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A woman with dark skin and a red headwrap is shown in profile, carrying a large woven basket filled with green plants on her head. She is wearing a red and white striped shirt. The background is a bright blue sky with white clouds.

Coherence and Alignment among Sustainable Land Management, Ecosystem-based Adaptation, Ecosystem-based Disaster Risk Reduction and Nature-based Solutions

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A report written by UNU-EHS for the UNCCD secretariat

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List of abbreviations and acronyms

CBD	Convention on Biological Diversity
CCA	Climate Change Adaptation
COP	Conference of the Parties
DLDD	Desertification, Land Degradation and Drought
DRR	Disaster Risk Reduction
EbA	Ecosystem-based Adaptation
EC	European Commission
Eco-DRR	Ecosystem-based Disaster Risk Reduction
FAO	Food and Agriculture Organization of the United Nations
FEBA	Friends of Ecosystem-based Adaptation
FESLM	Framework for Evaluating Sustainable Land Management
GEF	Global Environment Facility
GIZ	Deutsche Gesellschaft für Internationale Zusammenarbeit
GM	Global Mechanism
HFA	Hyogo Framework for Action
ICLM	Integrated Crop-Livestock Management
(I)NDC	(Intended) Nationally Determined Contribution
IPBES	Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services
IPCC	Intergovernmental Panel on Climate Change
IUCN	International Union for Conservation of Nature and Natural Resources
LDN	Land Degradation Neutrality
LEG	UNFCCC Least Developed Countries Expert Group

M&E	Monitoring and Evaluation
MEA	Millennium Ecosystem Assessment
NAP (UNCCD)	National Action Programme
NAP (UNFCCC)	National Adaptation Plan
NAPA	National Adaptation Programme of Action
NbS	Nature-based Solutions
NBSAP (CBD)	National Biodiversity Strategies and Action Plan
NGO	Non-governmental Organization
PEDRR	Partnership for Environment and Disaster Risk Reduction
SBSTTA	Subsidiary Body on Scientific, Technical and Technological Advice
SCBD	Secretariat of the Convention on Biological Diversity
SFDRR	Sendai Framework for Disaster Risk Reduction
SLM	Sustainable Land Management
SPI	Science-Policy Interface
UN	United Nations
UNCCD	United Nations Convention to Combat Desertification
UNCCD SPI	United Nations Convention to Combat Desertification Science Policy Interface
UNDRR	United Nations Office for Disaster Risk Reduction (formerly UNISDR)
UNEP	United Nations Environment Programme
UNFCCC	United Nations Framework Convention on Climate Change
UNU-EHS	United Nations University – Institute for Environment and Human Security
WOCAT	World Overview of Conservation Approaches and Technologies

Glossary

Approach

The ways and means used to implement one or several measures (adapted from the definition of SLM approaches from WOCAT¹). Its implementation is motivated by the specific goal to address certain challenges and their drivers.

Climate change adaptation

“The process of adjustment to actual or expected climate conditions 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, 2013, p.881).

Climate risk management

An integrated approach that “seeks to maintain and improve society’s ability to achieve socio-economic and development goals in the context of the changing climate” (UNDP, 2012, p.4).

Challenge

The problems linked to the interaction between society and nature, causing negative impacts for people, their health and security, including at the individual and societal level.

Co-benefit

“The positive effects that a policy or measure aimed at one objective might have on other objectives, thereby increasing the total benefits for society or the environment. Co-benefits are often subject to uncertainty and depend on local circumstances and implementation practices, among other factors. Co-benefits are also referred to as ancillary benefits” (IPCC, 2018, p.546).

Combat desertification

“Activities which are part of the integrated development of land in arid, semi-arid and dry sub-humid areas for sustainable development which are aimed at: prevention and/or reduction of land degradation; rehabilitation of partly degraded land; and reclamation of desertified land” (Article 1(b); UNCCD, 1994, p.4).

Desertification

Desertification is defined as “the land degradation in arid, semi-arid and dry sub-humid areas resulting from various factors, including climatic variations and human activities” (Article 1(a); UNCCD, 1994, p.4).

Disaster

[In CCA context] “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, 2012, p.558).

[In DRR context] “A serious disruption of the functioning of a community or a society at any scale due to hazardous events interacting with conditions of exposure, vulnerability and capacity, leading to one or more of the following: human, material, economic and environmental losses and impacts.” (UN General Assembly, 2016, p.13).

Disaster risk

[In CCA context] “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 recovery” (IPCC, 2012, p.558).

[In DRR context] “The potential loss of life, injury, or destroyed or damaged assets which could occur to a system, society or a community in a specific period of time, determined probabilistically as a function of hazard, exposure, vulnerability and capacity.” (UN General Assembly, 2016, p.14)

Disaster risk management

[In CCA context] “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, 2012, p.558).

[In DRR context] “Application of disaster risk reduction policies and strategies to prevent new disaster risk, reduce existing

disaster risk and manage residual risk, contributing to the strengthening of resilience and reduction of disaster losses” (UN General Assembly, 2016, p.15).

Disaster risk reduction

“Disaster risk reduction is aimed at preventing new and reducing existing disaster risk and managing residual risk, all of which contribute to strengthening resilience and therefore to the achievement of sustainable development.” (UN General Assembly, 2016, p.16).

Driver

Natural- or human-induced factor which creates a change in a direct or indirect way (following Nelson, 2005, p.74).

Drought

Drought is “a naturally occurring phenomenon that exists when precipitation has been significantly below normal recorded levels, causing serious hydrological imbalances that adversely affect land resource production systems” (Article 1(c); UNCCD, 1994, p.4).

Ecosystem

“A dynamic complex of plant, animal and micro-organism communities and their non-living environment interacting as a functional unit” (CBD, 1993, p.3).

Ecosystem approach

“Integrated management of land, water and living resources that promotes conservation and sustainable use in an equitable way” (SCBD, 2009, p.12).

¹ For the original definition from WOCAT, please see: <https://www.wocat.net/en/global-slm-database/slm-practices-technologies-and-approaches>

Ecosystem-based Adaptation

“The use of biodiversity and ecosystem services to help people to adapt to the impacts 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, p.41).

Ecosystem-based Disaster Risk Reduction

“Sustainable management, conservation and restoration of ecosystems to reduce disaster risk, with the aim of achieving sustainable and resilient development.” (Estrella and Saalis-maa, 2013, p.30)

Implementation characteristics

The characteristics which are related to successful planning, design and implementation of the multiple actions and measures of a project to reach its specific goals.

Land

“A terrestrial bio-productive system that comprises soil, vegetation, other biota, and the ecological and hydrological processes that operate within the system” (Article 1(e); UNCCD, 1994, p.4).

Land degradation

“Land degradation means the reduction or loss of the biological or economic productivity and complexity of rainfed cropland, irrigated cropland, or range, pasture, forest and woodlands resulting from land uses or from a process or combination of processes, including processes arising from human activities and habitation patterns, such as: (i) soil erosion caused by wind and/or water; (ii) deterioration of the

physical, chemical and biological or economic properties of soil; and (iii) long-term loss of natural vegetation” (Article 1(f); UNCCD, 1994, p.4).

Land Degradation Neutrality

“A state whereby the amount and quality of land resources necessary to support ecosystem functions and services and enhance food security remains stable or increases within specified temporal and spatial scales and ecosystems” (UNCCD, 2015a, p.24).

Measure

Actions necessary to implement an approach or to achieve a particular outcome, namely practices, methods, procedures, tools or specific techniques.

Mitigation (of climate change)

“A human intervention to reduce the sources or enhance the sinks of greenhouse gases” (IPCC, 2014, p.4).

Mitigation (of disaster risk)

“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, 2012, p.561).

Mitigation (of drought impacts)

“Activities related to the prediction of drought and intended to reduce the vulnerability of society and natural systems to drought as it relates to combating desertification” (Article 1(a); UNCCD, 1994, p.4).

Nature-based Solutions

“Solutions that are inspired and supported by nature, which are cost-effective, simultaneously provide environmental, social and economic benefits and help build resilience. Such solutions bring more, and more diverse, nature and natural features and processes into cities, landscapes and seascapes, through locally adapted, resource-efficient and systemic interventions” (EC, 2015).

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

Practice

Combination of “technologies, policies and activities, aimed at integrating socio-economic principles with environmental concerns” (Sanz, and others, 2017, p.23).

Specific goal

Intention which motivates all actions and measures to implement an approach and to generate certain benefits. All actions and measures implemented under an approach are oriented towards its specific goal.

Strategy

Rational plan of prioritized and necessary actions logically structured and coherently connected to achieve specific outcomes.

Sustainable Land Management

“The use of land resources, including soils, water, animals and plants, for the production of goods to meet changing human needs, while simultaneously ensuring the long-term productive potential of these resources and the maintenance of their environmental functions.” (WOCAT, n.d.)

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” (SCBD, 2019, p.88).

Ultimate goal

The overall intention to implement an approach with a specific goal. For example, a specific goal of Sustainable Land Management (SLM) is to combat DLDD with the overall intention to achieve sustainable development, human well-being and environmental health.

Executive Summary

Approaches integrating environmental management practices have been gaining importance in recent years. They address current global challenges such as food insecurity, water scarcity, decline in biodiversity and threats to livelihoods, while also considering both human well-being and ecosystem functions and services. More specifically, Sustainable Land Management (SLM), Ecosystem-based Adaptation (EbA), Ecosystem-based Disaster Risk Reduction (Eco-DRR) and Nature-based Solutions (NbS) are widely-applied approaches that tackle certain drivers of these challenges in a goal-oriented way, in particular land degradation, climate change impacts and disasters due to natural hazards. A better understanding of similarities, differences and relationships between these approaches helps to improve efficiency and leverage synergies. By shedding more light on where these approaches align, investments in land-based solutions in response to different types of environmental challenges can be more effectively designed to achieve multiple co-benefits.

The United Nations Convention to Combat Desertification (UNCCD) Decision 19/COP.14 paragraph 4² seeks to encourage coherence and alignment in the way these approaches are categorized. Based on this, the UNCCD secretariat contracted UNU-EHS to conduct an assessment of these approaches and provide information on their specificities, similarities and differences in reference to how each is used in the context of implementing the Rio Conventions and other international

² ICCD/COP(14)/23/Add.1, Decision 19/COP.14: Interfacing Science and Policy, and Sharing Knowledge “4. Requests the secretariat to work in coordination with other Rio Conventions and relevant partners to ensure coherence and alignment in the way ecosystem-based adaptation, ecosystem-based disaster risk reduction, nature-based solutions and sustainable land management are categorized through the UNCCD science-policy instruments and the UNCCD Knowledge Hub” (UNCCD, 2019, p.56).

agreements, such as the Sendai Framework for Disaster Risk Reduction (SFDRR) and the 2030 Agenda for Sustainable Development.

The main objective of this report is to understand and elaborate upon the characteristics of SLM, EbA, Eco-DRR and NbS. The report begins with an overview of the historical backgrounds and origins of SLM, EbA, Eco-DRR and NbS. Embedded in the text of the UNCCD drafted in 1994, SLM is the oldest of the four approaches, and all actions, measures and co-benefits under SLM aim to combat Desertification/ Land Degradation and Drought (DLDD). The other approaches were developed and formally defined more recently. The Convention on Biological Diversity (CBD) officially defined EbA in 2009 with Climate Change Adaptation (CCA) as a specific goal. The CBD furthermore encouraged the implementation of Eco-DRR with the specific goal to reduce disaster risk in 2014. NbS, being the youngest of the four terms, is considered a broad concept to address various environmental and societal challenges by capitalizing on nature, and has been defined both by the European Commission (EC) in 2015 and the International Union for Conservation of Nature (IUCN) in 2016. While the concept of NbS addresses a broad variety of challenges, drivers and goals, the approaches of SLM, EbA and Eco-DRR address very specific goals. Therefore, the comparative analysis of this report focuses exclusively on these approaches.

The analysis shows that the specific goals of each approach, such as CCA, combating land degradation or Disaster Risk Reduction (DRR), determine the type of baseline assessment needed, and form the reference for monitoring and evaluation (M&E) of the individual approaches. Despite differences in their specific goals and targeted benefits, all approaches aim for the support of biodiversity, land-based ecosystems and ecosystem services and functions, and employ measures to conserve, restore and sustainably use land to support ecosystem services and functions, including SLM technologies.

There are similarities in a number of implementation characteristics, such as being people-centered, transdisciplinary, focused on equity and inclusivity, as well as the fact that all approaches call for the integration of traditional and indigenous environmental knowledge and practices. Furthermore, irrespective of their different goals, the projects developed under any approach can generate comparable co-benefits, especially due to their support of biodiversity. The capacity for all these approaches to deliver multiple co-benefits means that projects of each approach can directly contribute to implementing the specific goals of the other approaches as well. Multiple global and national targets, frameworks, strategies and conventions call for the implementation of one or more of these approaches. And thus, the clear coherence among them means projects pursued under each approach can readily contribute to the achievement of multiple goals and targets (and the national reporting requested of countries to help the world track progress).

This is critical for achieving the ambitious Agenda 2030, including voluntary Land Degradation Neutrality (LDN) targets and climate action under the Paris Agreement. It will also be the case for the post-2020 global biodiversity framework currently under development. The added value that will come from optimizing the links among these approaches extends from national policymakers to the practitioners of SLM, EbA and Eco-DRR projects, which all share the ultimate goal of sustainable development.

To capture the coherence and alignment among these approaches, their similarities and differences have been summarized in a conceptual framework with underlying tables that provide more nuanced detail. The framework has been designed to help practitioners understand the specific goals of each approach, and to link these to the relevant global and national targets, frameworks, strategies and conventions, which can support M&E as well as reporting processes.

The coherence among these approaches is further illustrated through three case studies in order to demonstrate opportunities for leveraging multiple co-benefits and targets at implementation level irrespective of the different objectives under each.

