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SYNTHESIS REPORT ON EXPERIENCES WITH ECOSYSTEM-BASED APPROACHES TO CLIMATE CHANGE ADAPTATION AND DISASTER RISK REDUCTION

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Synthesis Report on Experiences with Ecosystem-Based Approaches to Climate Change Adaptation and Disaster Risk Reduction

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FOREWORD

According to the Intergovernmental Panel on Climate Change, changes in the climate and extreme weather are unprecedented. Further warming and climate change is expected due to continued greenhouse gas emissions, causing devastating impacts to human and natural systems. While concerted efforts for a substantial reduction in greenhouse gas emissions is crucial, societies also need develop ways and means to adapt to the unavoidable consequences of climate change. In fact, the Paris Agreement establishes a global goal to significantly strengthen national adaptation efforts, enhance adaptive capacity, strengthen resilience and reduce vulnerability to climate change.

Biodiversity and ecosystem services have been recognized as an integral part of climate change adaptation and disaster risk reduction strategies as they can deliver benefits that increase people's resilience to the impacts of climate change. In fact, the second Ad Hoc Technical Expert Group on Biodiversity and Climate Change of the Convention on Biological Diversity defined ecosystem-based approaches to climate change adaptation as the use of biodiversity and ecosystem services as part of an overall adaptation strategy to help people adapt to the adverse effects of climate change.

Ecosystem-based approaches to climate change adaptation and disaster risk reduction also provide multiple benefits beyond adaptation and reducing disaster risk. For example, the restoration and conservation of coastal vegetated ecosystems, such as mangroves for protection from storm surges, contributes to the enhancement of carbon sequestration, opportunities for community engagement and improvement of livelihoods, by maintaining the ecosystem services that provide clean water, food and fiber.

Ecosystem-based adaptation is a key approach contributing to the achievement of the Strategic Plan for Biodiversity 2011–2020, particularly Target 15, which aims, by 2020, to enhance ecosystem resilience and the contribution of biodiversity to carbon stocks, through conservation and restoration, including restoration of at least 15 per cent of degraded ecosystems, thereby contributing to climate change mitigation and adaptation and to combating desertification. In addition, ecosystem-based approaches to disaster risk reduction have been supported in the international policy arena in various ways, including through the Sendai Framework for Disaster Risk Reduction 2015-2030.

In decision X/33, the Conference of the Parties recognized that ecosystems can be managed to limit climate change impacts on biodiversity and to help people adapt to the adverse effects of climate change and invited Parties and other Governments to implement, where appropriate, ecosystem-based approaches for adaptation.

In decision XII/20, the Conference of the Parties requested the Executive Secretary to compile experiences with ecosystem-based approaches to climate change adaptation and disaster risk reduction. Pursuant to this request, the present report was prepared to provide a synthesis of experiences with ecosystem-based approaches to climate change adaptation and disaster risk reduction, and an analysis of challenges, lessons learned and opportunities related to their design and implementation.

While support for ecosystem-based approaches is growing, more information is still needed to inform international, regional and national policies, as well as sub-national and local policies. I believe that this report makes an important contribution to enhancing knowledge in this field and I hope that it will assist Parties, policy-makers and practitioners.

Braulio Ferreira de Souza Dias
Executive Secretary
Convention on Biological Diversity

