to support climate change practitioners working in national governments, non-governmental organisations, regional and international organisations, integrate gender into all aspects of policy, programming and project work. The Pacific Gender and Climate Change toolkit https://www.pacificclimatechange.net/sites/default/files/documents/Pacific_gender_toolkit_full_version.pdf
Making Ecosystem-based Adaptation Effective: A Framework for Defining Qualification Criteria and Quality Standards (FEBA 2017)	Practical assessment framework for designing, implementing and monitoring EbA measures by proposing a set of elements, qualification criteria and quality standards and example indicators. EN: http://www.adaptationcommunity.net/download/ecosystem-based_adaptation/technical_paper/FEBA_EbA_Qualification_and_Quality_Criteria_EN.pdf SP: http://www.adaptationcommunity.net/download/ecosystem-based_adaptation/technical_paper/FEBA_EbA_Qualification_and_Quality_Criteria_ES.pdf FR: http://www.adaptationcommunity.net/wp-content/uploads/2017/07/FEBA_EbA_Qualification_and_Quality_Criteria_FR.pdf
EbA Finance Guidebook (GIZ 2018)	This guidebook, provides practical information on potential funding sources for EbA measures from public and private actors by a collection of country examples. http://www.adaptationcommunit.net
Exploring nature-based solutions: The role of green infrastructure in mitigating the impacts of weather- and climate change-related natural hazards	Report focusing on extreme events and natural hazards at the European scale that are projected to increase due to climate change, such as landslides, avalanches, floods and storm surges. In addition, the report also touches upon the green infrastructure and ecosystem services contributing to global climate regulation. The analysis is carried out using spatially explicit data centred on the physical capacity of ecosystems to deliver services that can mitigate natural hazard risks.
AdaptationCommunity.net	On-line platform for sharing information on applying approaches, methods and tools that facilitate the planning and implementation of adaptation action.
A Community of Practice	A YouTube channel, established in October 2016, provides regular information from

for EbA on YouTube	practitioners, experts, planners and decision makers on EbA related topics, such as broadcasted webinars.

F. Monitoring and Evaluation of EbA and Eco-DRR

Purpose

Monitoring and evaluation (M&E) of EbA and Eco-DRR actions are critical for assessing the progress and effectiveness of EbA and Eco-DRR interventions. **Monitoring** involves systematically collecting and documenting data on specified indicators with the aim of tracking change. This enables planners and practitioners to improve adaptation efforts by adjusting processes and targets, and can be carried out during implementation throughout the lifetime of the adaptation/risk reduction intervention (UNFCCC 2012). Continuous monitoring throughout the EbA/Eco-DRR planning and implementation process is needed so that management can be adapted according to changing conditions (Hale et al. 2009). **Evaluation** is the systematic and objective assessment of an ongoing or completed project, programme or policy, its design, implementation and results. An evaluation should also assess the effects of any positive or negative changes in the developmental and environmental context of an EbA measure (GIZ 2018 based on UNEP 2017). Together, monitoring and evaluation improve implementation by providing information for adaptive management and applying lessons learned, informing communication education and outreach. Moreover, the can also help to build the evidence base for EbA and Eco-DRR and inform future policy and practice.

Just as the adaptation and disaster risk reduction fields are merging in terms of assessing risks and vulnerability, there is also a movement towards integrating approaches for M&E from both fields. A myriad of M&E approaches and frameworks have been developed for monitoring and evaluation of adaptation and risk reduction interventions, such as logical frameworks and results-based management (Doswald and Estrella 2015). As with risk and vulnerability assessments (Step B), rather than providing detailed step-by-step guidance, key actions and considerations are outlined[15] (see Table 6, Step E tool box).

Outcome

- Monitoring and Evaluation Framework

Key Actions

- Set up an M&E framework, establishing its objectives, audience (who uses the information from an M&E assessment), data collection, mode of information dissemination, and available technical and financial capacity.
- Develop a results framework within the M&E framework that details expected effects from the EbA/Eco-DRR intervention, including short-, and medium-term outcomes and long-term results.

[15] Several of the key actions and considerations outlined in this section are based on GIZ's M&E Learning Brief currently in development

- Develop indicators at the appropriate temporal and spatial scales to monitor the quantity and quality of change:
    - Ensure that monitoring and evaluation include SMART indicators, which are specific, measurable, achievable and attributable, relevant and realistic, time-bound, timely, trackable and targeted (WWF 2013). In addition, the ADAPT principles (Adaptive, Dynamic, Active, Participatory, Thorough) provide a useful reference (GIZ 2017). More information on indicators are available through CBD[16] and IPCC AR5 (Noble et al. 2014).
    - Ensure that indicators are vulnerability and risk-oriented and focused, and that they are able to measure high risks vs. low risks and how EbA/Eco-DRR interventions reduce risk over time. It is important to define "risk layers" and to prioritise which risks should be measured using indicators.
    - Use targets and indicators under the Sustainable Development Goals, Aichi Biodiversity Targets and other relevant frameworks to track progress in sustainable ecosystem management and biodiversity enhancement, which also deliver towards strengthening resilience to climate change impacts and disasters.
    - Align indicators with existing M&E frameworks where possible
- Determine baselines for assessing effectiveness
- Use appropriate participatory and inclusive tools for monitoring and evaluation of EbA and Eco-DRR, ensuring engagement of local communities, stakeholders and rights holders (see Annex III). Ensure the relevant experts are engaged, such as specialists on ecosystem status, species status, ecosystem function.
- Test EbA/Eco-DRR related indicators for local relevance.

[16] https://www.cbd.int/sp/indicators/

Increasing scientific and technical knowledge of EbA and Eco-DRR approaches

EbA and Eco-DRR are based on transdisciplinary and multi-sectoral approaches, creating new avenues for research which can help to increase the evidence base and work towards transformational change (Box 4). The Paris Agreement (Article 8) outlines several areas of cooperation and facilitation to enhance understanding, action and support for adaptation. This includes adaptation to slow onset events, events that may involve irreversible and permanent loss and damage, comprehensive risk assessment and resilience of communities, livelihoods and ecosystems.

Box 4: Opportunities for research to enhance the evidence base for EbA and Eco-DRR

The transdisciplinary, multi-sectoral approaches of EbA and Eco-DRR provide many opportunities for enhancing the evidence base for EbA and Eco-DRR. To do so, it is necessary to enhance linkages between IPLCs, the scientific community, experts and practitioners throughout all stages of EbA and Eco-DRR. These stages include planning and implementation through consultations, knowledge platforms, learning networks, communities of practice, and knowledge co-generation.

Areas that could benefit from collaborative research regarding EbA and Eco-DRR include:

- Exploring new modeling approaches to understand the linkages between adaptation, disaster risks, and socio-ecological systems, and linkages between biodiversity and climate change at different scales
- Developing comparative assessment procedures of EbA and Eco-DRR vs. traditional hard or grey infrastructure
- Developing and testing indicators of EbA and Eco-DRR efficacy in the context of socio-ecological resilience
- Understanding the limits and thresholds of EbA and Eco-DRR
- Understanding the full scope of multiple benefits from implementing EbA and Eco-DRR, and means to upscale them
- Enhancing efficacy of participatory processes

Table 7.

Toolbox for Monitoring and Evaluation

Tool/Organization	Description
Monitoring and evaluating ecosystem-based adaptation (EbA) – A guidebook (GIZ, 2018)	Step-by-step practical guidance on the development and implementation of an M&E system for EbA. The guidebook takes a multiscale approach, which enables EbA projects operating at a local and community level to connect with EbA policies and programmes generated at regional and national levels and demonstrates the benefits of EbA and how effective M&E can strengthen the case for its inclusion in strategies for responding to the impacts of climate change.
Monitoring and Evaluation Learning Brief:	Experiences from practitioners on how to set up M&E

How to measure successes of ecosystem-base adaptation (GIZ 2017)	systems and indicators for monitoring and evaluating adaptation results and linking EbA-specific M&E to other monitoring and reporting systems
Climate Change Policy Brief: Adaptation metrics and the Paris Agreement (GIZ)	http://www.adaptationcommunity.net/wp-content/uploads/2017/11/giz2017-en-policy-brief-adaptation-metrics.pdf
Learning Framework for IUCN's Work on EbA	This document summarises a more detailed version of a learning framework and set of core learning questions for union-wide learning on EbA.
AdaptMe: Adaptation Monitoring and Evaluation Toolkit	http://www.ukcip.org.uk/wp-content/PDFs/UKCIP-AdaptME.pdf
Annex VI (this document)	Contains a list of tools and approaches for conducting EbA and Eco-DRR M&E (DEA and SANBI 2017)

Mainstreaming EbA and Eco-DRR

Purpose

Mainstreaming refers to the integration of ecosystem-based approaches into climate- and disaster-sensitive planning and decision making processes at all levels. The mainstreaming process may start with integrating ecosystem considerations into adaptation and disaster risk reduction objectives, strategies, policies, measures or operations so that they become part of the national and regional development policies, processes and budgets at all levels and stages (Jiménez Hernández 2016). Mainstreaming enhances the effectiveness, efficiency, and longevity of EbA and Eco-DRR initiatives by embedding their principles into local, municipal and national policies, planning, assessments, financing, training, and awareness campaigns, among other policy tools. The overall goal is enhanced support and implementation of EbA and Eco-DRR where it proves to be an effective means to climate change adaptation and disaster risk reduction through increased awareness and understanding of how ecosystems and biodiversity contribute to multiple policy objectives.