The results of this assessment demonstrate that activities under one approach can be beneficial to achieve the specific goals of other approaches with little additional effort other than ensuring that the outcomes are reported against all relevant national and global targets. It is essential for policymakers, project developers and practitioners to recognize that with small adjustments in project design and greater attention to the full range of global co-benefits attainable, the synergies among the Rio Conventions, the SFDRR, the Ramsar Convention and the 2030 Agenda can be more readily realized. This is key to the achievement of sustainable development. The explicit integration of multiple approaches into the development of national plans and strategies in order to respond to the multiple goals and targets of international agreements could avoid duplication and reduce the overall investments necessary to achieve the set targets and goals.

1. Introduction

1.1. Background and rationale

The terms Sustainable Land Management (SLM), Ecosystem-based Adaptation (EbA), Ecosystem-based Disaster Risk Reduction (Eco-DRR) and Nature-based Solutions (NbS) have originated, been defined and been used in different contexts. This includes the Rio Conventions: The United Nations Convention to Combat Desertification (UNCCD), Convention on Biological Diversity (CBD) and the United Nations Framework Convention on Climate Change (UNFCCC), as well as the United Nations Office for Disaster Risk Reduction (UNDRR). However, there is currently a lack of clarity around their definitions, their characteristics and the potential links and synergies between these terms.

The UNCCD Decision 19/COP.14 paragraph 4 “requests the secretariat to work in coordination with other Rio Conventions and relevant partners to ensure coherence and alignment in the way Ecosystem-based Adaptation, Ecosystem-based Disaster Risk Reduction, Nature-based Solutions and Sustainable Land Management are categorized through the UNCCD science-policy instruments and the UNCCD Knowledge Hub” (UNCCD, 2019, p.56). Responding to this, the UNCCD secretariat contracted UNU-EHS to conduct research and analyse the specificities, similarities and differences between SLM and the related approaches used by various processes of the Rio Conventions and UNDRR to support parties in this field.

Bringing coherence and alignment in the way these terms are used in science-policy instruments and in knowledge products

is crucial for several reasons. First, all these terms relate in some way to environmental and ecosystem management and therefore, enhancing understanding of their characteristics and linkages will allow better implementation on the ground and potential synergies in outcomes. Second, given that these approaches are used by different agencies, donors, member states, as well as the private sector, understanding the characteristics and interlinkages may improve impact reporting. Third, it will improve communication, awareness raising and capacity-building. Finally, it may also contribute to realizing the synergies among the Rio Conventions and to leverage on these with the aim of increasing the effectiveness of actions to ultimately support sustainable development and strengthen the resilience of communities and ecosystems.

1.2. Aim and objectives

The overall aim of this report is to clarify what each of these approaches entail and enable a coherent and aligned categorization of SLM, EbA, Eco-DRR and NbS within UNCCD. To achieve this, the report analyses the similarities and differences between these approaches based on key characteristics and how they relate to each other, taking into account the best available scientific and expert knowledge as well as their common usage.

The specific objectives of this report are as follows:

Objective I. To understand the characteristics of SLM, EbA, Eco-DRR and NbS

Chapter 3 of this report documents the history and origins of SLM, EbA, Eco-DRR and NbS, and documents the definitions

of the approaches which have been intergovernmentally agreed. The chapter further elaborates the similarities and differences between SLM, EbA and Eco-DRR based on certain categories, such as goals, measures and co-benefits.

Objective II. To consolidate the similarities and differences

Chapter 4 is based on the outcomes of the first objective, consolidating and illustrating the similarities and differences of the approaches as part of a conceptual framework as displayed in Figure 1 (p. 53).

Objective III. To demonstrate opportunities for leveraging multiple co-benefits and targets at implementation level

Chapter 5 explores how selected SLM technologies and measures result in multiple co-benefits and opportunities that can be leveraged to contribute to multiple targets.

1.3. Target groups

This report targets the representatives and national focal points from the Rio Conventions as well as the Sendai Framework for Disaster Risk Reduction and documents potential synergies between the terminologies adopted in these global conventions and frameworks. Furthermore, with its conceptual focus, this report aims to inform people at the level of project design. Therefore, representatives of partners of the Rio Conventions working in the areas of SLM, EbA, Eco-DRR and NbS are within

the target group of this report and have at the same time been involved in the co-creation of this report during a participatory process. These include the Food and Agriculture Organization of the United Nations (FAO), Friends of EbA (FEBA), International Union for Conservation of Nature and Natural Resources (IUCN), Partnership for Environment and Disaster Risk Reduction (PEDRR), United Nations Environment Programme (UNEP) and the World Overview of Conservation Approaches and Technologies (WOCAT). Donors could benefit from this report through better recognition of the interconnected, transdisciplinary nature of SLM, EbA, Eco-DRR and NbS.

2. Methods

The preparation of this report consists of two parts: conceptualization and demonstration. The latter is based on evidence provided through case studies, illustrating and supporting the conceptual findings through examples. The following subsections provide a detailed explanation of the methods used.

2.1. Data collection

The data collection is based on official publications from UN entities (UNCCD, UNFCCC, UNDRR, FAO, CBD), the Intergovernmental Panel on Climate Change (IPCC), the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES), the UNCCD Science-Policy Interface (SPI) and grey literature published by relevant organizations including WOCAT, PEDRR, FEBA, World Bank and IUCN. This was supplemented by a comprehensive review of scientific literature, employing the search tools provided by Scopus, Elsevier-ScienceDirect, PreventionWeb, DOAJ and JSTOR³. The names and acronyms of SLM, EbA, Eco-DRR and NbS were the primary keywords employed, supplemented by relevant terms (e.g. “land degradation”, “land assessment”, “ecosystem-based adaptation”, “climate change adaptation”, “disaster risk reduction” and “DRR”) associated with the organizations employing SLM, EbA, Eco-DRR and NbS. To present up-to-date information and to reflect the current state of the literature, the selection criteria included the following:

³ To learn more see: <https://www.scopus.com/>; <https://www.sciencedirect.com/>; <https://www.preventionweb.net/>; <https://doaj.org/>; <https://www.jstor.org/>.

- Peer-reviewed publications and/or grey literature publications used to implement SLM, EbA, Eco-DRR and NbS
- Content relevant to the research objective (key characteristics, similarities and differences)
- Cited by several authors or used as sources in publications of UN entities
- Highly cited papers in the last 12 years with priority given to papers published in the last five years

In the conceptual part, 40 papers were pre-selected, and after screening, an additional 50 papers were identified through snowball sampling⁴. For the demonstration, 34 papers and reports were also collected for all three case studies using snowball sampling. The final set of 124 documents (see References), including research articles, review articles, guidelines, sourcebooks, handbooks, case studies and reports, were reviewed.

To select the case studies, specialists from different projects were consulted for recommendations on selection criteria. Their recommendations included to cover a wide range of possible scenarios through the following: (i) representing one or several approaches; (ii) in different contexts where the largest number of projects are usually developed (Africa, Asia and America); and (iii) have been successfully implemented in three different types of terrestrial ecosystems (grasslands, mountainous areas and coastal areas). Following this recommendation, the case studies presented in Chapter 5 were selected.

2.2. Review of similarities and differences

In order to clarify the use of terms commonly used to describe certain processes within the conceptual design and implementation of projects under the terms SLM, EbA and Eco-DRR, the terms “approach”, “measure”, “strategy” and “practice” have been reviewed.

For the conceptual analysis, documents were reviewed to understand the specificities of SLM, EbA, and Eco-DRR along the following categories.

- a) Historical background
- b) Intergovernmentally agreed definitions
- c) Specific goals
- d) Measures
- f) Key steps for design, planning, implementation, monitoring and evaluation (M&E)
- g) Implementation characteristics
- f) Scale, timeframe and context
- h) Co-benefits
- i) Relevant global and national targets, frameworks, strategies and conventions

For the demonstration part, the literature related to the three selected case studies was reviewed according to the following aspects.

- Basic information about the context (climate-related impacts, climate and natural hazards, potential risks and recent disaster events, environmental degradation status and trends with an emphasis on land and relevant social conditions)
- Description of implemented measures and their resulting co-benefits
- Types of studies or assessments conducted during the project implementation
- Contribution to specific goals (documented co-benefits generated in relation to combat DLDD, Climate Change Adaptation (CCA) or Disaster Risk Reduction (DRR))

2.3. Analysis

The analysis involved a comparison of the terminologies and key characteristics of SLM, EbA and Eco-DRR identified during the literature review (based on categories a) to i) listed in Chapter 2.2), and was conducted to document their similarities and differences. Case studies of implemented projects helped to demonstrate interlinkages between the approaches.

The demonstration part used information from the three selected case studies to demonstrate existing synergies at the implementation level between SLM, EbA and Eco-DRR. The presentation of each case study illustrates that regardless of the approach used to address a specific problem, multiple co-benefits are generated from the same implemented

measures (or SLM technologies). To this end, the information for each case study was organized according to its relationship to the specific goals (combat DLDD, CCA and DRR), mentioning the drivers addressed, assessments performed and the obtained co-benefits, respectively. Furthermore, for each case study, opportunities to contribute to different national and global targets were mentioned by potentially accounting for the co-benefits generated for each specific goal.

2.4. Stakeholder workshop

To refine and enhance the findings, a workshop was held virtually on 29 July 2021 with 22 participants from 13 organizations (CBD, FAO, FEBA, IUCN, UNCCD, UNDP, UNDRR, UNEP, UNFCCC, UNU-EHS, Ramsar Convention, Wetlands International and WOCAT). Through a consultative process, leading specialists on SLM, EbA, Eco-DRR and NbS provided their feedback on the following:

- Main benefits of supporting coherence and alignment in the way the terms SLM, EbA, Eco-DRR and NbS are used
- Draft conceptual framework diagram and its rationale
 - The position of SLM
 - The position of NbS
 - The specific goals of all approaches
 - Challenges and drivers of all approaches
 - Feasibility of multiple assessments
 - Integrated approach and management

⁴ This involved using the reference list of each selected paper as well as citations of that paper to identify additional papers.

- Additional comments and recommendations
 - The role of biodiversity
 - The narrative and the purpose of the project and framework
 - The international framework agreements and UN processes
 - Case studies

After the workshop, changes and adjustments in the conceptual framework were made according to the feedback received. As part of the suggestions from the workshop to better understand the similarities and differences, an additional review of the historical background of SLM, EbA, Eco-DRR and NbS was conducted, including an analysis of the context of their development to date.

3. Specific characteristics of SLM, EbA, Eco-DRR and NbS

To understand the characteristics of SLM, EbA, Eco-DRR and NbS (Objective I), the history and origins of SLM, EbA, Eco-DRR and NbS, as well as the definitions of the approaches agreed upon in intergovernmental processes, are documented in Chapter 3.1. This chapter further elaborates the similarities and differences between SLM, EbA and Eco-DRR based on certain categories, such as goals, measures and co-benefits.

3.1. Historical background and definitions

Prior to Western science and the establishment of current scientific ecosystem-based approaches such as SLM, EbA, Eco-DRR and NbS, environmental knowledge and environment-friendly management practices based on biodiversity, landscape conservation and sustainable resource use already existed and were practiced throughout history by indigenous peoples (Berkes and Davidson-Hunt, 2006; Berkes, and others, 2000; IPBES, 2019; Nakashima, and others, 2012). The scientific ecosystem-based approaches have a lot in common with these traditional practices (Berkes and Davidson-Hunt,

2006), particularly the process of learning from nature and being nature-friendly. Therefore, SLM, EbA, Eco-DRR and NbS highlight the importance of indigenous people and their environmental knowledge and practices, as well as the call for their inclusion in all processes. This has also been emphasized in the 2019 IPCC Special Report on Climate Change and Land (IPCC, 2019).

Sustainable Land Management

Sustainable Land Management (SLM) is the oldest of the concepts. It can be traced back to soil conservation and terracing schemes in the context of the “Great Dust Bowl” in the United States, which negatively affected farming in Africa through agricultural policies in United States colonies and a lack of soil moisture (Critchley, 2009). Recognizing that top-down technology transfer was inefficient and likely to fail, the paradigm started to shift in the late 1970s towards bottom-up approaches and the participation of local communities (Critchley, 2009). Furthermore, in the late 1970s, the acknowledgement of indigenous knowledge and practice, such as agroforestry, started to grow among technical experts and became an important element of conservation approaches in the following decades (Critchley, 2009; Hurni, and others, 1996). With these developments, a new approach arose. It was characterized by a focus on production, participation of local communities and conservation strategies, assigned to terms such as “soil and water conservation” and “soil and water management”, until “sustainable land management” became the preferred and accepted term (Critchley, 2009; Hurni, and others, 1996; WOCAT, 2007). It was first defined in 1991 by the Framework for Evaluating Sustainable Land Management (FESLM) (FAO, 1993), in the context of population growth and the increasing demand for fertile land. SLM thus refers to practices and policies aiming at incorporating social, economic and environmental needs equally to contribute to sustainable

development. The FESLM defined SLM as follows: “Sustainable land management combines technologies, policies and activities aimed at integrating socio-economic principles with environmental concerns in order to simultaneously: maintain or enhance production and services (Productivity), reduce the level of production risk (Security), protect the potential of natural resources and prevent degradation of soil and water quality (Protection), be economically viable (Viability), and socially acceptable (Acceptability) (FAO, 1993)”. In 1994, the UNCCD embedded “conservation and sustainable management of land and water” as a strategy for addressing DLDD in its Convention text (Article 2, Objective 2 in UNCCD, 1994, p.5). Furthermore, SLM has been widely used in the agricultural sector (Harari, and others, 2017; Hurni, and others, 1996) due to its origins in the FAO, but its benefits for CCA and DRR have been increasingly promoted in recent years (e.g. Chotte, and others, 2019; Sanz, and others, 2017; UNCCD, 2017a; UNCCD SPI, 2017; UNFCCC, 2021). The most dominant definition of SLM is from WOCAT (see Table 1, p.31), keeping the principles and goals of the FESLM definition. This definition has been intergovernmentally agreed through the 2019 IPCC Special Report on Climate Change and Land (Olsson, and others, 2019). Therefore, SLM has been recognized as an important instrument to address the issues of the three Rio Conventions synergistically (CBD, and others, 2012). In keeping with its origins, SLM focuses on land-based ecosystems and resources. Since EbA, Eco-DRR and NbS were recognized as official concepts and approaches much later than SLM, they embrace many aspects of SLM.