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GLOSSARY AND ACRONYMS

Name	Acronym	DEFINITION/DESCRIPTION AND SOURCE
Adaptation		In human systems, the process of adjustment to actual or expected climate and its effects, in order to moderate harm or exploit beneficial opportunities. In natural systems, the process of adjustment to actual climate and its effects; human intervention may facilitate adjustment to expected climate (Intergovernmental Panel on Climate Change).
Adaptive capacity		The combination of the strengths, attributes, and resources available to an individual, community, society, or organization that can be used to prepare for and undertake actions to reduce adverse impacts, moderate harm, or exploit beneficial opportunities (Intergovernmental Panel on Climate Change) Builds the capacity of people to adapt to climate change impacts through maintaining and enhancing their asset/capital sets, addressing entitlements, encouraging innovation, giving greater access to information, establishing flexible governance/decision-making, related to biodiversity and ecosystem services (IUCN)
Agroforestry		The practice of integrating trees into agriculturally productive landscapes (World Agroforestry Centre)
Capacity		The combination of all the strengths, attributes, and resources available to an individual, community, society, or organization, which can be used to achieve established goals (Intergovernmental Panel on Climate Change)
Climate change		A change in the state of the climate that can be identified (e.g., by using statistical tests) by changes in the mean and/or the variability of its properties and that persists for an extended period, typically decades or longer. Climate change may be due to natural internal processes or external forcings, or to persistent anthropogenic changes in the composition of the atmosphere or in land use (Intergovernmental Panel on Climate Change)
Climate change adaptation	**CCA**	The process of adjustment to actual or expected climate and its effects. In human systems, adaptation seeks to moderate harm or exploit beneficial opportunities. In natural systems, human intervention may facilitate adjustment to expected climate and its effects (Intergovernmental Panel on Climate Change)
Climate extreme		The occurrence of a value of a weather or climate variable above (or below) a threshold value near the upper (or lower) ends of the range of observed values of the variable. For simplicity, both extreme weather events and extreme climate events are referred to collectively as "climate extremes." (Intergovernmental Panel on Climate Change)
Climate risk management	**CRM**	An integrated approach that advances climate-sensitive decision-making. It focuses on development outcomes that are dependent on climatic conditions, such as in agriculture, water resources, food security, health, the environment, urbanism and livelihoods (United Nations Development Programme)
Climate-smart agriculture	**CSA**	CSA contributes to the achievement of sustainable development goals. It integrates the three dimensions of sustainable development (economic, social and environmental) by jointly addressing food security and climate challenges. It is composed of three main pillars: 1) sustainably increasing agricultural productivity and incomes; 2) adapting and building resilience to climate change; 3) reducing and/or removing greenhouse gases emissions, where possible (Food and Agriculture Organization of the United Nations).
Community-based adaptation	**CBA**	A community-led process, based on communities' priorities, needs, knowledge and capacities, which should empower people to plan for and cope with the impacts of climate change (International Institute for Environment and Development)
Community-based natural resource and risk management	**CBNRM**	An approach that combines the sustainable management of natural resources and risks in a given area. It combines the concept of "co-management" of natural resources with community-based disaster risk reduction.
Desertification		Defined as land degradation in drylands, leading to a condition of significantly reduced fertility and water holding capacity. Desertification is a reversible condition of the earth's surface, as opposed to aridity, which is a climatic condition (United Nations Convention to Combat Desertification)