Mainstreaming occurs continuously throughout the EbA and Eco-DRR planning and implementation process. The process begins in Step A with achieving a broad understanding of the political and institutional set-up of the target system, which enables the identification of potential entry points for mainstreaming. Other key components of mainstreaming include raising awareness, capacity-building and enhancing sectoral outreach, which are discussed in further detail below. A sample framework for mainstreaming is shown in Figure 8.

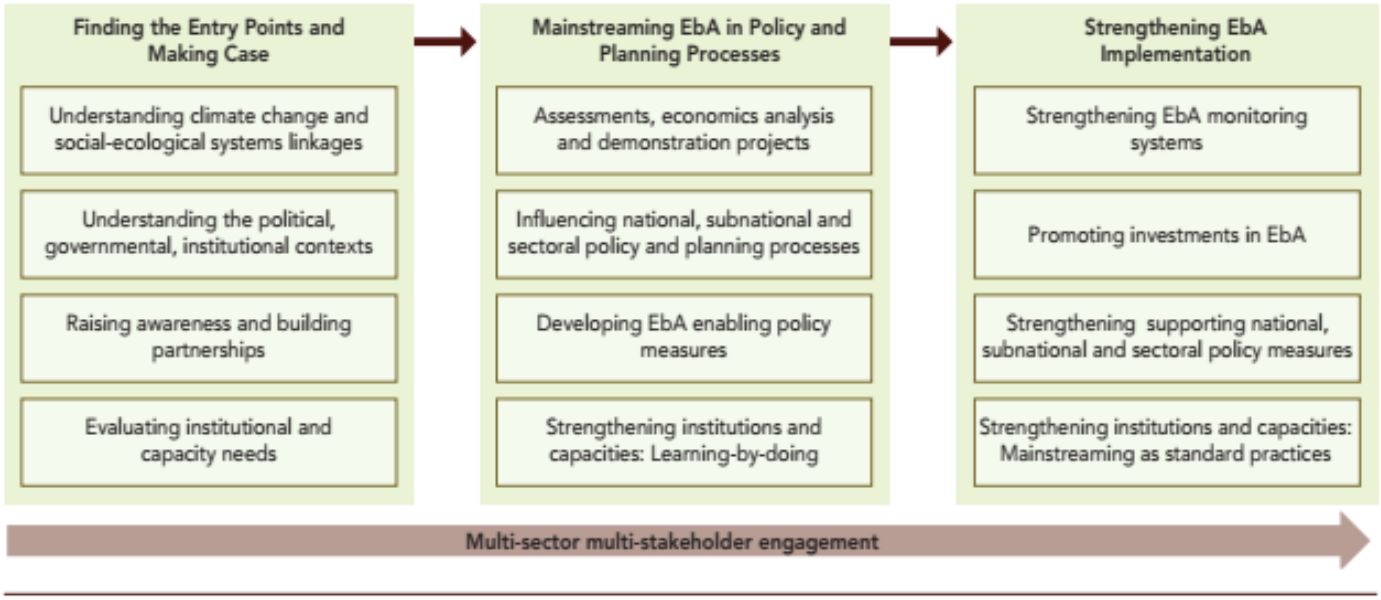

Figure 8: Example framework for mainstreaming EbA (and Eco-DRR) in development planning (Source: WWF 2013, adapted from UNDP-UNEP Framework for mainstreaming adaptation into development planning.

Key Actions

- Underscore the value of healthy ecosystems in adaptation and disaster risk reduction policies and frameworks, supporting the maintenance of functioning and provisioning of essential services under various future climates;
- Assess existing national adaptation and disaster risk reduction policies, plans and investments, in addition to broader (non-adaptation- and DRR-related) environmental, land use and development policies and plans to identify entry points for promoting Eco-DRR/CCA implementation. These include, but are not limited to:
    - National Biodiversity Strategies and Action Plans (NBSAPs)
    - National Adaptation Plans (NAPs) and linkages to Nationally Determined Contributions (NDCs) and national legislation
    - National Plans for Land Degradation Neutrality
    - Disaster risk management plans, including national drought strategies
    - Land-use planning, including urban planning
    - Agricultural, fisheries, water, infrastructure, and other sectors
    - Development policies
    - Budget plans;
- Align EbA and Eco-DRR with national and sub-national development frameworks and mainstream into relevant plans, policies and practice at multiple scales to enhance long-term sustainability and possibilities for funding;
- Align with international frameworks and conventions, such as the SDGs, CBD Strategic Plan for Biodiversity, and others, and incorporate EbA / Eco-DRR measures into reporting schemes;

- Improve convergence in the design and implementation of EbA and Eco-DRR into existing programmes of work (including adaptation, environment, development, humanitarian), including climate-proofing existing interventions;
- Incorporate a disaster and climate risk reduction lens when implementing Environmental Impact Assessments (EIAs) and Strategic Environmental Assessments (SEAs) to prevent unintended environmental impacts that may exacerbate risk and to promote EbA and Eco-DRR measures;
- Invest in risk-informed development by protecting existing healthy natural/green infrastructure from new development (e.g. water-infrastructure or coastal) and by creating boundary conditions for the design of such large-scale developments;
- Create entry points for ecosystem-based solutions in ministerial guidelines for tenders by developing boundary conditions, including considering green or hybrid solutions before grey when more effective;
- Create incentive structures for the promotion of eco-friendly infrastructure development and incentives for private sector to include EbA / Eco-DRR (e.g. tax reduction); and

- Screen national tax systems and public funding to avoid / eliminate perverse incentives,

Box 4: How do EbA & Eco-DRR fit into the UNFCCC (I)NDCs and NAPs?

(Intended) Nationally Determined Contributions ((I)NDCs) set out high-level objectives and a vision for addressing adaptation goals. 86 % of countries who submitted (I)NDCs include an adaptation component in their plans which outline goals, activities and needs for adaptation (World Resources Institute 2017). The most commonly cited needs for adaptation among sectors are in the water, agriculture and human health sectors (Mogelgaard and McGray 2015).

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. The main elements in developing a NAP are laying the groundwork and addressing gaps, preparatory elements including identifying and appraising adaptation options, implementation strategies; and reporting, monitoring and review. The NAP process is a key tool for coherent implementation of an (I)NDC adaptation component (GIZ 2016b). Entry-points for integrating EbA and Eco-DRR include:

- An ecosystem and risk reduction lens should be applied to the NAP process. For example, in assessing vulnerabilities and risk, using a landscape or systems approach will help to identify ecosystems that provide critical climate regulation services. EbA is explicitly listed as one of several approaches in the NAP Technical Guidelines for conducting vulnerability and risk assessments, which can aid in prioritizing of measures such as conservation or restoration actions to maintain ecosystem health and functioning.
- In reviewing and appraising adaptation options, it is recommended to consider economic, ecosystem and social costs and benefits. Using appraisal methods that consider costs and benefits in the short and long-term and within appropriate geographical scales can aid in making the case for ecosystem-based approaches.
- In implementing adaptation activities, the NAP process also notes that implementation approaches could include a resilience approach, through climate-proofing development or ecosystem-based approaches. The NAP planning process is iterative and adaptive, and can involve the use of several different approaches in each of its main elements. (see NAP Technical Guidelines, Least Developed Countries Expert Group 2012).

ecosystem degradation, or maladaptations.

Raising awareness and building capacity

Communicating the multiple benefits of EbA and Eco-DRR across sectors, communities of practice, and disciplines is crucial to enhancing uptake and sustainability of initiatives, in addition to opening avenues for funding. National and international policy agreements provide an opportunity to bridge the gap between different communities of practice. Inter-linkages between ecosystem management, climate change and disaster risk reduction are all reflected in various targets under the Sustainable Development Goals, the Sendai Framework for Disaster Risk Reduction, the Paris Agreement on Climate Change, decisions of the Rio Conventions, and Resolutions of the Ramsar Convention[17].