Ecosystem-based Adaptation

Ecosystem-based Adaptation (EbA) originates in the historical practice of environmental management in the context of climate change (Doswald and Estrella, 2015). It has increasingly gained importance in policy contexts after the IPCC stated in

2007 that many ecosystems globally are and will be affected by the warming climate system (IPCC, 2007), and highlights the need for actions to adapt to the changing climate. The increased recognition of ecosystems and their services was promoted through the Millennium Ecosystem Assessment (MEA) in 2005 (UNEP, 2011; MEA, 2005; WOCAT, 2016). In 2008, the EbA approach was recommended by the IUCN and its member organizations to become part of the future UNFCCC adaptation framework (UNFCCC, 2008; Vignola, and others, 2009). It was officially defined in 2009 by the second ad hoc technical expert group on biodiversity and climate change of the CBD (SCBD, 2009) as displayed in Table 1 (p.31). Since then, the definition from the CBD has been widely adopted (FEBA, 2017) and EbA is recognized as a tool to synergistically implement the Rio Conventions through mainstreaming EbA into national policies (SCBD, 2019; Seddon, and others, 2016). Indeed, EbA has been adopted in the CBD in Decision X/33. While EbA has not been formally adopted in the other Rio Conventions, some member states have still included it, for example, in the National Adaptation Programmes of Action (NAPA), the National Adaptation Plans (NAP (UNFCCC)), and (Intended) Nationally Determined Contributions ((I)NDC). EbA has also been emphasized as important for better collaboration among the Rio Conventions, as all Rio Conventions address CCA, as well as the need for environmental health and human well-being (CBD, and others, 2012).

Ecosystem-based Disaster Risk Reduction

Ecosystem-based Disaster Risk Reduction (Eco-DRR) has its origins in the 1970s when disaster risk management was institutionalized and developed into a bottom-up concept with emphasis on local community empowerment (Murti and Mathez-Stiefel, 2018; Scolobig, and others, 2015). Further, the 2004 Indian Ocean tsunami was an important event which brought forward a trend towards disaster prevention and

reduction. It was followed by the adoption of the Hyogo Framework for Action (HFA) (2005–2015), which for the first time emphasized the role of environmental degradation in disaster events and thus the need to protect and conserve ecosystems for their natural defensive function (Renaud, and others, 2013). This trend may also have been influenced by the MEA, as previously mentioned. Therefore, the framework highlighted the urgent need for sustainable environmental management and land use. The importance and understanding of the role of ecosystem-based strategies for DRR, however, received increasing attention in policy contexts later than EbA (Doswald and Estrella, 2015). The most recognized definition of Eco-DRR is the one from Estrella and Saalismaa (2013) as displayed in Table 1 (p.31). Acknowledging the overlaps between CCA and DRR and the benefits of ecosystem-based approaches for both, the CBD first mentioned both EbA and Eco-DRR in its Decision XII/20 in 2014 (CBD, 2014), and further in its Decision 14/5 in 2018 (CBD, 2018). This promoted approaches that integrate both EbA and Eco-DRR in a combined way and in line with the ecosystem approach. Furthermore, the CBD refers to the definition from Estrella and Saalismaa (2013) in its Technical Series No. 93 (SCBD, 2019), which was adopted by its parties. Eco-DRR was also recognized, but not specifically defined, by the Ramsar Convention on Wetlands in Resolution X11.13 2015 (Ramsar Convention on Wetlands, 2015), by the SFDRR (UNDRR, 2015) and by the UNFCCC Paris Agreement in 2015 (UNFCCC, 2016). The SFDRR recognizes the role of ecosystems and environment as a cross-cutting issue in DRR and specifies a range of actions focused on integrated environmental and natural resource management approaches to DRR.

Table 1: Definitions of SLM, EbA and Eco-DRR agreed upon in intergovernmental processes

SLM	EbA	Eco-DRR
The use of land resources, including soils, water, animals and plants, for the production of goods to meet changing human needs, while simultaneously ensuring the long-term productive potential of these resources and the maintenance of their environmental functions.	The use of biodiversity and ecosystem services to help people to adapt to the impacts of climate change. EbA aims to maintain and increase resilience and reduce the vulnerability of ecosystems and people in the face of the adverse effects of climate change.	Sustainable management, conservation and restoration of ecosystems to reduce disaster risk, with the aim of achieving sustainable and resilient development.
From WOCAT (n.d.), adopted by the 2019 IPCC Special Report on Climate Change and Land (Olsson, and others, 2019).	From SCBD (2009).	From Estrella and Saalismaa (2013), adopted by the CBD in its Decision XII/20 in 2014 (CBD, 2014), and its Decision 15/4 in 2018 (CBD, 2018).

Nature-based Solutions

Nature-based Solutions (NbS) refers to a broad concept for all remedies to environmental and social challenges which capitalize on nature (Cohen-Shacham, and others, 2019) and it is the most recent concept to become established (Ershad Sarabi, and others, 2019). It was introduced by the IUCN (IUCN, 2009) and the World Bank (World Bank, 2008a) in the context of the growing concern of climate change and biodiversity and in response to the increasing recognition of the importance of “natural capital” to tackle these issues (Nesshöver, and others, 2017). The benefits of NbS for adaptation and mitigation were further emphasized in a position paper prepared for the COP 21 in Paris by the IUCN (IUCN, 2015). In 2015, the EC⁵ defined NbS in the context of

the research program Horizon 2020 (EC, 2015). The IUCN⁶ defined NbS in 2016, and its definition has been adopted by more than 1,300 member states and non-governmental organizations (NGOs) of the IUCN (Seddon, and others, 2019). The two definitions are similar, however IUCN emphasizes the sustainable use of natural and modified ecosystems with no or minimal interference, whereas the EC definition is open to the possibility of greater interference and considers also newly and artificially created ecosystems (Eggermont, and others, 2015; Ruangpan, and others, 2020; UNDRR, 2021). The IUCN definition is the most widely used (UNEP, 2021a). The IUCN furthermore provides a “framework for the verification, design and scaling up of NbS” in its “Global Standard” publication for NbS, defining eight assessment criteria (IUCN, 2020). After its launch, the latest publication by UNDRR, Words into Action

on Nature-based Solutions for Disaster Risk Reduction, uses the definition by IUCN (UNDRR, 2021). The concept has been increasingly recognized and gained attention in science, policy, practice and business (Nesshöver, and others 2017) and in many contexts such as climate change, agriculture, water conservation and habitat restoration, both in the scientific community as well as in governmental and non-governmental policy contexts (Cohen-Shacham, and others, 2019; Nature4climate, 2021; Seddon, and others, 2021; The Nature Conservancy, 2021; UN Water, 2018). Furthermore, the UN Climate Action Summit in September 2019 drew attention to the role of NbS for climate as well as sustainable development. The Climate Manifesto as a plan to facilitate and increase NbS activities was signed by more than 70 governments and organizations from the private sector and civil society (UN Global Compact, 2019; UNEP, 2019) at this occasion. NbS has been referenced by the CBD through the recommendation 23/2, paragraph 4 by its Subsidiary Body on Scientific, Technical and Technological Advice (SBSTTA) as an “essential component of ecosystem-based approaches to climate change adaptation, mitigation and disaster risk reduction” (CBD, 2019, p.23), which has also been referred to recently in the 2021 Kunming Declaration (CBD; 2021, p.4). The IPCC Special Report on Climate Change and Land describes NbS as “living solutions inspired by, continuously supported by and using nature, which are designed to address various societal challenges in a resource-efficient and adaptable manner and to provide simultaneously economic, social, and environmental benefits” (Olsson, and others, 2019, p.391). Most recently, NbS has been mentioned in the Working Group I contribution to the IPCC 6th Assessment Report published in August 2021 as “a subset of Carbon Dioxide Removal⁷ methods that restore or sustainably manage natural or modified ecosystems while providing human well-being and biodiversity benefits”

(Canadell, and others, 2021, pp.5-99). Nevertheless, the concern of NbS being too vague has been raised by several authors (Cohen-Shacham, and others, 2019; Nature, 2017; Nesshöver, and others, 2017). To date, there is no intergovernmentally agreed definition of NbS. Given that the concept of NbS addresses a broad variety of challenges, drivers and goals, the following chapters will only compare SLM, EbA and Eco-DRR, which all address very specific goals.

3.2. Terminology

In the following chapter, terminologies used among the different communities and contexts associated with SLM, EbA, and Eco-DRR are elaborated. The terms “approach”, “technology”, “measure”, “practice” and “strategy” are commonly used in the literature reviewed to denote certain processes within the conceptual design and implementation of the respective approaches. The operational use of terminologies can be found in the Glossary.

The term “approach” is specifically defined in the context of SLM by WOCAT (2019a) as “the ways and means used to implement one or several [...] project[s]/programme[s] or activities [...]” (WOCAT, 2019a, p.4). Literature related to EbA and Eco-DRR have not defined the term as such, but the usage under these approaches is very similar (Table 2, p. 33).

The term “technology” (Table 3, p. 33) is mainly employed by the SLM community and defined as “a land management practice that controls land degradation and enhances productivity and/or other ecosystem services” (WOCAT, 2019a, p.4), consisting of one or several measures (e.g. afforestation, agroforestry, reduced tillage, improved grazing land management and cross-slope barriers) that are implemented at local scale (Liniger, and others, 2011).

5 The EC defines NbS as “Solutions that are inspired and supported by nature, which are cost-effective, simultaneously provide environmental, social and economic benefits and help build resilience. Such solutions bring more, and more diverse, nature and natural features and processes into cities, landscapes and seascapes, through locally adapted, resource-efficient and systemic interventions” (EC, 2015).

6 According to the IUCN (2016), NbS are defined as “actions to protect, sustainably manage and restore natural or modified ecosystems that address societal challenges, such as climate change and disaster risk, effectively and adaptively, simultaneously providing human well-being and biodiversity benefit”.

7 Carbon Dioxide Removal are “anthropogenic activities removing carbon dioxide (CO2) from the atmosphere and durably storing it in geological, terrestrial, or ocean reservoirs, or in products. It includes existing and potential anthropogenic enhancement of biological or geochemical CO2 sinks and direct air capture and storage, but excludes natural CO2 uptake not directly caused by human activities” (IPCC, 2021, p.AVII-9f.).

Table 2: Use of the term “approach” in the respective literature reviewed.

SLM	EbA	Eco-DRR	References
“Approach” is referred to as “the ways and means used to implement one or several [...] projects/programmes or activities.” (WOCAT, 2019a, p.4)	“Approach” is used as a way to address impacts and challenges in the socioeconomic or ecological systems; to conduct an assessment or to perform an activity.	“Approach” entails the combination of managerial techniques, practices, methods and measures to achieve a specific goal and to produce specific benefits.	SLM: Sanz, and others, 2017; WOCAT, 2019a; EbA: Doswald and Estrella, 2015; GIZ, and others, 2020 UNFCCC, 2013; SCBD, 2009; Eco-DRR: Doswald and Estrella, 2015; Renaud, and others, 2013; Sudmeier-Rieux, and others, 2019

Table 3: Use of the term “technology” in the respective literature reviewed.

SLM	EbA	Eco-DRR	References
An SLM technology is a land management practice that controls and restores land degradation and enhances productivity and/or other ecosystem services. It consists of one or several measures.	Refers to technical (hard, soft and organization) options working with ecological processes to enhance adaptive capacity.	Refers to technical (hard, soft and organization) options working with ecological processes for disaster risk reduction capacity.	SLM: WOCAT, 2019a; EbA: Jiménez Hernández, 2016; SCBD, 2019; UNFCC; 2020; Eco-DRR: Jiménez Hernández, 2016; SCBD, 2019; UNFCC, 2020

Table 4: Use of the term “measure” in the respective literature reviewed.

SLM	EbA	Eco-DRR	References
SLM measures are divided into agronomic, vegetative, structural and management measures.	Interventions necessary to reduce vulnerability of natural and human systems against climate stress such as livelihood diversification, coastal habitat restoration and land use planning. Actions needed to deliver a demonstrable outcome and to achieve desirable benefits while addressing several climate hazards.	Actions undertaken to protect people in the face of natural hazards (for example, greenbelts, coastal forests, coastal wetlands, sand dunes, coral reefs, dykes and non-structural measures such as regulatory frameworks or awareness-raising).	SLM: WOCAT, 2019a; EbA: GIZ, and others, 2020; Jiménez Hernández, 2016; Eco-DRR: Renaud, and others, 2013; Sudmeier-Rieux, and others, 2019

SLM technologies have been organized into 14 groups⁸ for certain land types (Sanz, and others, 2017). “Technology” in the EbA and Eco-DRR literature reviewed most often refers to technical options to enhance response capacity (coping capacity and adaptive capacity) (Jiménez Hernández, 2016; SCBD, 2019). These include a wide range of options from soft technologies (e.g. training capacities, building-capacity, technical knowledge and financing instruments), organizing technologies (e.g. policies, strategic planning, institutional settings, regulations and governance structures) to hard technologies consisting of models and information systems (e.g. monitoring systems, numerical models, GIS, satellite databases), planning and decision support tools (e.g. Marxan, SeaSKETCH or ALiVE⁹), nature-based techniques and ecologi-

cal engineering (e.g. slope stabilization through native trees, introduction of drought-tolerant species, cross-fertilization of crops) as well as structural or constructed systems (e.g. riverbanks, artificial wetlands or urban parks) (SCBD, 2019; UNFCCC, 2020). However, this is largely equivalent to the term “intervention”, which is generally used in the EbA community and whereby typically, an intervention consists of multiple EbA measures (e.g. coral rehabilitation alongside mangrove restoration) and includes supporting or enabling activities like capacity-building, livelihood diversification, institutional mainstream and improvement in governance (GIZ, and others, 2020). “Intervention” is not as frequently used and defined in the Eco-DRR literature reviewed. In addition, SLM technologies are used for EbA and Eco-DRR, if applicable (Harari, and others, 2017; Renaud, and others, 2013; Sudmeier-Rieux, and others, 2019).