Name	Acronym	DEFINITION/DESCRIPTION AND SOURCE
Disaster		A serious disruption of the functioning of a community or a society involving widespread human, material, economic or environmental losses and impacts, which exceeds the ability of the affected community or society to cope using its own resources (The United Nations Office for Disaster Risk Reduction (UNISDR)) Severe alterations in the normal functioning of a community or a society due to hazardous physical events interacting with vulnerable social conditions, leading to widespread adverse human, material, economic, or environmental effects that require immediate emergency response to satisfy critical human needs and that may require external support for recovery (Intergovernmental Panel on Climate Change)
Disaster risk		The likelihood over a specified time period of severe alterations in the normal functioning of a community or a society due to hazardous physical events interacting with vulnerable social conditions, leading to widespread adverse human, material, economic, or environmental effects that require immediate emergency response to satisfy critical human needs and that may require external support for recover (Intergovernmental Panel on Climate Change)
Disaster risk management	**DRM**	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 (Intergovernmental Panel on Climate Change)
Disaster risk reduction	**DRR**	Denotes both a policy goal or objective, and the strategic and instrumental measures employed for anticipating future disaster risk; reducing existing exposure, hazard, or vulnerability; and improving resilience (Intergovernmental Panel on Climate Change) The concept and practice of reducing disaster risks through systematic efforts to analyse and manage the causal factors of disasters, including through reduced exposure to hazards, lessened vulnerability of people and property, wise management of land and the environment, and improved preparedness for adverse events (UNISDR 2009)
Drought		A period of abnormally dry weather long enough to cause a serious hydrological imbalance. Drought is a relative term, therefore any discussion in terms of precipitation deficit must refer to the particular precipitation-related activity that is under discussion. For example, shortage of precipitation during the growing season impinges on crop production or ecosystem function in general (also termed agricultural drought), and during the runoff and percolation season primarily affects water supplies (hydrological drought). A megadrought is a very lengthy and pervasive drought, lasting much longer than normal, usually a decade or more. (Intergovernmental Panel on Climate Change)
Ecosystem approach		Strategy for the integrated management of land, water and living resources that promotes conservation and sustainable use in an equitable way (Convention on Biological Diversity)
Ecosystem-based adaptation	**EbA**	Incorporates biodiversity and ecosystem services into an overall adaptation strategy to help people to adapt to the adverse effects of climate change (Convention on Biological Diversity) Uses biodiversity and ecosystem services as part of an overall adaptation strategy to help people and communities adapt to the negative effects of climate change at local, national, regional and global levels (United Nations Environment Programme) Any initiative that reduces human vulnerabilities and enhances adaptive capacity in the context of existing or projected climate variability and changes through sustainable management, conservation and restoration of ecosystems (IUCN)
Ecosystem-based disaster risk reduction	**Eco-DRR**	Sustainable management, conservation and restoration of ecosystems to reduce disaster risk, with the aim to achieve sustainable and resilient development (Estrella and Saalismaa 2013) Decision-making activities that take into consideration current and future human livelihood needs and bio-physical requirements of ecosystems, and recognize the role of ecosystems in supporting communities to prepare for, cope with and recover from disaster situations. Sustainable ecosystem management for disaster risk reduction is based on equitable stakeholder involvement in land management decisions, land-use-trade-offs and long-term goal setting. (IUCN)

Name	Acronym	DEFINITION/DESCRIPTION AND SOURCE
Ecosystem services		The benefits people obtain from ecosystems, which have been classified by the Millennium Ecosystem Assessment as: *Supporting* services, such as seed dispersal and soil formation; *regulating* services, such as carbon sequestration, climate regulation, water regulation and filtration, and pest control; *provisioning* services, such as supply of food, fibre, timber and water; and *cultural* services, such as recreational experiences, education and spiritual enrichment (Millennium Ecosystem Assessment 2005)
Exposure		The presence of people; livelihoods; species or ecosystems, environmental services and resources; infrastructure; or economic, social, or cultural assets in places that could be adversely affected (Intergovernmental Panel on Climate Change)
Extreme weather		See "Climate extreme"
Famine		Scarcity of food over an extended period and over a large geographical area, such as a country. Famines may be triggered by extreme climate events such as drought or floods, but can also be caused by disease, war, or other factors (Intergovernmental Panel on Climate Change)
Flood		The overflowing of the normal confines of a stream or other body of water, or the accumulation of water over areas that are not normally submerged. Floods include river (fluvial) floods, flash floods, urban floods, pluvial floods, sewer floods, coastal floods, and glacial lake outburst floods (Intergovernmental Panel on Climate Change)
Food security		Occurs when all people, at all times, have physical and economic access to sufficient, safe and nutritious food to meet their dietary needs and food preference for an active and healthy life (Food and Agriculture Organization of the United Nations). Household level food security is complex, trans-boundary and multifaceted including biophysical, socio-economic, political, demographic, gender and other dimensions. In general, three key indicators are used to measure the level of food insecurity, namely: availability, access and utilization (United Nations Convention to Combat Desertification)
Gender mainstreaming		Gender mainstreaming is a globally recognized strategy for making women's as well as men's concerns and experiences an integral dimension of the design, implementation, monitoring, and evaluation of policies and programmes in all political, economic, and societal spheres. This is to ensure that women and men benefit equally from processes of development, and that inequality is not perpetuated.
Green infrastructure	**GI**	Green infrastructure a strategically planned network of natural and semi-natural areas with other environmental features designed and managed to deliver a wide range of ecosystem services. It incorporates green spaces (or blue if aquatic ecosystems are concerned) and other physical features in terrestrial (including coastal) and marine areas. On land, green infrastructure is present in rural and urban settings. (European Commission)
Hazard		The potential occurrence of a natural or human-induced physical event that may cause loss of life, injury, or other health impacts, as well as damage and loss to property, infrastructure, livelihoods, service provision, and environmental resources (Intergovernmental Panel on Climate Change) A climate hazard is an event caused by climate change or caused by natural variability in weather with the potential to cause harm, such as heavy rainfall, drought, a storm, or long-term change in climate variables such as temperature and precipitation (World Wildlife Fund) A potentially damaging physical event, phenomenon or human activity that may cause the loss of life or injury, property damage, social and economic disruption or environmental degradation. Hazards can include latent conditions that may represent future threats and can have different origins: natural (geological, hydrometeorological and biological) or induced by human processes (environmental degradation and technological hazards). (Hyogo Framework)
Impacts		Effects on natural and human systems. In this report, the term "impacts" is used to refer to the effects on natural and human systems of physical events, of disasters, and of climate change (Intergovernmental Panel on Climate Change)
Integrated water resource management	**IWRM**	A process that promotes the coordinated development and management of water, land and related resources in order to maximize the resultant economic and social welfare in an equitable manner without compromising the sustainability of vital ecosystems (Gobal Water Partnership)