[17] Annex II in this document, CBD Technical Series No. 85 (Lo 2016) Annexes II and III

Ways to enhance the capacity of government, civil society, and stakeholders to incorporate EbA measures into national and international adaptation processes include:

- Conduct a baseline assessment of existing skills/capacity of policy makers to identify capacity and address uptake gaps and needs;
- Conduct a baseline assessment on institutional capacities and existing coordination mechanisms to identify needs for sustainably mainstreaming and implementing EbA and Eco-DRR;
- Consider the different information and communication needs of different stakeholder groups to develop effective outreach;
- Build a common knowledge base and a common language among stakeholders to support their cooperation;
- Support active engagement of environmental managers in national platforms for the adoption and implementation of EbA and Eco-DRR strategies and plans aimed at strengthening economic, social, health and environmental resilience;
- Identify EbA and Eco-DRR champions, high-level decision makers and institutions that can help in advocacy;
- Systematically document the economic, social and environmental costs and benefits of EbA and Eco-DRR measures as compared with 'grey' or 'hard' infrastructure measures;
- Join networks to share information on experiences, barriers, opportunities, lessons learned, and best practices, including:
    - PEDRR (Partnership for Environment and Disaster Risk Reduction), a global alliance of UN agencies, NGOs and specialist institutes, a global thematic platform of the International Strategy for Disaster Reduction (ISDR) that 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.
    - Friends of EbA, an informal network of organizations with an interest in promoting collaboration and knowledge sharing on through joint events and initiatives, and the development of position papers and technical documents on EbA[18]
    - PANORAMA – Solutions for a Healthy Planet, 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.[19]
    - BES-Net (Biodiversity and Ecosystem Services Network)[20], a capacity building "network of networks" that promotes dialogue among science, policy and practice for more effective management of biodiversity and ecosystems

[18] https://www.iucn.org/theme/ecosystem-management/our-work/ecosystem-based-adaptation-and-climate-change/friends-eba-feba
[19] http://www.panorama.solutions/en/explorer/grid/1042
[20] http://www.besnet.world/

- Ecoshape: the foundation that carries out the public-private Building with Nature innovation programme. Within Ecoshape contractors, engineering companies, research institutions, governments and NGOs work together to develop and spread knowledge about Building with Nature. This is a new approach to hydraulic engineering that uses the forces of nature to benefit environment, economy and society. www.ecoshape.org

Box 5: What are opportunities for EbA and Eco-DRR funding?

EbA and Eco-DRR contribute to multiple objectives, including development, disaster risk, adaptation, mitigation, food and water security, and to ensure risk-informed investments. The cross-sectoral and transdisciplinary approaches of EbA and Eco-DRR, and the potential realization of multiple benefits, offer several opportunities to attract/enhance funding.

- Encourage new financial incentives for investments in sustainable ecosystem management that emphasize ecosystems as part of adaptation and disaster risk planning.
- Unlock new investments for EbA and Eco-DRR through the climate-proofing of existing investment portfolios.
- Work with the private sector (including insurance, tourism, agriculture and water sectors) to harness their expertise, resources and networks. This helps in encouraging and scaling up investments in EbA and Eco-DRR, and identifying public-private partnerships.
- Engage government regulatory bodies to support and endorse private sector investments in natural infrastructure and EbA and Eco-DRR.
- Identify partnerships with industry associations that can aid in the identification of climate risks, impacts and adaptation strategies. Examples include the development of climate risk assessment tools for use by private sector investors and insurance companies, adoption of hydro-meteorological and climate information services, and working with developers to improve land-use planning including EbA and Eco-DRR activities such as ecosystem restoration.
- Create incentive structures for EbA / Eco-DRR, especially for private landowners and companies.

The mainstreaming of EbA and Eco-DRR into funding priorities should ensure that initiatives adhere to the four EbA and Eco-DRR cornerstones with clear intentions to achieve enhanced socio-ecological resilience to climate change impacts and disasters, and with consideration of how to follow the principles and adhere to the safeguards to avoid adverse outcomes.

Enhancing Sectoral Outreach to Mainstream EbA and Eco-DRR

As emphasized throughout the process, outreach into sectors is key to raising awareness of EbA/Eco-DRR and integrating EbA and Eco-DRR into sectoral plans and national-level planning. Sectoral outreach will be discussed in more detail in Section C, but several lessons learned have emerged:

- Learn from well-established cross-sectoral planning mechanisms, such as integrated water resources management (IWRM), integrated coastal zone management (ICZM) and land-use

planning, to strengthen cross-sectoral cooperation and enhance uptake of EbA and Eco-DRR into relevant sectoral frameworks.

- Integrate EbA and Eco-DRR in sectoral development plans at local, national and regional scales, such as in land use and water management, both in rural and urban contexts.
- Integrate conservation, restoration and sustainable management of landscapes/seascapes as part of risk management strategies in rural and urban development planning.
- Analyze information among sectors related to ecosystem service benefits, and identify information gaps to assess opportunities for EbA and Eco-DRR.
- Create incentive structures to encourage innovation.
- Create an enabling environment by revising legislation or regulations that are obstacles.
- Develop an investment plan for innovation and aligning with priorities to attract budgets.
- Improve internal capacity and understanding of EbA and Eco-DRR, including through training workshops and promoting use of online resources.
- Review technical standards, e.g. procurement documents, guidance and M&E project cycle needs to allow flexibility of ecosystem solutions.

Table 8

Toolbox for mainstreaming adaptation and DRR

Tool/Organization	Description
Using NDCs and NAPs to Advance Climate-Resilient Development: Framework for linking NAPs and NDCs (IISD)	Guidelines on streamlining and leveraging Nationally Determined Contributions (NDCs) and National Adaptation Plans (NAPs) to improve adaptation planning and action. http://napglobalnetwork.org/2016/11/using-ndcs-naps-advance-climate-resilient-development/
NAP Align: Aligning NAP processes to development and budget planning (GIZ)	Provides practical recommendations on how to integrate adaptation to climate change into a country's planning and budgeting system (English and French)
Opportunities and options for enhancing adaptation actions and supporting their implementation: reducing vulnerability and mainstreaming adaptation	Provides an initial exploration of opportunities and options for reducing vulnerability and mainstreaming climate change adaptation, including through the process to formulate and implement national adaptation plans Provides stepwise guidance, includes a section on opportunities for financing and implementing EbA/Eco-DRR
Mainstreaming Ecosystem-based Adaptation into development planning	A practice-oriented training course developed by GIZ (2016), which contains four several flexible modules and complementary sessions to guideadressing the main steps of the EbA mainstreaming cycle and includes a session on Eco-DRR(also relevant to Eco-DRR) (English and Spanish)[21]
Biodiversity Mainstreaming Toolbox for land-use planning and development	Compiled by ICLEI – Local Governments for Sustainability and SANBI Grasslands Programme) (SANBI 2014)[22]
Mainstreaming Climate Change Adaptation into Development	Developed by UNDP-UNEP Poverty-Environment Facility)[23]

[21] For more information on the mainstreaming training course (available by request), please see http://www.adaptationcommunity.net/trainings/training-course-mainstreaming-ecosystem-based-adaptation-development-planning-updated-2016/

[22] SANBI 2014, available at http://biodiversityadvisor.sanbi.org/wp-content/uploads/2015/02/Biodiversity-Mainstreaming-Toolbox_Senior-Managers-Summary.pdf

[23] Available at http://www.unpei.org/

Planning: A Guide for Practitioners	
Integrated Strategic Environmental Assessment in Sri Lanka (UNEP and UNDP)	Provides guidance on undertaking Integrated Strategic Environmental Assessments that includes considerations for enhancing resilience. http://www.unep.org/disastersandconflicts/Introduction/DisasterRiskReduction/Capacitydevelopmentandtechnicalassistance/ISEAinSriLanka/tabid/105928/Default.aspx
CBD Technical Series No. 85 (Lo 2016)	Contains several examples of mainstreaming EbA and Eco-DRR into national plans, strategies and targets

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Annex I: Glossary[24]