The term “measure” (Table 4, see above) is frequently used in the literature reviewed to denote the actions necessary to achieve a particular outcome. The different types of measures

8 The technology groups consist of integrated soil fertility management, vegetation management, water management, grazing pressure management, animal waste management, sustainable forest management, reducing deforestation, afforestation/reforestation, forest restoration, agroforestry, agro-pastoralism, minimum soil disturbance, soil erosion control and fire, pest and disease control (Sanz, and others, 2017).

9 To learn more see: <https://www.gbif.org/es/tool/81349/marxan-conservation-planning-software>; <https://www.seasketch.org>; <https://www.iisd.org/projects/alive-adaptation-livelihoods-and-ecosystems-planning-tool>

Table 5: Use of the term “practice” in the respective literature reviewed.

SLM	EbA	Eco-DRR	References
SLM practices combine “technologies, policies and activities, aimed at integrating socioeconomic principles with environmental concerns”, which is in line with the definition of SLM from the FESLM (FAO, 1993) (see Chapter 3.2.1.).	—	The term refers to certain groups of actions such as agricultural practices, management practices, engineering practices, prevention practices, etc.	SLM: Sanz, and others, 2017; WOCAT, 2019a; FAO, 1993; Eco-DRR: Renaud, and others, 2013

Table 6: Use of the term “strategy” in the respective literature reviewed.

SLM	EbA	Eco-DRR	References
—	EbA strategy defines adaptation priorities and designs EbA measures. EbA literature recognizes “strategy” as the adoption of plans and programs to maintain ecosystems functioning.	It refers to a program or plan of activities to address a specific issue of the Eco-DRR project (e.g. educational strategy, gender strategy, communication strategy, etc.).	EbA: Jiménez Hernández, 2016; SCBD, 2009

described can be categorized as hard or structural measures, soft or non-structural measures and management measures.

The term “practice” (Table 5, p.35) is also commonly used in the literature reviewed. In the SLM community, a practice is defined as the combination of “[...] technologies, policies and activities, aimed at integrating socioeconomic principles with environmental concerns” (Sanz, and others, 2017, p.23) in line with the definition of SLM from the FESLM (FAO, 1993) (see Chapter 3.1.). Although a definition of the term “practice” could not be found in the EbA literature reviewed, it is often used synonymously with the term “measure”, which is more frequently used. Furthermore, a measure, intervention, practice or technology can include different underlying implementation characteristics such as community-based approach, people-centered approach or place-based approach. In the Eco-DRR literature, “practice” is used to refer to certain groups of actions (Renaud, and others, 2013).

Another frequently used term is “strategy” (Table 6, p. 35), which refers to several concepts at once. In the context of all approaches except for SLM, the term “strategy” is associated with a plan of prioritized and necessary actions logically structured and coherently connected to achieve specific outcomes under the respective approach (e.g. implementation strategy, communication strategy, management strategy, education strategy, technical strategy, financial strategy, social strategy, institutional strategy, etc.). “Strategy” can be described as the implementation guide to be followed by EbA or Eco-DRR. In addition, “strategy” is often used to replace the term “approach”. However, the term “approach” involves the assumptions and perceptions related to a challenge, while the term “strategy” tends to refer to the set of actions and activities leading to specific outcomes to overcome that challenge.

Summarizing these findings, the term “technology” is uniquely defined in the SLM literature and less used in the EbA and

Eco-DRR literature reviewed. SLM technologies are applied within projects of the EbA and Eco-DRR approach, if applicable (see also Figure 1, p. 53). However, in these cases, the EbA and Eco-DRR literature refers to using the term “SLM approach” instead of technologies (Sudmeier-Rieux, and others, 2019). The term “measure” is equally often used under SLM, EbA and Eco-DRR and has the same meaning. Both SLM and Eco-DRR use the term “practice” to describe certain groups of actions, with a precise definition under SLM, namely a combination of “technologies, policies and activities, aimed at integrating socioeconomic principles with environmental concerns” (Sanz, and others, 2017, p.23). “Practice” is not a commonly used term under the EbA approach. In contrast to SLM, “strategy” is frequently used under EbA and Eco-DRR to describe a certain program or plan with a specific definition of actions, measures and outcomes in direct relation to the approach. In addition, SLM, EbA and Eco-DRR can be integrated into global and national targets, frameworks, strategies and conventions.

3.3. Key characteristics of SLM, EbA and Eco-DRR

3.3.1. Specific and ultimate goals

As seen in the historical context, SLM has its roots already in the early 20th century, while the other approaches in some way or another derive from the thinking started in 1972 at the conference on the human environment, followed by the Earth Summit which created the Rio Conventions¹⁰, and finally the Sustainable Development Goals (O’Hagan, 2020). The ultimate goal that all these approaches aim for is sustainable develop-

¹⁰ For more background information see: <https://www.un.org/en/conferences/environment/rio1992>.

ment¹¹, aiming to achieve both human well-being and environmental health (Liniger, and others, 2011; UNCCD, 2016; FEBA, 2017; SCBD, 2009; Sudmeier-Rieux, and others, 2019) as displayed in Table 7 (p. 38). In addition, each approach also has very specific goals, which will be the driving force behind their implementation. Thus, all actions, measures and direct benefits will be oriented towards these goals, in accordance with their definitions (Table 1, p.31).

All actions and measures planned, designed and implemented in SLM projects aim to “use [...] land resources, [...], for the production of goods to meet changing human needs, while simultaneously ensuring the long-term productive potential of these resources and the maintenance of their environmental functions.” Therefore, the specific goals of SLM are to combat land degradation, aiming to prevent, reduce and/or rehabilitate the degradation of land and its resources and to support biodiversity, land-based ecosystems and ecosystem services and functions (Liniger, and others, 2011; UNCCD, 2016). In addition, land productivity and the provision of food security are essential in SLM (Liniger, and others, 2011).

All actions and measures planned, designed and implemented in EbA projects aim for the use of biodiversity and ecosystem services “to help people adapt to the impacts of climate change” and thus, the specific goals of EbA are CCA and the support of biodiversity, ecosystems and ecosystem services and functions (FEBA, 2017; SCBD, 2009). Furthermore, sustainable socioeconomic development is essential in EbA (FEBA, 2017).

All actions and measures planned, designed and implemented in projects of the Eco-DRR approach include the “sustainable management, conservation and restoration of ecosystems to reduce disaster risk”, which is why its specific goals are DRR and the support of biodiversity, ecosystems and ecosystem services and functions (Estrella and Saalismaa, 2013; Sudmeier-Rieux, and others, 2019).

11 For more background information see:
<https://www.un.org/sustainabledevelopment/development-agenda/>

3.3.2. Implementation: Key steps, measures and characteristics

Key steps to design and implementation

The key steps to design and implement SLM, EbA and Eco-DRR can be summarized as documented in Table 8 (p.39). All of them include a step for understanding the local challenges and needs, an assessment based on certain factors which influences the possibility and choice of measures and furthermore the design, implementation and M&E phase. Significant differences lie in their specific assessment and the factors which are determined by the specific goals (see Table 7, p. 38). For SLM, a variety of factors is considered. An important tool for its assessment is the Land Degradation Assessment in Drylands (LADA), a result of the LADA project from the Global Environment Facility (GEF), the FAO and the UNEP in partnership with WOCAT. It includes the assessment of vegetation, soil, water resources and the impacts of land use and management of ecosystem services, crop productivity, yields and livelihoods¹² (Biancalani, and others, 2011; Bunning, and others, 2016). For its implementation to achieve LDN, the indicators of land cover, land productivity and carbon stocks are specifically relevant (Cowie, 2020; Orr, and others, 2017). These indicators are part of the LADA. For EbA measures to help people adapt to climate change, the analysis of future climate scenarios and the impacts from the changing climate on livelihoods and ecosystems are essential (Sudmeier-Rieux, and others, 2019). The planning, design, implementation and

12 In more detail, the LADA includes: assessment of vegetation (forest, pasture, rangeland, cropland) in terms of productivity and ecological function and capacity to maintain the range of ecosystem services; assessment of soil properties, soil health and erosion activity, type and severity; assessment of water resources degradation, and effects of land degradation on water quantity and quality; assessment of the influence of socioeconomic, cultural and institutional factors on land-users’ views and on the management of their land resources; assessment of the impacts of land use and management on ecosystem services, crop productivity, yields and livelihoods (assets and vulnerability) (Biancalani, and others, 2011; Bunning, and others, 2016).

Table 7: Specific goals of land-based SLM, EbA and Eco-DRR derived from their definitions.

		SLM	EbA	Eco-DRR	References
Specific goals	Support of biodiversity, (land-based) ecosystems and ecosystem services and functions	X	X	X	SLM: Liniger, and others, 2011; UNCCD, 2016b; EbA: FEBA, 2017; SCBD, 2009; Eco-DRR: Sudmeier-Rieux, and others, 2019
	Reduce environmental degradation (on land)	X	—	—	
	Climate Change Adaptation (CCA)	—	X	—	
	Disaster Risk Reduction (DRR)	—	—	X	
Ultimate goal	Sustainable development	X	X	X	

Table 8: Key steps in SLM, EbA and Eco-DRR.

	SLM	EbA	Eco-DRR	References
Understanding local challenges and needs	X	X	X	
Land degradation assessment (assessment of vegetation, soil, water resources, livelihoods)	X	—	—	
Climate risk assessment (based on climate projections and vulnerability)	—	X	—	SLM: Biancalani, and others, 2011; Bunning, and others, 2016;
Disaster risk assessment (based on the risk factors hazard, exposure, vulnerability)	—	—	X	EbA: Doswald and Estrella, 2015; FEBA, 2017; SCBD, 2019; Sudmeier-Rieux, and others 2019;
Identifying options	X	X	X	Eco-DRR: Doswald and Estrella, 2015; SCBD, 2019; Sudmeier-Rieux, and others 2019
Prioritizing options	X	X	X	
Designing and implementing the project	X	X	X	
Monitoring and evaluating the project outcomes, impacts and effectiveness	X	X	X	

M&E of EbA are based on climate projections and on vulnerability and adaptive capacity of the local communities (Doswald and Estrella, 2015; FEBA, 2017; Sudmeier-Rieux, and others 2019). The key steps to implement measures under the Eco-DRR approach require a disaster risk assessment considering the main components of risk: hazard, exposure and vulnerability (Doswald and Estrella, 2015; Sudmeier-Rieux, and others, 2019).

Measures

SLM, EbA and Eco-DRR use similar and sometimes the same measures as they include the conservation, sustainable use and restoration of land (SLM: FAO, 2021; UNCCD, 2015b; EbA: FEBA, 2017; SCBD, 2009; Eco-DRR: Sudmeier-Rieux, and others, 2019). This results in many similar co-benefits (see Chapter 3.3.3. Co-benefits). In addition, the three approaches include “green” measures which make use of ecosystems and their services, such as the use of vegetation to stabilize slopes (Chotte, and others, 2019; Sanz, and others, 2017; SCBD, 2019; Sudmeier-Rieux, and others, 2019). The approaches also use hybrid or “green-grey” measures, which combine “green” measures with “grey” measures or built infrastructure such as dikes and dams (Chotte, and others, 2019; Sanz, and others, 2017; SCBD, 2019; Sudmeier-Rieux, and others, 2019). As previously mentioned, SLM technologies are being used among the measures of both EbA and Eco-DRR projects (Harari, and others, 2017; Renaud, and others, 2013; Sudmeier-Rieux, and others, 2019).

Implementation characteristics

Further overlaps exist in terms of the implementation characteristics (Table 9, p. 41), especially how the approaches are generally planned, designed and implemented to reach their

specific goals. As SLM, EbA and Eco-DRR are intended to sustain or increase human well-being, all of them are people-centered, as well as aiming for equity, gender-equality and particularly for the inclusion of the most vulnerable groups (Chotte, and others, 2019; SCBD, 2019). Additionally, the inclusion of local indigenous environmental knowledge and practices is important in all approaches not only to maximize acceptability in the given context, but also as a way to learn from indigenous knowledge, which is based on observations of nature throughout history (Berkes, and others, 2000; Berkes and Davidson-Hunt, 2006; Chotte, and others, 2019; FAO, 1993; SCBD, 2009, 2019). Furthermore, these approaches recognize that indigenous people are important keepers of nature with an estimated 80 per cent of the world’s forest biodiversity in their territory (IUCN, 2019). Thus, all approaches include participatory processes (Harari, and others, 2017; SCBD, 2009). SLM, EbA and Eco-DRR are highly local and context-specific in their planning, design and implementation (Doswald and Estrella, 2015; Sanz, and others, 2017; SCBD, 2009, 2019). All of them apply a system-scale perspective, considering different spatial and temporal scales of changes as well as their interactions, and acknowledging the complexity of the social-ecological system (SCBD, 2009, 2019; Chotte, and others, 2019). Transdisciplinarity is another important characteristic applied by all approaches, as they all accommodate multiple disciplines from social and environmental sciences (Chotte, and others, 2019; IUCN, 2020; SCBD, 2019) with a clear link to policies. Multi-stakeholder participation and collaboration is also important in all approaches to optimize the benefits for all stakeholders involved (Hurni, and others, 1996; Liniger, and others, 2011; SCBD, 2019). Capacity-building activities at multiple levels, from the individual to the community, are further integral parts of all approaches (Sanz, and others, 2017; Sudmeier-Rieux, and others, 2019). The same applies to mainstreaming of the approaches into sectoral, national and other policy frameworks, strategies and planning processes (Chotte, and others, 2019; SCBD, 2019).