Name	Acronym	DEFINITION/DESCRIPTION AND SOURCE
Landslide		A mass of material that has moved downhill by gravity, often assisted by water when the material is saturated. The movement of soil, rock, or debris down a slope can occur rapidly, or may involve slow, gradual failure. (Intergovernmental Panel on Climate Change)
Least developed country	**LDC**	A country that exhibits the lowest indicators of socioeconomic development, with the lowest Human Development Index ratings of all countries in the world.
Low-regrets adaptation options		Low-regrets adaptation options are those actions that could potentially deliver net socioeconomic benefits to local communities and ecosystems whatever the extent of future climate change. The low-regrets approach is an important part of EbA and focuses on maximizing positive and minimizing negative aspects of nature-based adaptation strategies and options. (definition adapted from a joint UNEP-UNDP-IUCN working definition of "no-regrets" adaptation)
Maladaptation		An action or process that increases vulnerability to climate change-related hazards. Maladaptive actions and processes often include planned development policies and measures that deliver short-term gains or economic benefits but lead to exacerbated vulnerability in the medium to long-term (United Nations development Programme). Maladaptation can also include trade-offs or benefitting one group at the expense of another.
Mitigation (of climate change)		A human intervention to reduce the sources or enhance the sinks of greenhouse gases (Intergovernmental Panel on Climate Change)
Mitigation (of disaster risk and disaster)		The lessening of the potential adverse impacts of physical hazards (including those that are human-induced) through actions that reduce hazard, exposure, and vulnerability (Intergovernmental Panel on Climate Change).
Multi-criteria analysis	**MCA**	A structured approach used to determine overall preferences among different alternative options, where the options accomplish several objectives that may not always complement one another. In MCA, desired objectives are specified and corresponding attributes or indicators are identified. The measurement of these indicators is often based on a quantitative analysis (through scoring, ranking, and weighting) of a wide range of qualitative impact categories and criteria.
Nairobi work programme (UNFCCC)	**NWP**	A mechanism under the United Nations Framework Convention on Climate Change to facilitate and catalyse the development and dissemination of information and knowledge that would inform and support adaptation policies and practices. Its implementation has been coordinated by the Subsidiary Body for Scientific and Technological Advice (SBSTA), under the guidance of the Chair of the SBSTA and with assistance from the secretariat, and with contributions from Parties and other adaptation stakeholders. Through its diverse range of modalities, the Nairobi work programme provides unique opportunities for linking relevant institutions, processes, resources and expertise outside the Convention to respond to adaptation knowledge needs arising from the implementation of the various workstreams under the Convention and identified by Parties.
National adaptation plan (UNFCCC)	**NAP**	Established under the Cancun Adaptation Framework, the NAP provides Parties to the United Nations Framework Convention on Climate Change with the means of identifying medium- and long-term adaptation needs and developing and implementing strategies and programmes to address those needs.
National adaptation programme of action (UNFCCC)	**NAPA**	Provide a process under the United Nations Framework Convention on Climate Change for least developed countries (LDCs) to identify priority activities that respond to their urgent and immediate needs to adapt to climate change – those for which further delay would increase vulnerability and/or costs at a later stage.
National biodiversity strategy and action plan (CBD)	**NBSAP**	The principal instruments for implementing the Convention on Biological Diversity at the national level (Article 6). The Convention requires countries to prepare a national biodiversity strategy and action plan (or equivalent instrument) and to ensure that this strategy is mainstreamed into the planning and activities of all those sectors whose activities can have an impact (positive and negative) on biodiversity.
National report (CBD)	**NR**	National reports provide information on measures taken for the implementation of the Convention on Biological Diversity, and their effectiveness. Parties submitted their fifth national reports in response to decision X/10 of the Conference of the Parties (COP) to the CBD.