Term	Definition/description and source
Adaptation	In human systems, the process of adjustment to actual or expected climate and its effects, in order to moderate harm or exploit beneficial opportunities. In natural systems, the process of adjustment to actual climate and its effects; human intervention may facilitate adjustment to expected climate (IPCC)
Adaptive capacity	The combination of the strengths, attributes, and resources available to an individual, community, society, or organization that can be used to prepare for and undertake actions to reduce adverse impacts, moderate harm, or exploit beneficial opportunities (IPCC) Builds the capacity of people to adapt to climate change impacts through maintaining and enhancing their asset/capital sets, addressing entitlements, encouraging innovation, giving greater access to information, establishing flexible governance/decision-making, related to biodiversity and ecosystem services (IUCN)
Agroforestry	The practice of integrating trees into agriculturally productive landscapes (World Agroforestry Centre)
Building with Nature	A new approach to hydraulic engineering that uses the forces of nature to benefit environment, economy and society (Ecoshape)
Capacity	The combination of all the strengths, attributes, and resources available to an individual, community, society, or organization, which can be used to achieve established goals (IPCC)
Climate change	A change in the state of the climate that can be identified (e.g., by using statistical tests) by changes in the mean and/or the variability of its properties and that persists for an extended period, typically decades or longer. Climate change may be due to natural internal processes or external forcings, or to persistent anthropogenic changes in the composition of the atmosphere or in land use (IPCC)
Climate change adaptation	The process of adjustment to actual or expected climate and its effects. In human systems, adaptation seeks to moderate harm or exploit beneficial opportunities. In natural systems, human intervention may facilitate adjustment to expected climate and its effects *(*IPCC AR5)
Climate extreme	The occurrence of a value of a weather or climate variable above (or below) a threshold value near the upper (or lower) ends of the range of observed values of the variable. For simplicity, both extreme weather events and extreme climate events are referred to collectively as "climate extremes." (IPCC)
Climate risk management	An integrated approach that advances climate-sensitive decision-making. It focuses on development outcomes that are dependent on climatic conditions, such as in agriculture, water resources, food security, health, the environment, urbanism and livelihoods (UNDP)
Climate-smart agriculture	CSA contributes to the achievement of sustainable development goals. It integrates the three dimensions of sustainable development (economic, social and environmental) by jointly addressing food security and climate challenges. It is composed of three main pillars: 1) sustainably increasing agricultural productivity and incomes; 2) adapting and building resilience to climate change; 3) reducing and/or removing greenhouse gases emissions, where possible (FAO)
Community-based adaptation	A community-led process, based on communities' priorities, needs, knowledge and capacities, which should empower people to plan for and cope with the impacts of climate change (IIED)
Community-based natural	An approach that combines the sustainable management of natural resources and risks in a given area. It combines the concept of "co-management" of natural

[24] Updated from CBD Technical Series No. 85 (Lo, V. 2016)

resource and risk management	resources with community-based disaster risk reduction.
Desertification	Defined as land degradation in drylands, leading to a condition of significantly reduced fertility and water holding capacity. Desertification is a reversible condition of the earth's surface, as opposed to aridity, which is a climatic condition (UNCCD)
Disaster	A serious disruption of the functioning of a community or a society involving widespread human, material, economic or environmental losses and impacts, which exceeds the ability of the affected community or society to cope using its own resources (UNISDR) Severe alterations in the normal functioning of a community or a society due to hazardous physical events interacting with vulnerable social conditions, leading to widespread adverse human, material, economic, or environmental effects that require immediate emergency response to satisfy critical human needs and that may require external support for recovery (IPCC)
Disaster risk	The likelihood over a specified time period of severe alterations in the normal functioning of a community or a society due to hazardous physical events interacting with vulnerable social conditions, leading to widespread adverse human, material, economic, or environmental effects that require immediate emergency response to satisfy critical human needs and that may require external support for recover (IPCC)
Disaster risk management	Processes for designing, implementing, and evaluating strategies, policies, and measures to improve the understanding of disaster risk, foster disaster risk reduction and transfer, and promote continuous improvement in disaster preparedness, response, and recovery practices, with the explicit purpose of increasing human security, well-being, quality of life, and sustainable development (IPCC)
Disaster risk reduction	Denotes both a policy goal or objective, and the strategic and instrumental measures employed for anticipating future disaster risk; reducing existing exposure, hazard, or vulnerability; and improving resilience (IPCC) The concept and practice of reducing disaster risks through systematic efforts to analyse and manage the causal factors of disasters, including through reduced exposure to hazards, lessened vulnerability of people and property, wise management of land and the environment, and improved preparedness for adverse events (UNISDR 2009, p. 10-11)
Drought	A period of abnormally dry weather long enough to cause a serious hydrological imbalance. Drought is a relative term, therefore any discussion in terms of precipitation deficit must refer to the particular precipitation-related activity that is under discussion. For example, shortage of precipitation during the growing season impinges on crop production or ecosystem function in general (also termed agricultural drought), and during the runoff and percolation season primarily affects water supplies (hydrological drought). A megadrought is a very lengthy and pervasive drought, lasting much longer than normal, usually a decade or more. (IPCC)
Ecosystem approach	Strategy for the integrated management of land, water and living resources that promotes conservation and sustainable use in an equitable way (CBD)
Ecosystem-based adaptation	Incorporates biodiversity and ecosystem services into an overall adaptation strategy to help people to adapt to the adverse effects of climate change (CBD) Uses biodiversity and ecosystem services as part of an overall adaptation strategy to help people and communities adapt to the negative effects of climate change at local, national, regional and global levels (UNEP) Any initiative that reduces human vulnerabilities and enhances adaptive capacity in the context of existing or projected climate variability and changes through sustainable management, conservation and restoration of ecosystems (IUCN)
Ecosystem-based disaster risk reduction	Sustainable management, conservation and restoration of ecosystems to reduce disaster risk, with the aim to achieve sustainable and resilient development (Estrella and Saalismaa 2013) Decision-making activities that take into consideration current and future human livelihood needs and bio-physical requirements of ecosystems, and recognize the role

	of ecosystems in supporting communities to prepare for, cope with and recover from disaster situations. Sustainable ecosystem management for disaster risk reduction is based on equitable stakeholder involvement in land management decisions, land-use-trade-offs and long-term goal setting. (IUCN)
Ecosystem services	The benefits people obtain from ecosystems, which have been classified by the Millennium Ecosystem Assessment as: *Supporting* services, such as seed dispersal and soil formation; *regulating* services, such as carbon sequestration, climate regulation, water regulation and filtration, and pest control; *provisioning* services, such as supply of food, fibre, timber and water; and *cultural* services, such as recreational experiences, education and spiritual enrichment (Millennium Ecosystem Assessment 2005)
Exposure	The presence of people; livelihoods; species or ecosystems, environmental services and resources; infrastructure; or economic, social, or cultural assets in places that could be adversely affected (IPCC)
Extreme weather	See "Climate extreme"
Famine	Scarcity of food over an extended period and over a large geographical area, such as a country. Famines may be triggered by extreme climate events such as drought or floods, but can also be caused by disease, war, or other factors (IPCC)
Flood	The overflowing of the normal confines of a stream or other body of water, or the accumulation of water over areas that are not normally submerged. Floods include river (fluvial) floods, flash floods, urban floods, pluvial floods, sewer floods, coastal floods, and glacial lake outburst floods (IPCC)
Food security	Occurs when all people, at all times, have physical and economic access to sufficient, safe and nutritious food to meet their dietary needs and food preference for an active and healthy life (FAO). Household level food security is complex, trans-boundary and multifaceted including biophysical, socio-economic, political, demographic, gender and other dimensions. In general, three key indicators are used to measure the level of food insecurity, namely: availability, access and utilization (UNCCD)
Gender analysis	A gender analysis examines how gender relations affect different problems and proposed solutions. It involves assessing gender norms, roles and relations in order to establish a baseline with regard to gender differences and to expose where there is gender inequality.
Gender equality	Gender equality refers to equal rights, responsibilities and opportunities for women and men. Achieving gender equality means ensuring that individuals' choices, options and autonomy are not constrained because of their gender. Gender equality implies that women and men, in their differences and similarities, are equally valued and respected by the society they live in.
Gender mainstreaming	Gender mainstreaming is a globally recognized strategy for making women's as well as men's concerns and experiences an integral dimension of the design, implementation, monitoring, and evaluation of policies and programmes in all political, economic, and societal spheres. This is to ensure that women and men benefit equally from processes of development, and that inequality is not perpetuated.
Green infrastructure	Green 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. It incorporates green spaces (or blue if aquatic ecosystems are concerned) and other physical features in terrestrial (including coastal) and marine areas. On land, green infrastructure is present in rural and urban settings. (European Commission)
Hazard	The potential occurrence of a natural or human-induced physical event that may cause loss of life, injury, or other health impacts, as well as damage and loss to property, infrastructure, livelihoods, service provision, and environmental resources (IPCC)
Impacts	Effects on natural and human systems. In this report, the term "impacts" is used to refer to the effects on natural and human systems of physical events, of disasters, and