Table 9: Implementation characteristics of SLM, EbA and Eco-DRR.

	SLM	EbA	Eco-DRR	References
People-centered	X	X	X	SLM: Bastidas Fegan, 2019; Chotte, and others, 2019; FAO, 1993, 2016; Harari, and others, 2017; Hurni, and others, 1996; Liniger, and others, 2011; Sanz, and others, 2017; EbA: Birkmann and Teichman, 2010; Doswald and Estrella, 2015; FEBA, 2017; SCBD, 2009; Eco-DRR: Doswald and Estrella, 2015; Sudmeier-Rieux, and others, 2019; UNDRR, 2021; SCBD, 2019
Equity and inclusion	X	X	X	
Integration of traditional and indigenous environmental knowledge and practices	X	X	X	
Participatory	X	X	X	
Place-based	X	X	X	
Prioritizing options	X	X	X	
System-scale perspective	X	X	X	
Transdisciplinary process	X	X	X	
Multi-stakeholder collaboration	X	X	X	
Integration of capacity-building	X	X	X	
To be mainstreamed into sectoral, national and other policy frameworks	X	X	X	
Adaptive, continuous learning, process oriented	X	X	X	
Prevention of harm to biodiversity, ecosystems and ecosystem services	X	X	X	
Emphasis on soil protection, land productivity, natural resources conservation and land user needs	X	—	—	
Focus to avoid, reduce and reverse land degradation	X	—	—	
Emphasis on preparedness and early warning	—	X	X	
Focus to avoid, anticipate and prevent climate risks and to enhance the resilience of ecosystems and people to climate risks	—	X	X	
Emphasis on reducing risks from natural hazards and enhancing ecosystem services for resilience	—	—	X	
Emphasis to prepare for, protect against, respond to and recover from natural hazards	—	—	X	

Table 10: Scale, timeframe and context of SLM, EbA and Eco-DRR.

		SLM	EbA	Eco-DRR	References
Scale	Small (site-specific)	X	X	X	SLM: Bastidas Fegan, 2019; Chotte, and others, 2019; Harari, and others, 2017; Liniger, and others, 2011; Sanz, and others, 2017; EbA: Doswald and Estrella, 2015; FEBA, 2017; SCBD, 2009, 2019; Eco-DRR: Doswald and Estrella, 2015; Sudmeier-Rieux, and others, 2019; SCBD, 2019
	Medium	X	X	X	
	Large	X	X	—	
Time frame	Short-term	—	—	X	
	Medium-term	—	—	X	
	Long-term	X	X	—	
Context	Rural	X	X	X	
	Urban	—	X	X	
	Terrestrial	X	X	X	
	Marine	—	X	X	

All approaches include risk and benefit assessments of possible solutions to identify the most suitable and effective options (Liniger, and others, 2011; SCBD, 2019). All three approaches acknowledge the dynamics and uncertainty within the system, which is why adaptive management is a characteristic in all approaches. Adaptive management is important, because flexibility as well as the perspective to learn over time is highly required for all approaches. Furthermore, and in relation to their common specific goal, all practices and

measures of all approaches do not harm biodiversity, ecosystems and ecosystem services (Liniger, and others, 2011; SCBD, 2009, 2019).

Furthermore, the implementation characteristics are influenced by the historical background and the specific goals. Therefore, many differences lie in the orientation of the measures in order to achieve the specific goals, such as to combat DLDD, to address CCA or DRR.

EbA and SLM are applied at the small to medium to large scale (Harari, and others, 2017; Sudmeier-Rieux, and others, 2019), whereas Eco-DRR tends to be focused on the local and community scale (Doswald and Estrella, 2015) as displayed in Table 10 (p. 42). As for the timeframe addressed in Table 10 (p.42), both EbA and SLM adopt a long-term future perspective, whereas Eco-DRR focuses on disasters in the short- to medium term (Sudmeier-Rieux, and others, 2019). This is related to the specific goals and thus the perspective and assessment required to achieve it. For SLM, the specific goal is to ensure long-term health and productivity of the land. In relation to the specific goal of EbA to adapt to climate change, future climate projections are considered and a long-term perspective is adopted. Eco-DRR considers present and near future risks based on assessing past and current risks. In addition, SLM focuses on land-based environments, and mostly on rural contexts (Harari, and others, 2017), whereas EbA and Eco-DRR are both applied in rural and urban areas and in land-based and marine ecosystems as shown in Table 10, page 42 (SCBD, 2019).

3.3.3. Co-benefits

The co-benefits identified in the literature have been divided into social, economic and environmental co-benefits. Each co-benefit can also be planned as direct benefit to achieve a specific goal, depending on the project. In Table 11 (p. 45-46), the specific goals are indicated as such, as these benefits will not be ancillary in projects of the respective approaches. For example, the improvement of land productivity is not a co-benefit of SLM, because it is a specific goal of SLM.

Table 11 (p. 45-46) shows that despite their different specific goals, SLM, EbA and Eco-DRR share many co-benefits and are similar in this regard. This is due to their common goal to support biodiversity, land-based ecosystems, as well as

ecosystem services and functions, and their ultimate shared goal of sustainable development. The respective measures (see Chapter 3.3.2 on Implementation) to achieve these goals can generate similar co-benefits, depending on the context and the specific measures implemented. In particular, the support of biodiversity can meaningfully contribute to the achievement of multiple co-benefits, such as human health, food security and sustainability of livelihoods (CBD, 2010a), as well as the ultimate shared goal of sustainable development (SCBD, 2018).

Therefore, this overview shows the high potential of SLM, EbA and Eco-DRR to contribute to the implementation of specific goals. For example, the co-benefits of SLM to increase the environmental buffer capacity against the impacts of climate hazards have been highlighted to meaningfully contribute to CCA (Sanz, and others, 2017). Furthermore, the contribution of SLM to DRR is highlighted in the SLM literature reviewed (e.g. Chotte, and others, 2019; Sanz, and others, 2017; UNCCD, 2017a; UNCCD SPI, 2017).

3.3.4. Global and national targets, frameworks, strategies and conventions

In this section, the relevant global and national targets, frameworks, strategies and conventions for the goals of SLM, EbA and Eco-DRR are presented in alphabetical order. This can support practitioners of SLM, EbA and Eco-DRR projects to monitor and report progress about achieving specific goals and associated co-benefits.

The CBD and the National Biodiversity Strategies and Action Plans

The Conference of the Parties (COP) to the CBD references EbA in its Decisions X/33 (CBD, 2010b), XII/20 (CBD, 2014), XIII/4 (CBD, 2016) and 14/5 (CBD, 2018), and encourages the use of EbA to address climate change issues while integrating biodiversity and ecosystem resilience through the National Biodiversity Strategies and Action Plans (NBSAP). Decisions XII/20 and XIII/4 also reference Eco-DRR to be implemented in a combined way with EbA through the NBSAP (CBD). Additionally, the annex of Decision 14/5 (CBD, 2018) provides voluntary guidelines for the design and effective implementation of EbA and Eco-DRR including a stepwise approach for planning, design, implementation and M&E (CBD, 2018). This Decision furthermore encourages parties to contribute to the implementation of the 2030 Agenda for Sustainable Development and the SDGs through ecosystem-based approaches to address climate change issues and disaster risk, as well as to combat land degradation, emphasizing the importance of EbA and Eco-DRR for sustainable development and the implementation of the SDGs. Moreover, parties and other governments are encouraged in this decision “to integrate ecosystem-based approaches when updating their nationally determined contributions, where appropriate, and pursuing domestic climate action under the Paris Agreement, while taking into account the importance of ensuring the integrity and functionality of all ecosystems, including oceans, and the protection of biodiversity” (CBD, 2018, p.3).

The Ramsar Convention on Wetlands

The Ramsar Convention on Wetlands is an international treaty providing a framework for the conservation and sustainable use of wetlands. Its Resolution XII.13 encourages its parties “to

integrate ecosystem management related considerations, in particular relating to wetland and water management, in their national disaster risk reduction and climate change adaptation strategies” (Ramsar Convention on Wetlands, 2015, p.3). The resolution further highlights the importance of environmental management for poverty reduction strategies. Furthermore, the resolution recognizes the important links to DRR through the SDGs and the SFDRR and underlines the importance of the conservation, restoration and sustainable use of wetlands in these contexts.

The Sendai Framework for Disaster Risk Reduction 2015–2030

The SFDRR is the global policy guide for DRR and resilience building that aims for a “substantial reduction of disaster risk and losses in lives, livelihoods and health and in the economic, physical, social, cultural and environmental assets of persons, businesses, communities and countries.” (UNDRR, 2015, p.12) The Framework is structured around seven targets and four priorities for action to guide actions to reduce disaster risk. It includes a monitoring tool to assess and report progress around 38 indicators, agreed through an intergovernmental process, some of which are shared with selected targets of SDGs 1, 11 and 13 (48(c), UNDRR, 2015, p.25f.; UNDRR, 2016). The framework strongly encourages Eco-DRR and ecosystem-based approaches. Under Priority 2, “Strengthening disaster risk governance to manage disaster risk”, it states the importance to “promote transboundary cooperation to enable policy and planning for the implementation of ecosystem-based approaches regarding shared resources, such as within river basins and along coastlines, to build resilience and reduce disaster risk, including epidemic and displacement risk” (28(d), UNDRR, 2015, p.18). Acknowledging the links between DRR and other fields of actions, such as biodiversity, climate change and sustainable development, the framework stresses the

Table 11: Social, economic and environmental co-benefits of SLM, EbA and Eco-DRR.

		SLM	EbA	Eco-DRR	References
Economic co-benefits	Job creation	X	X	X	SLM: Bastidas Fegan, 2019; Chotte, and others, 2019; Harari, and others, 2017; Liniger, and others, 2011; Sanz, and others, 2017; EbA: Doswald and Estrella, 2015; FEBA, 2017; SCBD, 2009, 2019; Eco-DRR: Doswald and Estrella, 2015; Sudmeier-Rieux, and others, 2019; SCBD, 2019
	Support and diversification of livelihoods	X	X	X	
	Local income enhancement	X	X	X	
	Land/service value increase	X	X	X	
	Improvement of land productivity	Specific Goal	X	X	
Environmental co-benefits	Increase in buffer capacity against climate hazard impacts	X	Specific Goal	Specific Goal	
	Carbon storage and sequestration	X	X	X	
	Stabilization of regional climate	X	X	X	
	Enhanced condition of microclimate	X	X	X	
	Reduced emissions and air pollution	X	X	X	

		SLM	EbA	Eco-DRR	References
Environmental co-benefits	Sustainable regeneration of natural resources	X	X	X	SLM: Bastidas Fegan, 2019; Chotte, and others, 2019; Harari, and others, 2017; Liniger, and others, 2011; Sanz, and others, 2017; EbA: Doswald and Estrella, 2015; FEBA, 2017; SCBD, 2009, 2019; Eco-DRR: Doswald and Estrella, 2015; Sudmeier-Rieux, and others, 2019; SCBD, 2019
	Reduced water stress	X	X	X	
	Enhanced ecological connectivity	X	X	X	
	Soil protection (erosion control, land degradation, drought and desertification)	Specific Goal	X	X	
	Contribution to soil health, fertility, nutrient cycling and water retention	Specific Goal	X	X	
Social co-benefits	Sustainable provision of food	X	Specific Goal	Specific Goal	
	Social cohesion	X	X	X	
	Human health	X	X	X	
	Support of cultural diversity	X	X	X	
	Sustainable access to fresh water	X	X	X	
	Poverty alleviation	X	X	X	
	Reduced conflicts over resources	X	X	X	
	Capacity building	X	X	X	
	Provision of building materials and biomass	X	X	X	

importance of collaboration at regional and global levels (28(b), UNDRR, 2015, p.18). Priority 3, “Investing in disaster risk reduction for resilience” further highlights the sustainable use and management of ecosystems while addressing disaster risk (30(n), UNDRR, 2015, p.19). Moreover, under Priority 3, the framework notes the importance “to promote the mainstreaming of disaster risk assessments into land-use policy development and implementation, including (...) land degradation assessments (...)” (30(f), UNDRR, 2015, p.19). The necessity to incorporate DRR measures into development assistance programmes in multiple sectors with links to sustainable development and CCA, amongst others, is mentioned in paragraph 47(d) (UNDRR, 2015, p.25).

The Sustainable Development Goals

The SDGs, adopted by all UN member states in 2015 under the 2030 Agenda for Sustainable Development (UN, n.d.), are a very important international agreement which is directly related to all of the specific goals of SLM, EbA and Eco-DRR as well as their common ultimate goal (see Table 7, p. 38). The agreement encompasses 17 goals and 169 targets, and provides an indicator framework for these (UN, 2017). The 2030 Agenda for Sustainable Development has been recognized by the three Rio Conventions (CBD, 2018; UNCCD, 2017b; UNFCCC, n.d.) as an important agreement with many objectives to be achieved through the efforts under the Conventions. Table 12 (p. 48) lists the SDGs which each approach specifically addresses, as documented in the literature (see references in Table 12, p. 48). Similar to the observations made in terms of co-benefits (Table 11, p. 45-46), there are many overlaps despite the different specific goals. The overlaps demonstrate the high potential of SLM, EbA and Eco-DRR to achieve multiple outcomes to address the ultimate goal.

The UNCCD 2018–2030 Strategic Framework and the National Action Programmes

The 2018–2030 Strategic Framework of the UNCCD (Decision 7/COP.13) (UNCCD, 2017b) is a global commitment to achieve Land Degradation Neutrality (LDN) and includes five Strategic Objectives¹³ with progress indicators. It references SLM as an implementation response to address DLDD and to achieve LDN in its Strategic Objective 1: “To improve the condition of affected ecosystems, combat desertification/land degradation, promote sustainable land management and contribute to land degradation neutrality” (Decision 7/COP.13) (UNCCD, 2017b, p.24). The Strategic Framework recognizes the importance of resilient ecosystems and highly encourages countries to use SLM to address DLDD through their National Action Programmes (NAP UNCCD), which may include their pursuit of LDN if they have voluntarily set LDN targets. Decision 2/ COP.12, Article 3 “invites affected country Parties, in accordance with Decision 22/COP.11, to establish baselines and national-level voluntary Land Degradation Neutrality (LDN) targets within their NAPs” (UNCCD, 2015b, p.6).

The LDN Target Setting Programme¹⁴, together with the UNCCD Global Mechanism (GM) for financial mechanisms and the secretariat of the UNCCD, provides support to countries with interest in setting LDN targets. Tools have been developed to facilitate planning, design, implementation and M&E processes, such as a scientific conceptual framework for LDN (Orr, and others, 2017), as well as guidelines for LDN (Cowie, 2020).

13 The five Strategic Objectives are: **Strategic objective 1:** To improve the condition of affected ecosystems; **Strategic objective 2:** To improve the living conditions of affected populations; **Strategic objective 3:** To mitigate, adapt to, and manage the effects of drought in order to enhance resilience of vulnerable populations and ecosystems; **Strategic objective 4:** To generate global environmental benefits through effective implementation of the UNCCD; **Strategic objective 5:** To mobilize substantial and additional financial and non-financial resources to support the implementation of the Convention by building effective partnerships at global and national level (UNCCD, 2017b, p.24).

14 To learn more see: <https://www.unccd.int/actions/ldn-target-setting-programme>

Table 12: SDGs specifically addressed through SLM, EbA and Eco-DRR

	SLM	EbA	Eco-DRR	References
1 No Poverty	X	X	X	
2 Zero Hunger	X	X	X	
3 Good Health and Well-being	X	X	X	
6 Clean Water and Sanitation	X	X	X	SLM: Sanz, and others, 2017, p.34;
7 Affordable and Clean Energy	—	X	X	EbA: SCBD, 2019, p.89f.; Sudmeier-Rieux, and others, 2019, p.41;
9 Industry, Innovation and Infrastructure	—	X	X	Eco-DRR: SCBD, 2019, p.89f.; Sudmeier-Rieux, and others, 2019, p.41
11 Sustainable Cities and Communities	—	X	X	
13 Climate Action	X	X	X	
14 Life Below Water	—	X	X	
15 Life on Land	X	X	X	

In addition, the Strategic Framework acknowledges the diverse co-benefits of SLM, formulated under Strategic Objective 4 its “Expected Impact 4.1: Sustainable land management and the combating of desertification/land degradation contribute to the conservation and sustainable use of biodiversity and addressing climate change” (UNCCD, 2017b, p.20).

The Strategic Framework furthermore states: “The strategy will contribute to (i) achieving the objectives of the Convention and

the 2030 Agenda for Sustainable Development, in particular regarding SDG 15 and Target 15.3 (...)” (UNCCD, 2017b, p.19), which includes striving to achieve a land degradation-neutral world. Hence, especially the LDN Target Setting Programme addresses SDG Target 15.3. This highlights the importance of SLM for sustainable development and thus the implementation of the SDGs, in particular SDG 15.

The UNFCCC Cancun Adaptation Framework and the National Adaptation Plans

The UNFCCC Cancun Adaptation Framework was established as a result of the UNFCCC COP16 in 2010 to support actions and international cooperation for CCA (Least Developed Countries Expert Group, 2012; UNEP, 2021b). It is being implemented through the National Adaptation Plans (NAP). The technical guidelines for the NAP (UNFCCC), created by the UNFCCC Least Developed Countries Expert Group (LEG) to facilitate countries to define strategies to meet their adaptation needs and encourage the implementation of EbA within adaptation strategies (Least Developed Countries Expert Group, 2012; UNEP, 2021b).

The UNFCCC Paris Agreement and the (Intended) Nationally Determined Contributions

The UNFCCC Paris Agreement is an international treaty on climate change which is legally binding and has been adopted and signed by the 21st COP (COP21) in 2015 (FCCC/CP/2015/L.9) (UNFCCC, 2016). It is a commitment between 195 countries to pursue actions to reduce greenhouse gas emissions in order to constrain global warming, as well as to adapt to the impacts of climate change. It is being implemented by countries through their (Intended) Nationally Determined Contributions ((I)NDC) (Decision 1/CP.21, UNFCCC, 2016). The agreement recognizes “the importance of ensuring the integrity of all ecosystems, including oceans, and the protection of biodiversity, (...) when taking action to address climate change” (Annex, UNFCCC, 2016, p.21), and further appeals for actions to “building the resilience of socioeconomic and ecological systems, including through economic diversification and sustainable management of natural

resources” (Article 7, paragraph 9, UNFCCC, 2016, p.25). This highlights the high potential of SLM, EbA and Eco-DRR to support countries in developing their (I)NDC.

The links between climate change, biodiversity, DLDD and sustainable development have furthermore been recognized by the Rio Conventions and their Joint Liaison Group¹⁵, which highlights the NAP (UNCCD and UNFCCC) and the NBSAP (CBD), as well as the different ecosystem-based approaches as important instruments for synergistic actions.

In summary, the previously presented global and national targets, frameworks, strategies and conventions are related to at least one of the specific goals achieved through the approaches. Most of them build links to other specific goals, to the ultimate goal of sustainable development as well as reference each other, particularly the SDGs which accommodate each of the specific goals of SLM, EbA and Eco-DRR through their targets.

15 To learn more see: <https://www.unccd.int/convention/about-convention/unccd-cbd-and-unfccc-joint-liaison-group>

4. Similarities and differences between SLM, EbA and Eco-DRR

Based on the findings previously elaborated and in accordance with Objective II of this report, the similarities and differences of SLM, EbA and EcoDRR are consolidated in a conceptual framework (Figure 1, p. 53).

In addition to the categories previously mentioned, the conceptual framework includes challenges and drivers addressed through each approach. The categories “specific assessment” and “M&E” as well as their characteristics for each approach have been derived from the key steps. The overarching boxes highlight the similarities between the approaches in a horizontal line.

Challenges

The challenges which the approaches address are displayed at the top of the framework and were derived from the literature reviewed in relation to SLM, EbA and Eco-DRR, such as Hurni (1997), Liniger, and others (2011), Renaud, and others (2013), Sanz, and others (2017), SCBD (2009), SCBD (2019), Sudmeier-Rieux, and others (2019) and the World Bank (2008b). The challenges include food insecurity, water scarcity, threatened livelihoods and economic opportunities, effects on human health, climate change, disaster risk, decline in natural capital and loss of biodiversity and ecosystem services.

Figure 1: Conceptual framework of similarities and differences of SLM, EbA and Eco-DRR.

Drivers and approaches

The challenges can be caused by and interconnect with certain drivers, namely DLDD, current and future climate-related impacts and natural hazards, including geological, hydrological, biological and climatic hazards. According to their specific goals, the approaches are designed to address these drivers, thus motivating their implementation. Through addressing these drivers, the approaches also address the challenges mentioned. Furthermore, the drivers are highly interconnected, which is demonstrated through their overlap in the framework. For example, ecosystem and land degradation is a key driver of disaster risk (IUCN, 2017), and vice versa. Further, climate-related impacts contribute to a large extent to natural hazards (Faivre, and others, 2017). Therefore, the implementation of each approach contributes to the specific goals of the other approaches, and they are essentially connected in terms of drivers and challenges addressed.

Specific assessment

For the assessment process of projects under each approach, different factors are considered. The implementation of SLM is motivated to combat DLDD and follows the arrow below SLM. The land degradation assessment focuses on vegetation, soil, water resources and livelihoods (Biancalani, and others, 2011; Bunning, and others, 2011). EbA is designed to address current and future climate-related impacts. Following the arrow below EbA, it includes the assessment of climate projections, vulnerability and adaptive capacity of the local communities (Doswald and Estrella, 2015; FEBA, 2017; Sudmeier-Rieux, and others, 2019). Eco-DRR is designed to reduce disaster risk from natural hazards, including geological, hydrological, biological and climatic ones, which is why the arrow below Eco-DRR is pointed towards DRR. It requires a risk assessment based on

the key components of risk, namely hazard, exposure and vulnerability (Sudmeier-Rieux, and others, 2019).

Measures

Despite the differences in terms of drivers and specific goals, all approaches are similar through their measures which encompass the conservation, sustainable use and restoration of land. Furthermore, measures of all three approaches include or can include SLM technologies.

Implementation characteristics

This category shows the design and implementation of the measures under each approach and includes important similarities, as presented in Table 9 (p. 41), including their people-centred nature, their transdisciplinarity, the focus on equity and inclusion and the integration of traditional and indigenous environmental knowledge and practices, among others.

This category also shows the main differences between them, mainly due to the specific goals of the approaches (Table 7, p. 38). Thus, measures under SLM are applied in order to avoid, reduce and reverse land degradation; measures under EbA are directed towards to avoid, minimize and address climate risks; and measures under Eco-DRR are chosen to prepare for, protect against, respond to and recover from natural hazards.

Co-benefits

Despite the different specific goals, the approaches are similar in terms of the many common co-benefits which SLM, EbA and Eco-DRR can produce (see Table 11, p. 45-46). As all measures are ecosystem-based and include the conservation, sustainable use and restoration of land, the same co-benefits as additional outcomes can be generated by all approaches, depending on the context and the measures implemented. Therefore, one approach can contribute to the achievement of the specific goals of the other two approaches (represented as the small curved arrows in Figure 1, p. 53).

Specific goals and M&E

According to the specific goals and against a baseline assessment, progress will be monitored and evaluated. Therefore, the progress of projects for each approach to achieve certain specific goals will be monitored and evaluated based on the factors mentioned in the category “Specific assessment”. The specific goal which all the approaches have in common is the support of biodiversity, land-based ecosystems and ecosystem services and functions. The specific goal of SLM is to combat DLDD, the specific goal of EbA is CCA and the specific goal of Eco-DRR is DRR.

Global and national targets, frameworks, strategies and conventions to report to

The global and national targets, frameworks, strategies and conventions which are relevant for the specific goals of SLM, EbA and Eco-DRR include the UNFCCC NAP and (I)NDC, the CBD NBSAP, the UNCCD NAP, the Ramsar Convention on Wetlands, the SFDRR and the SDGs. They are grouped

according to their correspondence with the specific goals. Therefore, the UNCCD NAP and the voluntary LDN Targets are below SLM due to their focus on the SLM specific goal to combat DLDD. Similarly, the UNFCCC NAP and (I)NDC are below EbA due to their links to CCA, and the SFDRR is below Eco-DRR due to its link to DRR. The CBD NBSAP and the Ramsar Convention on Wetlands are placed in between, as they encourage both the application of EbA and Eco-DRR, as well as to preserve and enhance biodiversity, which is a benefit delivered through all approaches due to the specific goal to support biodiversity. The SDGs are grouped below as they encompass all three specific goals equally through their targets, as well as correspond with the other global and national targets, frameworks, strategies and conventions.

The surrounding box with the headline “Multi-target approach” highlights the fact that most of the global and national targets, frameworks and strategies build links to multiple specific goals, in the ultimate goal of sustainable development as well as referencing one another.

Ultimate goal

The ultimate goal which all three approaches have in common and which they aim to achieve through their specific goals is sustainable development (see Table 7, p. 38), placed as overarching all approaches. Therefore, through the co-benefits delivered, each approach can contribute beyond its specific goal to sustainable development.

5. Demonstrating opportunities for multi-target contributions based on three selected SLM technologies

Through three selected case studies, the following chapter illustrates how a particular measure (or SLM technology) contributes to all specific goals by generating multiple co-benefits regardless of the approach driving its implementation. Based on what is documented in the case study publications, each section of the chapter starts with an overview of the major challenges and drivers in the case study context, followed by a general description of the implemented measure. After this, information about on how measures can contribute to each specific goal (combat DLDD/LDN, CCA and DRR) is presented by mentioning the particular co-benefits generated for the respective goal, the specific assessments performed in the project and its outcome. In addition, an analysis of the opportunities to leverage multiple national and international targets was included by applying the conceptual framework developed above. This analysis shows how it is possible to simultaneously report contributions to different goals if additional resources are available to account for the co-benefits and monitor the outcomes of the SLM technologies presented.

By describing these three case studies, it is intended to demonstrate how the conceptual framework reflects the reality of the projects during their implementation and supports the main idea that one measure (or SLM technology) delivers multiple co-benefits that can be accounted for in the different strategies.

5.1. Rehabilitation of degraded grasslands by using Integrated Crop-Livestock Management in the Ethiopian humid highlands

Setting the context

The combined effect between natural and anthropogenic factors has extremely degraded the humid highlands of

Ethiopia (Liniger, and others, 2011). With several lands irreversibly degraded, the remaining productive lands have been under enormous pressure due to agricultural and pastoral overuse (Amsalu and Addisu, 2014; Gebremedhin, and others, 2010; Liniger, and others, 2011), as well as high-intense precipitations followed by long dry periods (Gebremedhin, and others, 2010; Mekonen, and others, 2020). In consequence, Ethiopian humid highlands have been overgrazed and soils compacted, depleted from nutrients, eroded by water and decreased in fertility, which altogether led to a significant reduction in agricultural production (Gebremedhin, and others, 2004; Liniger, and others, 2011). In addition, the livelihoods of thousands of people in rural communities are endangered due to the permanent threat of flooding, water siltation, and landslides (Gebremedhin, and others, 2010; Liniger, and others, 2011), increasing fire outbreaks and droughts on agricultural and pastoral lands in the recent years (Gebremedhin, and others, 2010; Mekonen, and others, 2020; Yigzaw and Abitew, 2019). This situation has caused massive migration of farmers and pastoral communities to urban areas in search of a better quality of life and options for survival (Yigzaw and Abitew, 2019).