	of climate change (IPCC)
Incremental adaptation	Refers to actions where the central aim is to maintain the essence and integrity of the existing technological, institutional, governance, and value systems, such as through adjustments to cropping systems via new varieties, changing planting times, or using more efficient irrigation.
Integrated Risk Management	Integrating Disaster Risk Reduction (DRR), Ecosystem Management and restoration (EMR) and Climate Change Adaptation (CCA) to strengthen and protect livelihoods of vulnerable communities, as applied by Partners for Resilience (www.partnersforresilience.nl)
Integrated water resource management	A process that promotes the coordinated development and management of water, land and related resources in order to maximize the resultant economic and social welfare in an equitable manner without compromising the sustainability of vital ecosystems (GWP 2000)
Landscape Approach	Landscapes are distinct geographical areas or properties uniquely representing the combined work of nature and of man, illustrative of the evolution of human society and settlement over time, under the influence of the physical constraints and/or opportunities presented by their natural environment and of successive social, economic and cultural forces, both external and internal (World Heritage Committee)
Landslide	A mass of material that has moved downhill by gravity, often assisted by water when the material is saturated. The movement of soil, rock, or debris down a slope can occur rapidly, or may involve slow, gradual failure. (IPCC)
Land use planning	
Least developed country	A country that exhibits the lowest indicators of socioeconomic development, with the lowest Human Development Index ratings of all countries in the world.
Low-regrets adaptation options	Low-regrets adaptation options are those actions that could potentially deliver net socioeconomic benefits to local communities and ecosystems whatever the extent of future climate change. The low-regrets approach is an important part of EbA and focuses on maximizing positive and minimizing negative aspects of nature-based adaptation strategies and options. (definition adapted from a joint UNEP-UNDP-IUCN working definition of "no-regrets" adaptation)
Maladaptation	An action or process that increases vulnerability to climate change-related hazards. Maladaptive actions and processes often include planned development policies and measures that deliver short-term gains or economic benefits but lead to exacerbated vulnerability in the medium to long-term (UNDP). Maladaptation can also include trade-offs or benefitting one group at the expense of another.
Mitigation (of climate change)	A human intervention to reduce the sources or enhance the sinks of greenhouse gases (IPCC)
Mitigation (of disaster risk and disaster)	The lessening of the potential adverse impacts of physical hazards (including those that are human-induced) through actions that reduce hazard, exposure, and vulnerability (IPCC).
Multi-criteria analysis	A structured approach used to determine overall preferences among different alternative options, where the options accomplish several objectives that may not always complement one another. In MCA, desired objectives are specified and corresponding attributes or indicators are identified. The measurement of these indicators is often based on a quantitative analysis (through scoring, ranking, and weighting) of a wide range of qualitative impact categories and criteria.
Nairobi work programme (UNFCCC)	A mechanism under the UNFCCC to facilitate and catalyse the development and dissemination of information and knowledge that would inform and support adaptation policies and practices. Its implementation has been coordinated by the SBSTA, under the guidance of the Chair of the SBSTA and with assistance from the secretariat, and with contributions from Parties and other adaptation stakeholders. Through its diverse range of modalities, the Nairobi work programme provides unique opportunities for linking relevant institutions, processes, resources and expertise outside the Convention to respond to adaptation knowledge needs arising

	from the implementation of the various workstreams under the Convention and identified by Parties.
National adaptation plan (UNFCCC)	Established under the Cancun Adaptation Framework, the NAP provides Parties to the UNFCCC with the means of identifying medium- and long-term adaptation needs and developing and implementing strategies and programmes to address those needs.
National adaptation programme of action (UNFCCC)	Provide a process under the UNFCCC for least developed countries (LDCs) to identify priority activities that respond to their urgent and immediate needs to adapt to climate change – those for which further delay would increase vulnerability and/or costs at a later stage.
National biodiversity strategy and action plan (CBD)	The principal instruments for implementing the CBD at the national level (Article 6). The Convention requires countries to prepare a national biodiversity strategy and action plan (or equivalent instrument) and to ensure that this strategy is mainstreamed into the planning and activities of all those sectors whose activities can have an impact (positive and negative) on biodiversity.
National report (CBD)	National reports provide information on measures taken for the implementation of the CBD, and their effectiveness. Parties submitted their fifth national reports in response to decision X/10 of the Conference of the Parties (COP) to the CBD.
Nature-based Solutions	Actions to protect, sustainably manage and restore natural or modifed ecosystems, which address societal challenges (e.g. climate change, food and water security or natural disasters) effectively and adaptively, while simultaneously providing human well-being and biodiversity benefits. (Cohen-Shacham 2017)
Precautionary approach	The precautionary approach is Principle 15 of the Rio Declaration on Environment and Development, adopted by the United Nations Conference on Environment and Development in Rio de Janeiro (1992). It states that: "In order to protect the environment, the precautionary approach shall be widely applied by States according to their capabilities. Where there are threats of serious or irreversible damage, lack of full scientific certainty shall not be used as a reason for postponing cost-effective measures to prevent environmental degradation."
Preparedness	The knowledge and capacities developed by governments, professional response and recovery organizations, communities and individuals to effectively anticipate, respond to, and recover from, the impacts of likely, imminent or current hazard events or conditions (UNISDR)
Recovery	The restoration, and improvement where appropriate, of facilities, livelihoods and living conditions of disaster-affected communities, including efforts to reduce disaster risk factors (UNISDR)
Resilience	The ability of a system and its component parts to anticipate, absorb, accommodate, or recover from the effects of a hazardous event in a timely and efficient manner, including through ensuring the preservation, restoration, or improvement of its essential basic structures and functions (IPCC)
Risk	The combination of the probability of an event and its negative consequences (UNISDR). Risk is commonly expressed as a function of exposure, the conditions of vulnerability that are present, and the magnitude and frequency of a hazard event (Sudmeier-Rieux 2013).
Socio-ecological system	Involves the interaction between humans and the biophysical world and are increasingly used as a mechanism for conceptualizing human-environment systems and how these systems can be managed to be sustainable and resilient (WWF 2013)
Spatial planning	A method used to influence the future distribution of activities in space (European Commission 1997). It goes beyond traditional land-use planning to integrate and bring together policies for the development of land-use, along with other policies and responses that influence the use of land (Office of Disaster Preparedness and Management, UK 2005). Spatial planning is critical for delivering economic, social, and environmental benefits by creating more stable and predictable conditions for investment and development, by securing community benefits from development,

	and by promoting prudent use of land and natural resources for development (WWF 2013).
Storm surge	The temporary increase, at a particular locality, in the height of the sea due to extreme meteorological conditions (low atmospheric pressure and/or strong winds). The storm surge is defined as being the excess above the level expected from the tidal variation alone at that time and place. (IPCC)
Sustainable land and water management	The adoption of land use systems that, through appropriate management practices, enables land users to maximize the economic and social benefits from the land while maintaining or enhancing the ecological support functions of the land resources. SLWM includes management of soil, water, vegetation and animal resources. It involves a holistic approach that integrates social, economic, physical and biological assets. SLWM encompass other approaches such as integrated natural resource management, integrated water resource management, eco-agriculture and sustainable forest management (SFM), and many facets of sustainable agriculture, agriculture (GEF 2011).
Synergies	Linking processes in a way that increases the effects of the sum of the joint activities beyond the sum of individual activities, and thus making efforts more effective and efficient
Transformational adaptation	Seeks to change the fundamental attributes of systems in response to actual or expected climate and its effects, often at a scale and ambition greater than incremental activities. It includes changes in activities, such as changing livelihoods from cropping to livestock or by migrating to take up a livelihood elsewhere, and also changes in our perceptions and paradigms about the nature of climate change, adaptation, and their relationship to other natural and human systems. (IPCC 2014)
Vulnerability	The propensity or predisposition to be adversely affected. Vulnerability encompasses a variety of concepts including sensitivity or susceptibility to harm and lack of capacity to cope and adapt (IPCC AR5) A function of the character, magnitude, and rate of climate variation to which a system is exposed, its sensitivity, and its adaptive capacity. In EbA the ecosystems and their vulnerabilities are included in the analysis together with the vulnerability of communities (WWF 2013). The characteristics and circumstances of a community, system or asset that make it susceptible to the damaging effects of a hazard (UNISDR)
Women's empowerment	Women's empowerment is the process of supporting women in gaining more control over their own lives: it involves support at the personal level, such as self-esteem and awareness development, in conjunction with measures to help women challenge the broader barriers to their autonomy, such as gender-discriminatory laws and cultural practices.

Annex II: Policies related to EbA and Eco-DRR

Table A1: Policy instruments and frameworks related to EbA and Eco-DRR

Framework	Policy Instrument	Description
CBD Strategic Plan for Biodiversity	Strategic Goal B *Reduce direct pressures on biodiversity and promote sustainable use*	Target 5: Rate of loss of all natural habitats halved Target 7: Areas under agiculture, aquaculture and forestry are managed sustainably including biodiversity conservation Target 10: Multiple anthropogenic pressures on coral reefs and other vulnerable ecosystems impacted by climate change or ocean acidification are minimized to maintain integrity and functioning
	Strategic Goal C *Improve status of biodiversity by safeguarding ecosystems, species and genetic diversity*	Target 11: Protected areas – terrestrial, inland water, coastal and marine water landscapes and seascapes Target 13: Genetic diversity of cultivated plants and farmed and domesticated animals and of wild relatives, including other socio-economically as well as culturally valuable species, is maintained
	Strategic Goal D *Enhance the benefits to all from biodiversity and ecosystem services*	Target 14: Ecosystems that provide essential services including water and that contribute to health livelihoods and wellbeing are restored and safeguarded Target 15: Ecosystem resilience and contribution of biodiversity to carobn stocks enhanced, including restoration of degraded ecosystems, mitigation, adaptation, and desertification
Sustainable Development Goals	SDG 13 Take urgent action to combat climate change and its impacts	- Strengthen resilience and adaptive capacity to climate-related hazards and natural disasters in all countries - Integrate climate change measures into national policies, strategies and planning
	SDG 6 Ensure access to water and sanitation for all	- achieve universal and equitable access to safe and affordable drinking water for all - implement integrated water resources management at all levels, including through transboundary cooperation as appropriate - , protect and restore water-related ecosystems, including mountains, forests, wetlands, rivers, aquifers and lakes
	SDG 2 End hunger, achieve food security and improved nutrition and promote sustainable agriculture	- ensure sustainable food production systems and implement resilient agricultural practices that increase productivity and production, that help maintain ecosystems, that strengthen capacity for adaptation to climate change, extreme weather, drought, flooding and other disasters and that progressively improve land and soil quality
	SDG 1: End poverty in all its forms everywhere	- Build the resilience of the poor and those in vulnerable situations and reduce their exposure and vulnerability to climate-related extreme events and other economic, social and environmental shocks and disasters
	SDG 3: Ensure healthy lives and well-being for all at all ages	- Strengthen the capacity of all countries, in particular developing countries, for early warning, risk reduction and management of national and global health risks

	SDG 11: Make cities inclusive, safe, resilient, and sustainable	- Substantially increase the number of cities and human settlements adopting and implementing integrated policies and plans towards inclusion, resource efficiency, mitigation and adaptation to climate change, resilience to disasters, and develop and implement, in line with the Sendai Framework
	SDG 14: Conserve and sustainably use the oceans, seas and marine resources	- sustainably manage and protect marine and coastal ecosystems to avoid significant adverse impacts, including by strengthening their resilience, and take action for their restoration in order to achieve healthy and productive oceans
	SDG 15: Sustainably manage forests, combat desertification, halt and reverse land degradation, halt biodiversity loss	- Ensure the conservation, restoration and sustainable use of terrestrial and inland freshwater ecosystems and their services, in particular forests, wetlands, mountains and drylands, in line with obligations under international agreements
Sendai Framework	Prioritizes ecosystem based approaches to build resilience and reduce disaster risk	- Priority Action 1: The role of ecosystems will need to be taken into account in disaster risk assessments - Priority Action 2: Strengthening risk governance - Priority Action 3: Strengthen investments in disaster resilience
Paris Agreement:	Parties established the global goal on adaptation of enhancing adaptive capacity, strengthening resilience and reducing vulnerability to climate change, with a view to contributing to sustainable development (Article 7, paragraph 1)	Preamble: - Recognizing the importance of the conservation and enhancement, as appropriate, of sinks and reservoirs of the greenhouse gases referred to in the Convention, - Noting the importance of ensuring the integrity of all ecosystems, including oceans, and the protection of biodiversity, recognized by some cultures as Mother Earth, and noting the importance for some of the concept of "climate justice", when taking action to address climate change, Article 7, paragraph 2 - Parties recognize that adaptation is a global challenge faced by all with local, subnational, national, regional and international dimensions, and that it is a key component of and makes a contribution to the long-term global response to climate change to protect people, livelihoods and ecosystems, taking into account the urgent and immediate needs of those developing country Parties that are particularly vulnerable to the adverse effects of climate change. Article 7, paragraph 5 - Parties acknowledge that adaptation action should follow a country-driven, gender-responsive, participatory and fully transparent approach, taking into consideration vulnerable groups, communities and ecosystems, and should be based on and guided by the best available science and, as appropriate, traditional knowledge, knowledge of indigenous peoples and local knowledge systems, with a view to integrating adaptation into relevant

		socioeconomic and environmental policies and actions, where appropriate.
CBD Decisions	X/33	The Conference of the Parties called for implementation of ecosystem-based approaches for adaptation, including sustainable management, conservation and restoration of ecosystems
	XII/20	Calls on governments and other relevant organisations to promote EbA and Eco-DRR approaches and integrate these into their respective policies and programmes on Biodiversity and Climate Change and DRR, recognizing that while biodiversity and ecosystems are vulnerable to climate change, the conservation and sustainable use of biodiversity and restoration of ecosystems can play a significant role in climate change mitigation and adaptation, combating desertification and disaster risk reduction.
UNFCCC Cancun Adaptation Framework	National Adaptation Plans (NAPs)	Enables Parties to formulate and implement national adaptation plans as a means of identifying medium- and long-term adaptation needs and developing and implementing strategies and programmes to address those needs
CBD Article 6	National Biodiversity Strategies and Action Plans (NBSAPs)	Urges Parties and other governments to use revised and updated NBSAPs as instruments for the integration of biodiversity targets into national development and poverty reduction policies and strategies, economic sectors and spatial planning processes (decision X/2). Parties were also invited to integrate ecosystem-based approaches for adaptation into relevant strategies, including adaptation strategies and plans, national action plans to combat desertification, NBSAPs, poverty reduction strategies, disaster risk reduction strategies and sustainable land management strategies (decision X/33).
UNCCD Decisions	Land degradation neutrality (LDN) target	The amount of healthy and productive land should stay stable starting in 2030. Parties also agreed to develop indicators for measuring progress in LDN and for enhancing land resilience to climate change and halting biodiversity loss linked to ecosystem degradation
Ramsar Convention Resolutions	Resolution XII.13 on Wetlands and Disaster Risk Reduction	Encourages Parties to integrate wetland-based disaster risk management and climate change adaptation into development policies and planning at all levels of government, including in vulnerability analysis, poverty reduction strategies and natural resource management plans (including land-use and water-use plans) and sectors, and in multi-sector policies and plans
	Resolution VIII.35 The Impact of natural disasters, particularly drought, on ecosystems	Encourages Parties with Ramsar sites affected by drought or other natural disasters to use the mechanisms and benefits of the Montreux Record by placing such sites that are in need of priority conservation action on the Record and, as appropriate, seeking national and international assistance to support their conservation action.
Ramsar Convention	Wetlands for disaster risk reduction: Effective	- Wetlands and the benefits they provide should be considered in disaster risk assessments and their

Policy Brief	choices for resilient communities	impacts should be considered across entire river basins or coastal zones rather than just political and administrative boundaries; - Development planning and land use changes should be considered when assessing disaster risk patterns and wetland degradation; and - Rapid environmental assessments conducted after a disaster should consider options for wetland restoration as a contribution to wetland recovery.

Annex III: Existing Guidelines and Tools

In the past decade, much work has been accomplished and documented on EbA and Eco-DRR, although information gaps remain. This has given rise to the formulation of guidance such as principles and frameworks for planning and implementing EbA and Eco-DRR (see Table A2 for several examples). A summary of existing guidelines to EbA and Eco-DRR are listed in this Annex in Table A2, together with descriptions of their main aims and target audience.

Table A2: Examples of existing guidelines on EbA and Eco-DRR and related practices

Guidelines	Description/Aims	Target Audience
Principles and Guidelines for Integrating Ecosystem-based Approaches to Adaptation in Project and Policy Design (Andrade et al. 2011)	Set of draft principles and guidelines to act as a foundation for planning and implementing EbA	Planners/ implementers; Financial institutions
EbA Decision Support Framework: From Principles to Practice (UNEP 2012)	Framework includes setting adaptive context, selecting adaptation options, designing for change, and adaptive implementation.	Mid-level decision-makers and planners at national / local level
Operational Guidelines on EbA (GEF 2012)	Aimed at clarifying criteria for EbA projects and at providing practical, operational advice; guidelines also complement review criteria applied to projects and programmes submitted for funding approval	EbA implementing agencies, executing agencies and project proponents seeking LDCF and SCCF funding
Operational Framework for Ecosystem-based Adaptation (WWF 2013)	Framework aims to provide robust and detailed guidance for planning, assessment and implementation of EbA measures. Vulnerability-based, begins with vulnerability assessment of socio-ecological systems, then identification and prioritization of options, implementation, and mainstreaming EbA into national policies and programmes	Decision-makers involved in subnational decision making
Advancing Implementation of the Sendai Framework for Disaster Risk Reduction (2015-2030) through Ecosystem Solution (PEDRR 2016)	Highlights opportunities for implementing integrated ecosystem management and risk reduction strategies in countries and communities, and outlines a roadmap for advancing implementation of the SFDRR through Eco-DRR/CCA and reflects on the scope for promoting Eco-DRR/CCA as an integrated strategy that delivers across the 2030 Sustainable Development Agenda	Policy-makers, implementers
A Landscape Approach for Disaster Risk Reduction in 7 steps (CARE Netherlands and Wetlands International 2017)	Synthesizes the main characteristics of the landscape approach and suggests seven steps when adopting a landscape approach. Although this paper focuses specifically on disaster risk reduction to help increase community resilience, the landscape approach is applicable to other types of programming.	Policy-makers, implementers