Figure 2: Multiple co-benefits generated by Grazing Land Improvement measures in Ethiopia.

Implemented measures

Integrated Crop-Livestock Management is an SLM technology group consisting of various measures that use waste products from one system as an input for the other, optimizing the use of land resources (Liniger, and others, 2011). Crop residues are supplementary feed for livestock, and manure is an organic fertilizer for soil enhancement with the aim to improve crop production (Liniger, and others, 2011).

Figure 2 (p.60) summarizes the co-benefits that were retrieved from the implementation of grazing land improvement measures in the Ethiopian Humid Highlands and illustrates how these measures can contribute to multiple specific goals and targets. It presents the set of co-benefits generated by rehabilitated and healthier grasslands, and how they contribute directly to each of the specific goals by achieving specific outcomes. It also highlights the relationship between the measurement of specific outcomes and their potential contribution to multiple global and national targets, through particular baseline assessments and their respective M&E systems. This will be explained in more detail in the following sub-sections.

Contribution to LDN and DLDD targets

In order to rehabilitate land, stabilize gullies and recover its productivity, Ethiopian communities implemented Integrated Crop-Livestock Management (ICLM) (Gebremedhin, and others 2010; Liniger, and others, 2011). Through a land suitability assessment and mapping, which is a method of land evaluation consisting of identifying the most appropriate land use according to land qualities and the requirements of different uses of land (FAO, 1976), degraded grasslands in the Ethiopian humid highlands were converted from extensive grazing areas

to a highly productive silvo-pastoral system (Liniger, and others, 2011; Mekuria and Aynekulu, 2011).

Besides control of land degradation, rural communities in the humid highlands of Ethiopia chose grazing land improvement to enhance fodder and livestock production (Liniger, and others, 2011; Mekasha, and others, 2015; Pantuliano and Wekesa, 2008). Complementary to grazing land improvement, small-scale farmers implemented other ICLM measures such as rotational land use (fallow), mixed cropping, water harvesting, multi-purpose shrubs and trees, haymaking, selective cutting, enclosure (fencing), stall-feeding, mix seeding (grass, alfalfa, clovers, among others), apiculture and grazing rules for communal grasslands (Gebremedhin, Pender and Tesfay, 2004; Gebremedhin, and others, 2010; Liniger, and others, 2011; Mekasha, and others, 2015; Mekura and Aynekulu, 2011). As a result, land users have been able to control soil erosion by water, avoid decrease in land fertility, improve crop production, increase soil biological activity and resources (organic matter, nutrients), enhance water retention, improve carbon sequestration and alleviate poverty (Liniger, and others, 2011). Other co-benefits were also obtained, for example improvement in groundwater recharge, revegetation of hillsides and slopes, maintenance and improvement of food security and fair communal resource management (Gebremedhin, and others, 2010; Gebremedhin, Pender and Tesfay, 2004; Liniger, and others, 2011).

All those co-benefits mentioned above are directly linked to Strategic Objectives 1, 2 and 3¹⁶, of the UNCCD 2018–2030 Strategic Framework (UNCCD, 2017b) and their respective indicators, at the same time supporting the accomplishment of

16 **Strategic Objective 1:** To improve the conditions of affected ecosystems and indicators: SO 1-1 Trends in land cover, SO 1-2 Trends in land productivity or functioning of land and SO 1-3 Trends in carbon stocks above and below ground; **Strategic Objective 2:** To improve the living conditions of affected population and indicators: SO2-1 Trends in population living below the relative poverty line and/or income inequality in affected areas and SO2-2 Trends in access to safe drinking water in affected areas; **Strategic Objective 3:** To mitigate, adapt, and manage the effects of drought in order to enhance resilience of vulnerable population and ecosystems, Monitored through qualitative information (UNCCD, 2017b, p.24).

multiple targets¹⁷ from the Ethiopian NBSAP 2015–2020. However, to effectively report results to that Strategic Framework and Plan, it is necessary to count on the respective baseline study and a targeted M&E system that quantitatively captures the progress achieved in the different indicators.

Contribution to CCA targets

As a result of improving grazing lands, rural communities from the Ethiopian humid highlands strengthened resilience and local adaptive capacity (Liniger, and others, 2011). ICLM systems tackled ongoing risks and other future climate change impacts by analysing how climate variability and change may increase the vulnerability of small-scale farmers (Gebrehiwot, and others, 2011; Mekonen, and others, 2020). ICLM systems in Ethiopian grasslands have been primarily used to address extreme droughts, which is considered the main climate-related threat for the country (Gebrehiwot, and others, 2011; Mekonen, and others, 2020; Pantuliano and Wekesa, 2008), but at the same time, to protect land from other climate-related effects such as intensive rainfalls, extreme storms and rising temperatures (Liniger, and others, 2011). Through the provision of a well-adapted system to climate variability, ICLM systems recovered, secured, supported and diversified livelihoods from highly land-dependent rural communities (Gebremedhin, and others, 2010; Liniger, and others, 2011). Additional co-benefits were generated, such as prevention of massive internal migration and social conflicts (Cortés Ferrández, 2017; Yigzaw and Abitew, 2019); poverty alleviation due to stabilization of product prices and income generation (Gebremedhin, Pen der and Tesfay, 2004); and social connectedness (Mudida, 2019). The co-benefits mentioned above could be accounted for targets included in the NAPA and the NAP (UNFCCC), which are directly linked to the progress of SDG 13, specifically Target 13.1 on strengthening resilience and adaptive capacity to climate-related disasters (UN, 2017; Wiseman, 2016).

17 Targets 4, 5, 6, 10 and 14 of the Ethiopian NBSAP 2015–2020 (more information in: <https://www.cbd.int/doc/world/et/et-nbsap-oth-en.pdf>)

Nevertheless, to report the progress in this SDG target, it would be necessary to also include indicators within the baseline study and M&E system that can quantify benefits and progress in CCA.

Contribution to DRR targets

ICLM systems work as a buffer to prolonged dry periods through increasing water availability (Liniger, and others, 2011). Spatial and temporal drought risk assessment (Gebrehiwot, and others, 2011; Mekonen, and others, 2020), drought early warning systems and contingency action plans (Pantuliano and Wekesa, 2008) and establishment of community DRR committees (Cortés Ferrández, 2017) complemented the ICLM systems, contributing significantly to reducing disaster risks in place. Besides reducing drought risks, the implemented ICLM system in Ethiopia contributed to avoid, reduce and control risks related to failed crop production, outbreaks of pests in crops and animal diseases, as well as invasion of alien weeds (Liniger, and others, 2011; Mekasha, and others, 2015). Furthermore, ICLM systems reduced the likelihood of wildfires, downstream flooding and landslides (Gebremedhin, and others, 2010; Liniger, and others, 2011).

In this perspective, the contribution of this SLM technology can directly address Targets (b) and (c) of the Sendai framework¹⁸ and could support the progress of its global goal¹⁹ by expanding baseline studies to other types of risks (e.g. wildfires, floods and landslides) and the respective indicators for their monitoring (i.e. hazards, exposure and vulnerability).

18 Targets of the SFDRR (UNDRR, 2015): Target (b) “Substantially reduce the number of affected people globally by 2030, aiming to lower the average global figure per 100,000 in the decade 2020–2030 compared to the period 2005–2015”; and Target (c) “Reduce direct disaster economic loss in relation to global gross domestic product (GDP) by 2030”.

19 “The substantial reduction of disaster risk and losses in lives, livelihoods and health and in the economic, physical, social, cultural and environmental assets of persons, businesses, communities and countries” (UNDRR, 2015).

5.2. Mangrove afforestation: Experience of Bangladesh

Setting the Context

The coastal zone of Bangladesh contains around 2.85 million hectares of cultivable land and provides livelihoods, sustenance and shelter for around 46 million people (Golam and Colin, 2013). With an extremely high population density and generalized poverty, Bangladesh is one of the most vulnerable countries to climate change impacts and natural hazards (Eckstein, and others, 2019; Hasan and Alam, 2008; Islam, and others, 2010; Zimmermann, and others, 2010). Due to its geographical location, the Bangladeshi littoral zone is inherently exposed to many natural hazards (Zimmermann, and others, 2010) such as floods (monsoon, flash, coastal and

pluvial), tropical cyclones, storm surges, intense rainfalls, sea level rise, saline water intrusion, heavy coastal erosion and shoreline encroachment (Golam and Colin, 2013; Hasan and Alam, 2008; Islam, and others, 2010; Nandy, and others 2013; Nicholls, and others, 2007; Saroar, 2018; Zimmermann, and others, 2010). In the last two decades, Bangladesh has been one of the countries most affected by climate change (Eckstein, and others, 2019). Human activities have accelerated land degradation processes, especially in agricultural lands, exacerbating existing risks and inducing new ones (Hasan and Alam, 2008; Islam, and others, 2010). Natural factors such as droughts, storms and tidal changes, and human activities such as land transformation, deforestation, urbanization and intensive agriculture contribute significantly to the loss of productive areas (Golam and Colin, 2013; Hasan and Alam, 2008; Islam, and others, 2010). Due to the continuing threat of coastal-related hazards, land degradation processes and loss of livelihoods, several communities have been forced to leave their homes (Ahmad, 2012).

Figure 3: Multiple co-benefits generated by Mangrove Afforestation measures in Bangladesh.

Implemented measure

Afforestation is an SLM technology that recovers lands through plantations where there were no forests before (Liniger, and others, 2011; Sanz, and others, 2017). Planted forests complement and mutually reinforce the production of natural forests' ecosystem services, contributing to ecological sustainability (Liniger, and others, 2011). Because of the improvements in biomass accumulation, soil organic carbon sequestration, biological activity, ecosystem biodiversity and nutrient cycling, afforestation has been used for reclaiming and rehabilitating degraded lands (Liniger, and others, 2011; Sanz, and others, 2017). Since native species are introduced and mixed at different spatial scales, planted forests can act as carbon sinks, sources of food, fuelwood, wooden and non-wooden products, and poverty alleviators by providing employment and generating stable incomes (Liniger, and others, 2011; Sanz, and others, 2017).

Figure 3 (p.64) summarizes the co-benefits, outcomes, assessments, direct and potential contributions of implementing mangrove afforestation in the context of Bangladesh. Further elaboration on those contributions is presented in the following sub-sections.

Contribution to CCA

To address climate change impacts and to increase social and ecological resilience, Bangladeshi communities and governments have historically used the natural capacity of mangrove forests to buffer climate change impacts as a long-term and cost-effective solution (Ahmad, 2012; Saroar, 2018).

While adapting to future sea level rise, mangrove afforestation measures in Bangladesh have reduced vulnerability to climate change in coastal communities at the same time as improved

resilience by restoring the provision of ecosystem services, enhancing ecological connectivity between existing mangrove forests, salt marshes, estuaries, rivers, creeks and inner lands, (Earp, and others, 2018; Macintosh, and others, 2012), creating new options of income generation (e.g. ecotourism), and diversifying livelihoods (Nandy and Ahammad, 2012; Nandy, and others, 2013; Saroar, 2018). From the analysis of future climate scenarios, the “Community-based Adaptation to Climate Change through Coastal Afforestation” project recognized new opportunities for Bangladeshi coastal communities, in which flood- and salinity-resistant varieties of fruits, rice and vegetables were incorporated in agricultural practices as well as aquaculture activities (e.g. shrimp, fish and crab production) were introduced, under the name of FFF (forest, fish and fruit) model (Ahmad, 2012; Saroar, 2018; WOCAT, 2019b).

Those interventions of the coastal afforestation programme were intentionally designed to ensure long-term sustainability of climate change responses while supporting food security, poverty alleviation, ecosystem functioning and biodiversity (Nandy, and others, 2013; Saroar, 2018), which could be accounted for the pillars 1 (food security, social protection and health) and 2 (comprehensive disaster management) of the Bangladesh Climate Change Strategy and Action Plan 2009 (MoEF, 2009) and to different strategies²⁰ described in Bangladesh NBSAP 2004–2016.

Contribution to combat DLDD and LDN Targets

Mangrove afforestation in Bangladesh also served to increase land productivity and to address underlying biophysical and socioeconomic causes of land degradation. Projects from the Bangladesh Forest Department have strategically used

mangrove afforestation to reduce coastal erosion, avoid soil salinization, reduce agricultural pressures on existing ecosystems, and converted accreted lands and coastal embankments into highly productive integrated fish farming systems (Ahmad, 2012; Nandy and Ahammad, 2012; WOCAT, 2019b).

By using planted mangroves as a “bioshield”, mangrove afforestation projects in Bangladesh have contributed to controlling coastal erosion, stabilizing deposited sediments and protecting inner productive lands from saline water intrusion (Ahmad, 2012; Nandy and Ahammad, 2012; UNDP, 2011). In parallel, mangrove afforestation projects have contributed to increase land productivity and food security by sustainably integrating livestock, forestry, fishery and agriculture (Nandy and Ahammad, 2012; WOCAT, 2019b). Sustainable increases in yields and in the production of food, timber and non-timber materials in coastal areas were achieved by conducting a land suitability assessment to properly plan current and future land uses and land resources (Ahmad, 2012; Nandy and Ahammad, 2012; Nandy, and others, 2013).

In this sense, mangrove afforestation as an SLM technology also leverages LDN targets and combats DLDD. These contributions could be properly quantified by an M&E system that takes into account indicators related to the Strategic Objectives 1, 2 and 4²¹ of the UNCCD 2018–2030 Strategic Framework (UNCCD, 2017b).

Contribution to DRR targets

The Bangladesh Coastal Afforestation Program used the buffer capacity of mangroves to protect agricultural activities in inner croplands, avoid damage in infrastructure and human settlements, and safeguard the integrity of inhabitants from extreme events and other natural phenomena such as cyclones, tidal surges, seasonal storms, flash floods, saline intrusion and other coastal hazards (Saroar, 2018). With the aim to protect lives, livelihoods and ecosystems, and to reduce economic losses resulting from exposure to natural hazards (Zimmerman, and others, 2010), mangrove afforestation was complemented with DRR actions and practices such as risk assessments, flood forecasting models, cyclone preparedness programmes, early warning systems, hazard monitoring and response and recovery action plans (Saroar, 2018).

In the context of the Sendai Framework for Disaster Risk Reduction (2015–2030) (UNDRR, 2015), mangroves are considered and can be reported as critical green infrastructure, which provide basic regulating services relevant for DRR, and can be monitored by indicators of Target (D)²² (Walz, and others, 2021) as well as accounted for the pillar 2²³ of the Bangladesh Climate Change Strategy and Action Plan- 2009. This shows the need for more robust M&E systems in the types of projects that can measure the progress made in reducing multiple risks.

21 “**Strategic Objective 1:** To improve the conditions of affected ecosystems” and indicators: “SO 1-1 Trends in land cover”, “SO 1-2 Trends in land productivity or functioning of land” and “SO 1-3 Trends in carbon stocks above and below ground”; “**Strategic Objective 2:** To improve the living conditions of affected population” and indicators: “SO2-1 Trends in population living below the relative poverty line and/or income inequality in affected areas” and “SO2-2 Trends in access to safe drinking water in affected areas”; “**Strategic Objective 4:** To generate global environmental benefits through effective implementation of the UNCCD” with the indicators: “SO 4-1 Trends in carbon stocks above and below ground” and “SO 4-2 Trends in abundance and distribution of selected species” (UNCCD, 2017b, p.24).

22 “Substantially reduce disaster damage to critical infrastructure and disruption of basic services, among them health and educational facilities, including through developing their resilience by 2030” (UNDRR, 2015, p. 12).

23 Pillar 2: Comprehensive disaster management. To learn more see: https://www.iucn.org/downloads/bangladesh_climate_change_strategy_and_action_plan_2009.pdf

5.3. Rehabilitation of degraded pasturelands for slope stabilization and drought risk reduction in Rio de Janeiro, Brazil

Setting the context

The Itaocara region in the state of Rio de Janeiro, Brazil, is characterized by moderately- and strongly-inclined slopes within a dominant pastoral landscape, where poor rural families are highly dependent on dairy farming (Seliger, and others, 2019). Recurrent landslides, mudslides and flooding disasters in the last years have caused considerable human and economic losses as well as severe damages to infrastructure

(Lange, and others, 2019; Seliger, and others, 2019). Disaster risks and local vulnerability to natural hazards and climatic extreme events have increased due to an extreme land degradation process, consisting of forest fragmentation, accelerated soil erosion, soil compaction, melioration of wetlands, channelization, river incisions, overgrazing, prolonged uncovered soil exposure and geomorphological modification (da Silva, and others, 2019; Lange, and others, 2019; Nehren, and others, 2019; Seliger, and others, 2019). In recent years, active processes of desertification and droughts have reduced land productivity and fertility in the northwest part of the state of Rio de Janeiro (da Silva, and others, 2019). Periods of water scarcity and droughts in Itaocara are becoming increasingly frequent and intense due to overuse of water resources for agricultural processes, poor water management and deforestation (Nehren, and others, 2019). Unsustainable management of pasturelands combined with the erosive effect of strong precipitation have destabilized steep slopes and accelerated landslide dynamics in hillsides (Nehren, and

Figure 4: Multiple co-benefits generated by revegetation, slope terracing and rotational grazing measures in the Itaocara region, in Brazil.

others, 2019; Seliger, and others, 2019). Climate projections predict that those hazards and other extreme events will continue to threaten rural communities in Rio de Janeiro state (Nehren, and others, 2019).

Implemented measures

In this case, three SLM technologies were implemented. The first one was cross-slope barriers consisting of vegetative strips, live hedges, contouring and slope terracing to control soil erosion (Liniger, and others, 2011; Sattler, and others, 2018). The second one consists of grazing land rehabilitation by revegetating with grass and native shrubs. This technology includes measures such as assisting green cover regeneration through introducing grass species, seeding and planting native shrubs and legumes, fencing and maintenance of the vegetative protective cover (Liniger, and others, 2011; Sanz, and others, 2017; Sattler, and others, 2018). The third one was grazing pressure management mainly through rotational grazing. This SLM technology consists of managing livestock density and its timing and frequency of grazing based on the land's carrying capacity (Sanz, and others, 2017).

Figure 4 (p. 68) compiles the main points presented in a pilot project for degraded pasture lands rehabilitation in Brazil. It compiles the co-benefits, assessment, direct and potential contributions of the implemented SLM technologies according to the framework explained in Chapter 4 (p. 52). The following sub-sections explain the case study in more detail.

Contribution to DRR targets

In order to reduce disaster risk in the Itaocara’s rural communities and to assure their livelihoods, the Integrated Eco Technologies and Services for a Sustainable Rural Rio de

Janeiro (INTECRAL) pilot project rehabilitated and stabilized slopes prone to landslides, erosion and droughts through revegetation and terracing (Lange, and others, 2019; Seliger, and others, 2019). Different activities were undertaken focusing on broad risk management. Studies on gravitational mass movements and floods susceptibility mapping, a landslide risk map (vulnerability, susceptibility and aptness for urbanization), floods susceptibility, hazard and risk mapping, and flood risk assessment, conducted by The State Civil Defense, the Environmental State Institute and the Environmental State Department of Mineral Resources were used as inputs to plan for the prevention, mitigation, preparedness, response and recovery actions for landslide hazards (Frank, and others, 2019). Moreover, an analysis of extreme drought events based on the evolution of total reservoir storage in the river basin were used to recommend actions to improve water security in the State (Ribbe, and others, 2019).

Aiming to control soil erosion, stabilize slopes and to continue having dairy cattle as a main source of income, the following activities were implemented in the pilot project: slope terracing using ox-plough, soil amelioration, grass seeding (*Brachiaria* sp.) on bare soils, parceling with hedgerows of native shrubs and trees, construction of palisades, gullies filled with brushes, drip irrigation, pest control, and extensive rotational grazing system (Sattler, and others, 2018; Seliger, and others, 2019). In parallel to those activities, local authorities carried out other DRR practices, for instance the creation of environmental protection areas and recovery of riverbank areas, hydro-meteorological monitoring and warning systems, early warning and response protocols and training programs for community-based risk monitoring (Frank, and others, 2019).

As a result of that, the INTECRAL project regained slope stability, reestablished ecosystem services, reduced the degradation of pasturelands and improved farmers’ income (Seliger, and others, 2019). Co-benefits that – if quantified – could be directly linked to the attainment of different targets²⁴ included in the Brazilian NBSAP 2016–2020.

24 Targets 1, 5, 7, 14 and 19 of the Brazilian NBSAP 2016–2020. To learn more see: <https://www.cbd.int/doc/world/br/br-nbsap-v3-en.pdf>

Contribution to CCA targets

The INTECRAL pilot project in the Itaocara region contributed to reducing vulnerability to future climate-related hazards while strengthening the local farmers’ adaptive capacity (Seliger, and others, 2019). According to climate projections, it is expected that Southeast Brazil will face impacts such as intense precipitation, prolonged droughts, higher temperatures, landslides, floods, changes in agroclimatic zoning and rainfall distribution (Nehren, and others, 2019). Using this information, the INTECRAL project was able to improve climate resilience of rural families by regaining ecological stability, improving water retention, establishing protection against increasingly intensive rainfall events, providing habitat for biodiversity and supporting current traditional livelihoods (Seliger, and others, 2019). However, these measures can only be effective if they are scaled up from the pilot region to larger areas.

Co-benefits generated by the INTECRAL project are suitable to account for Goal 3.3²⁵ of the Brazil NAP 2016 if eventually scaled up to a landscape or regional scale.

Contribution to combat DLDD and LDN targets

To establish the pilot project of degraded pasturelands rehabilitation, three specific assessments were conducted: an initial multi-criteria site prioritization for land rehabilitation and a scenario development (Naegeli de Torres, and others, 2018), followed by a land evaluation of moderate degraded areas (Seliger, and others, 2019). By matching land quality with an appropriate land use (i.e. recovery and conservation) for the degraded slopes, notable enhancements on land productivity and carbon sequestration were achieved (da Silva, and others,

25 Goal 3.3: Preparation of Ecosystem-based Adaptation strategy measures in areas at risk of extreme events and other climate change impacts. To learn more see: <https://www4.unfccc.int/sites/NAPC/Documents/Parties/Brazil%20NAP%20English.pdf>

2019). The change of land use from hillside grazing lands to a more suitable one, such as silvopastoral, established more resilient and sustainable livelihoods in the local communities (da Silva, and others, 2019; Nehren, and others, 2019).

These results from the pilot project can be considered directly in line with the three indicators of Strategic Objective 1²⁶ of the UNCCD 2018–2030 Strategic Framework. In the process of slope stabilization and pastureland rehabilitation, the set of interventions contributes to increase the organic matter on soil, enhance pasture productivity, improve soil fertility, reduce soil erosion forces and recover protective vegetation cover with grass and native trees, while reducing land degradation agents (livestock) and stressors (overgrazing) (Seliger, and others, 2019). However, comprehensive and long-term M&E systems are required to report such progress on the mentioned indicators.

26 “Strategic Objective 1: To improve the conditions of affected ecosystems” and indicators: “SO 1-1 Trends in land cover”, “SO 1-2 Trends in land productivity or functioning of land” and “SO 1-3 Trends in carbon stocks above and below ground” (UNCCD, 2017b, p.24).

6. Conclusion and recommendations

In support of the implementation of the request of the UNCCD parties in Decision 19/COP.14 paragraph 4, this report analyses and consolidates information and knowledge on specific characteristics, similarities and differences among the four approaches SLM, EbA, Eco-DRR and NbS, and the terminology used in those approaches. The analyses of official publications from UN entities, peer-reviewed scientific and grey literature showed that while the approaches SLM, EbA and Eco-DRR have very specific goals, NbS is a broader concept to address various environmental and social challenges. As a result of this, the report focuses its comparative analysis on the three approaches SLM, EbA and Eco-DRR, disclosing their similarities and differences.

The analyses revealed a lot of similarities between the three approaches: All three approaches use measures to conserve, restore and sustainably use land, and include SLM technologies. The implementation characteristics are similar in terms of multiple characteristics, such as their people-centred nature, their transdisciplinarity, their focus on equity and inclusion and the integration of traditional and indigenous environmental knowledge and practices, among others. Furthermore, despite having different specific goals, projects under each approach can generate the same co-benefits, especially due to their common specific goal to support biodiversity, land-based ecosystems and ecosystem services and functions. Due to the multiple similarities, projects of each approach can contribute to implementing the specific goals of the other approaches. Multiple global and national targets, frameworks, strategies

and conventions call for the implementation of one or several of these approaches, which have at the same time a high potential to report progress on multiple targets due to the contribution of multiple co-benefits. In particular, the SDGs provide important agreed goals for practitioners of projects on SLM, EbA and Eco-DRR due to their common and ultimate goal of sustainable development.

The differences between the three approaches are mainly driven by their specific goals (to combat DLDD for SLM, CCA for EbA and DRR for Eco-DRR), and how these specific goals guide the respective assessments to establish the baseline for monitoring and evaluation. A conceptual framework (Figure 1, p. 53) illustrates the similarities and differences for the different categories analysed.

Three case studies using SLM technologies and measures have been selected to demonstrate opportunities for leveraging multiple co-benefits and achieving multiple targets at the implementation level. By presenting different types of measures (or SLM technologies), it was demonstrated how multiple co-benefits are generated regardless of the approach that drives their implementation. In addition, the detailed analysis of these case studies also show the actual contribution of the respective measures to the specific goals of combatting DLDD, CCA and DRR in three different contexts. Also, the case studies pointed out that the three approaches have common practices among them, and the projects frequently combine specific assessments to maximize their impacts. In addition, it was shown that, on the one hand, particular drivers and challenges were addressed, and on the other hand, other drivers and challenges were simultaneously tackled by additional co-benefits generated. Furthermore, the three case studies highlighted the existing need to conduct specific assessments and establish more robust, long-term and multi-target M&E frameworks. In this way, the progress made through the various co-benefits can be quantified and reported

to the different global and national frameworks to contribute to their targets.

The findings presented in this report demonstrate that activities under one approach can be beneficial to achieve the specific goals of other approaches with little additional effort. This needs to be recognized to facilitate collaboration between different stakeholders and to achieve greater effectiveness and impact to implement the Rio Conventions as well as other national and international frameworks and agreements. To maximize efficiency and comprehensiveness of projects in achieving their goals and for practitioners to report the multiple co-benefits delivered, it is recommended to expand the specific assessment of one approach through intentionally incorporating and considering the specific goals and assessment of the others. While this may require additional resources during the project planning phase to assess and monitor other identified risks and environmental and social conditions, the return on this investment is clear. Facilitating this would require adjustments to the specific financing windows donors have created that target specific areas of work. It also will require that national plans and strategies provide entry points for more effectively capitalizing on the areas of alignment among all of these approaches. These institutional adjustments can facilitate the efforts of practitioners to simultaneously address multiple goals and targets of international agreements, which will help countries reduce duplication of efforts and optimize the overall investments needed to meet the important environmental challenges of our time.

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