Guidelines for EbA in South Africa (Republic of South Africa, in draft 2017)	Outlines actions for identifying, developing and implementing EbA and defines EbA cornerstones, high-level principles, criteria, and safeguards	Practitioners, funders, researchers, policy makers
EbA: Question-based guidance for assessing effectiveness (Reid et al. 2017)	Describes a process, based around asking a detailed set of questions, that can be used by project managers and researchers to shape project design, assess progress, or draw conclusions effectiveness.	Project managers, researchers
Ethical Principles on Disaster Risk Reduction and People's Resilience (Prieur 2012)	European and Mediterranean Ethics Charter on resilience to major disasters, approved by the Council of Europe, with the aim to improve preparedness and deal with ethical problems concerning victims of disasters	Policy-makers
Making Ecosystem-based Adaptation Effective: A Framework for Defining Qualification Criteria and Quality Standards (FEBA technical paper developed for UNFCCC -SBSTA 46) (FEBA 2017)	Practical assessment framework for designing, implementing and monitoring EbA measures by proposing a set of elements, qualification criteria and quality standards and example indicators	Policy-makers and practioners
Implementing nature-based flood protection: Principles and implementation guidance. (World Bank 2017)	Present five principles and implementation guidance for planning, such as evaluation, design, and implementation of nature-based solutions for flood risk management as an alternative to or omplementary to conventional engineering measures.	Professionals in risk management and climate adaptation, NGOs, donors, and international organizations.
Nature-based Solutions to address global societal challenges (Cohen-Shacham et al. 2017)	Proposes a definitional framework for nature-based solutions (NbS), which includes EbA/Eco-DRR. The report includes a set of general principles for any NbS intervention and considers several potential parameters that can be used to build an operational framework, on the basis of which the efficiency, effectiveness and sustainability of NbS interventions can be systematically assessed.	Conservation and development practitioners, policy makers and researchers, as well as civil society organizations.
Ecoshape Building with Nature design guideline https://www.ecoshape.org/en/design-guidelines/	Aims to give guidance on how to introduce and integrate Building with Nature into water infrastructure developments, including the Building with Nature principles and the five general design steps that are involved.	Contractors, engineering companies, research institutions, governments and NGOs
Implementing nature-based flood protection - Principles and implementation guidance, World Bank, GFDRR, UNDP, Deltares, Ecoshape, Profor. https://www.profor.info/sites/profor.info/files/Brochure%20Implementing%20nature-based%20flood%20protection_WEB.PDF	Contains detailed principles and implementation guidelines for EbA and DRR in the context of flood protection	Policy makers and practitoners

Integrating ecosystems in resilience practice: Criteria for Ecosystem-Smart Disaster Risk Reduction and Climate Change Adaptation, Wetlands International	This document introduces a set of criteria and steps to develop an 'ecosystem-smart' approach in the design, implementation and evaluation of risk reduction programmes, and guidance on the required capacities, partnerships, institutional set-up and planning needs	Policy makers and practitioners
When not every response to climate change is a good one: Identifying principles for sustainable adaptation (Eriksen et al. 2011)	Proposes normative principles to guide responses to climate change, avoid maladaptation and promote sustainable adaptation: 1. Recognize context for vulnerability, 2. Acknowledge differing values and interests, 3. Integrate local knowledge into adaptation, 4. Consider feedbacks between local and global processes	Policy-makers

Annex IV: Summary of Adaptation/DRR Frameworks and Processes

Table A3: Summary of adaptation and DRR processes/cycles considered for developing the EbA/Eco-DRR planning and implementation process in these guidelines

Name/Organization	Description	Key features
Adaptation Process (UNFCCC) https://cop23.unfccc.int/index.php/topics/ adaptation-and-resilience/big-picture/introduction-adaptation-and-resilience	Key stages of the adaptation process: Assess impacts, vulnerability and risks; Plan for adaptation (identifying and appraising options); Implementation at local, national and regional levels, via projects, programmes, policies or strategies; monitoring and evaluation	Throughout the adaptation cycle, emphasis is placed on continually engaging stakeholders, raising awareness and ambitions, sharing information, knowledge and guidance, strengthening technical and institutional capacities, and facilitating the provision of financial and technological support
Disaster management cycle modified to include Eco-DRR (Sudemeier-Roux et al. 2013)	Traditional disaster management cycle modified to include elements of Eco-DRR as a means to reduce disaster risk	Emphasizes the role of sustainable development in reduction and disaster prevention
Adaptation mainstreaming cycle (GIZ 2016a)	Adaptation mainstreaming cycle with focus on EbA options to maintain functionality of ecosystems	The cycle demonstrates which elements of EbA should be taken into account and the respective type of tools, methods and approaches that can be utilized at each step.
Landscape Approach A Landscape Approach for Disaster Risk Reduction in 7 Steps" (CARE Netherlands and Wetland International 2017)	Synthesizes the main characteristics of the landscape approach and suggests seven steps when adopting a landscape approach.	Emphasizes the importance of conducting an initial landscape assessment and continuous involvement of stakeholders
Operational Framework for Ecosystem-based Adaptation (WWF 2013)	Framework aims to provide robust and detailed guidance to decision makers involved in subnational decision making for the assessment and implementation of EbA measures	Framework includes Step 1. vulnerability assessment of socio-ecological systems; Step 2. Identification and prioritization of options; Step 3. implementation, and Step 4. mainstreaming EbA into national policies and programmes
Climate change adaptation and disaster risk reduction in Europe: Enhancing coherence of the knowledge base, policies and practices	Discusses the importance of integrating adaptation and disaster risk reduction for sustainable development, synthesizes current approaches in assessments and planning	Contains a multitude of EbA and Eco-DRR case studies in Europe

Annex V: Examples of the application of traditional knowledge to adaptation

Table A4: Examples of the application of local knowledge and traditional ecological knowledge in adaptation (IPCC AR5, IPCC 2014)

Location	Sector	Approach and strategy	Adaptive action implemented	Institutions	References
Southern Kimberley, Australia	Water supplies	• Define vulnerabilities • Increase adaptive capacity	• Compile observed changes • Increase monitoring • Manage water resources • Review TEK[a]	Universities; NGOs;[b] United Nations University	Green et al. (2010); Prober et al. (2011); Leonard et al. (2013)
Trinidad, Bolivia and northern central Bolivia	Ecosystems, agriculture	Reduce vulnerability	• Revive "camellones" (earthen platforms) TEK • Reduce erosion • Document local observations	Oxfam International; NGOs; Bolivian government; Food and Agriculture Organization	Oxfam International (2009)
Pinoleville Pomo Nation (California, USA)	Infrastructure	• Mitigation: solar power • Increase adaptive capacity	• Co-design infrastructure • Address insufficient capital • Address water shortages and energy needs	Universities; NGOs; Housing and Urban Development	Shelby et al. (2012); Pinoleville Pomo Nation Housing flyer (2013); Redsteer et al. (2013)
Fiji	Ecosystems and water supply	• Define vulnerabilities • Increase adaptive capacity	• Recognize TEK • Enable adaptive decision making • Enhance community awareness • Participate in development	Australian Agency for International Development; Fiji Department of Environment; University of the South Pacific	Dumaru (2010)
Kenya, Tanzania, Malawi, Zimbabwe, southern Zambia	Agriculture	• Define vulnerabilities • Increase technical capacity • Increase adaptive capacity	• Use drought early warning • Apply TEK • Develop novel reporting • Compile observed changes • Harvest rainwater • Change tilling practices • Use appropriate crop varieties	University of Capetown; University of Nairobi; the United Kingdom's Department for International Development; Canada's International Development Research Centre	Chang'a et al. (2010); Mugabe et al. (2010); Kalanda-Joshua et al. (2011); Majule et al. (2013); Masindel et al. (2013)
Reservation lands (western USA)	Health, water supplies, environment	• Define vulnerabilities and impacts • Increase adaptive capacity	• Compile observed changes • Utilize environmental legislation • Review indigenous knowledge • Analyze local meteorological data • Analyze historical/legal context • Increase monitoring	Universities and affiliated NGOs; tribal offices; federal agency research	Redsteer et al. (2010); Doyle et al. (2013); Gautam et al. (2013)

[a]TEK = Traditional ecological knowledge: adaptive ecological knowledge developed through an intimate reciprocal relationship between a group of people and a particular place over time.

Annex VI: Tools for Monitoring and Evaluation

Table A5: Additional tools for monitoring and evaluation of adaptation activities, and their compatibility with EbA and Eco-DRR (extracted from Spearman and Dave (2012:13 – 15) and modified by DEA & SANBI 2017

M&E TOOL	TOOL CHARACTERISTICS	COMPATIBILITY WITH EBA AND ECO-DRR	INCOMPATIBILITY WITH EBA AND ECO-DRR
OUTCOME MAPPING: E.G. EARL ET AL., 2001; SMUTYLO, 2005	• Focuses on the behaviour, actions or relationships of boundary partners (individuals, groups of stakeholders, organisations) influencing or being influenced by the project • Forces project team to be specific about actors targeted, change expected and strategies employed • Collectively maps out desired changes	• Participatory and inclusive decision-making processes • Looks beyond outputs to outcomes/long-term changes • Captures both processes and results, including progress markers to capture quality of change • Complements rigorous scientific analysis of adaptation options	• May not capture the specific links between particular ecosystems and human exposure and/or sensitivity • May require parallel monitoring systems to capture technical and non-technical components • Is likely to still require other M&E tools to meet reporting requirements
MOST SIGNIFICANT CHANGE: E.G. WILDER & WALPOLE, 2008	• non-indicator-based monitoring method • systematically collecting the anecdotal evidence of change that may be missed by conventional monitoring techniques • provides evidence for the impact of a project as a whole, through 'significant stories of change' •significant stories are systematically selected and passed between the layers of an organisation and feedback is provided to project stakeholders, so enabling both upward and	• Participatory and inclusive decision-making processes • Captures changes in community awareness, attitudes or behaviour, improvements in social cohesion or well-being, or increased empowerment – factors that can be linked to resilience outcomes of EbA • approach is highly malleable and is adapted to fit the local situation • well-suited to projects that are complex with divergent outcomes, have many sites and organisational layers, are participatory and	• can be difficult to convince people of the value of collecting unfamiliar forms of data • time consuming, and thus, potentially costly, to establish and implement. Changes • individuals capturing stories act as 'brokers of meaning', potentially influencing stories according personal biases or interpretations to what they perceive to be 'required' by the project, The need for translation may hinder verification of stories by others at a later stage. • Require parallel monitoring systems to

	downward accountability	focused on social change, and have regular contact between field teams and communities • stories of change within broad categories relating to project objectives but are not so restrictive that unexpected outcomes and impacts are overlooked • Complements rigorous scientific analysis of adaptation options	capture empirical data
IMPACT AND RESPONSE MATRIX: E.G. WORLD BANK, 2010	• systematically identifies expected positive and negative impacts climatic changes, the chosen responses needed to address impacts and how the pilot projects that would be the basis of the intervention, would support appropriate response • systematically links project activities to climate impacts, illustrating which pilot or project activities address/support which expected impacts	• Simple and straightforward for communication purposes • Utilises (best available) scientific evidence as a basis for decision-making • Can account for a variety of possible climate 'impact'/effect categories	• Is likely to still require other M&E tools to meet reporting requirements • May be difficult to integrate ecosystems if not already part of initial planning strategies
CONCEPTUAL MODELLING: E.G. MARGOLUIS ET AL., 2009	• Visually depicts the context within which a project is operating within, focusing on factors present that may influence outcomes • Determines actions that may best influence site factors and those that should be monitored to assess changes with implementation • Sets out scope, conservation target,	• Could be used to complement ecosystems-service mapping, results chains, and other M&E tools • Can be used as a communication tool for a broad set of stakeholders	• May prove difficult to identify a core set of indicators for ecosystems • Cannot apply easily to climate hazards and shocks in the system unless regularly revisited • May require additional M&E tools/methods to meet reporting requirements

	direct threats, contributing factors, strategies, goals, and objectives • Sets the stage for an intervention in the scope of a specific natural system		
THEORY OF CHANGE (TOC): E.G. CONSERVATION INTERNATIONAL, 2013; HTTP://WWW.THEORYOFCHANGE.ORG; MCKINNON & HOLE, 2015.	• maps the relationship project's long-term goal and the intermediate and early changes that are required to bring it about • Illustrates project components and inter-linkages between them required to meet short, medium and long-term objectives, through clear explanation of the process through which changes occur • Identifies key assumptions about underlying conditions • Can be used at different stages of project management cycle: i) strategic planning, ii) validation of existing plans, iii) communication of project priorities, iv) evaluation of progress	•Offers a process-oriented approach to complement result-oriented scientific evidence • Supports planners in taking a holistic and long-term perspective to interventions strategies • Illustrates both expected processes and results •Can be used as a communication tool for a broad set of stakeholders • Illustrates contributions to development impacts beyond the reach or the life of the project • Helps planners identify and test the relevance of indicators	•Difficult to account for moving baselines unless TOC is regularly revisited • May require additional tools/methods to meet reporting requirements • Quality of understanding links between ecosystems, climate change and human well-being depends on expertise and information available
PERFORMANCE MEASUREMENT FRAMEWORK (PMF): E.G. JAMES, 2001	• Outlines expected outputs, outcomes and impact indicators; baseline; targets; data sources; emphasises methods and frequency of collection; responsibilities	• Encourages planners to set clear objectives and targets and the methods and responsibilities to reach them • Can complement several other M&E tools/approaches (such as outcome mapping, theory of change) and integrate various sources of information • Commonly used for reporting and accountability requirements	• Does not necessarily capture dynamic and complex systems, i.e. ecosystems, accurately or adequately, unless frequently revisited • Relies on good quality information in design stages; may be difficult to integrate new information • A focus on monitoring may overlook evaluation
LOGICAL FRAMEWORK (LOGFRAME): E.G.	• Outlines expected outputs, outcomes, and impact indicators;	• Encourages planners to set clear objectives and milestones toward	• Does not necessarily capture dynamic and complex systems, i.e.

STEM ET AL., 2005; DIFID, 2011.	baseline values; data sources; emphasises milestones and assumptions • Provides clear structure for project planning, linking activities to indicators and assumptions	targets, and coinciding assumptions behind the logic model/results chain • Can complement several other M&E tools/approaches (such as outcome mapping, theory of change) and integrate various sources of information • Commonly used for reporting and accountability requirements, can be used for learning purposes	ecosystems, accurately or adequately, as assumes change occurs in logical, linear manner • Rigid structure may limit flexibility and adaptation as new knowledge is gained • Relies on good quality information in design stages; may be difficult to integrate new information
SCENARIO PLANNING: E.G. PETERSON ET AL., 2003; BIGGS ET AL., 2011; RAO ET AL., 2013; WALKER ET AL., 2013; ADDISON ET AL., 2015	• Represents possible future scenarios in the target system • Can represent likely future climatic effects and/or vulnerabilities (in the absence of an intervention), or possible adaptation outcomes/project impacts under specific climate / expectations • Allows multiple sequences of project implementation to be considered, with expected outcomes identified for each • Support evaluation of policies and specific actions in terms of how they initiate and allow project to respond under different implementation futures	• Enables planners to account for multiple possible conditions under which (or sequences in which) the project may be implemented • Allows for incorporation of multiple perspectives about future • Able to incorporate as much or as little climatic data, from various sources, as the planner chooses Inclusion of economic analysis (i.e. Rao et al., 2013) of different scenarios of the future will incorporate cost implications of different project implementation options / contrasting EbA to other adaptation choices • Complementary to existing conservation and ecosystems planning tools (ClimateWizard, EcoMetrix)	• Requires time and resources to consider multiple possible sequences of project implementation and likely climatic scenarios • May require additional M&E tools/methods to meet reporting requirements
INDEXED SCALE/ RANKING: E.G. VULNERABILITY REDUCTION ASSESSMENT:	• Outlines range of all possible outcomes of one or more indicators in the design phase (standardizes possible	• Encourages planners to think through and identify all possible outcomes during design stages	• May not be useful for capturing results and lessons learned outside of factors considered in the design phases

DROESCH ET AL., 2008; ADAPTIVE CAPACITY: SIETCHIPING, 2006	results) • Provides subjective rankings/ scores for (un) desirable change, (such as level of vulnerability), or objective ranges of changes (water table level), there by forming the basis of targets	• Focuses activities on achieving results tied to a range of changes in each parameter of measurement (indicators, objectives) • Compatible with various sources of technical and nontechnical information, qualitative and quantitative	• Does not necessarily capture dynamic and complex systems, i.e. ecosystems, accurately or adequately, unless frequently revisited and revised • Relies on good quality information in design stages; may be difficult to integrate new information