Name	Acronym	DEFINITION/DESCRIPTION AND SOURCE
Resilience		The ability of a system and its component parts to anticipate, absorb, accommodate, or recover from the effects of a hazardous event in a timely and efficient manner, including through ensuring the preservation, restoration, or improvement of its essential basic structures and functions (Intergovernmental Panel on Climate Change) The ability of a system, community or society exposed to hazards to resist, absorb, accommodate to and recover from the effects of a hazard in a timely and efficient manner, including through the preservation and restoration of its essential basic structures and functions (The United Nations Office for Disaster Risk Reduction) Theoretical advances in recent years include a set of principles that have been identified for building resilience and sustaining ecosystem services in social-ecological systems. The principles include maintaining diversity and redundancy, managing connectivity, managing slow variables and feedbacks, fostering complex adaptive systems thinking, encouraging learning, broadening participation, and promoting polycentric governance systems (Biggs et al. 2012).
Spatial planning		Spatial planning is a broad term that describes systematic and coordinated efforts to manage urban and regional growth in ways that promote well-defined societal objectives such as land conservation, economic development, carbon sequestration, and social justice (IPCC).
Storm surge		The temporary increase, at a particular locality, in the height of the sea due to extreme meteorological conditions (low atmospheric pressure and/or strong winds). The storm surge is defined as being the excess above the level expected from the tidal variation alone at that time and place. (Intergovernmental Panel on Climate Change)
Sustainable land and water management	**SLWM**	The adoption of land use systems that, through appropriate management practices, enables land users to maximize the economic and social benefits from the land while maintaining or enhancing the ecological support functions of the land resources. SLWM includes management of soil, water, vegetation and animal resources. It involves a holistic approach that integrates social, economic, physical and biological assets. SLWM encompass other approaches such as integrated natural resource management, integrated water resource management, eco-agriculture and sustainable forest management (SFM), and many facets of sustainable agriculture, agriculture (GEF 2011).
Synergies		Linking processes in a way that increases the effects of the sum of the joint activities beyond the sum of individual activities, and thus making efforts more effective and efficient
Vulnerability		The propensity or predisposition to be adversely affected. Vulnerability encompasses a variety of concepts including sensitivity or susceptibility to harm and lack of capacity to cope and adapt (Intergovernmental Panel on Climate Change) A function of the character, magnitude, and rate of climate variation to which a system is exposed, its sensitivity, and its adaptive capacity. In EbA the ecosystems and their vulnerabilities are included in the analysis together with the vulnerability of communities (WWF 2013). The characteristics and circumstances of a community, system or asset that make it susceptible to the damaging effects of a hazard (The United Nations Office for Disaster Risk Reduction)

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KEY MESSAGES

This report is a review and synthesis of global experiences on ecosystem-based approaches to climate change adaptation (EbA) and to disaster risk reduction (Eco-DRR). The report includes key findings from the CBD technical workshop on EbA and Eco-DRR, held in Sandton, Johannesburg, South Africa, from 28 September to 2 October 2016. The workshop was attended by experts and practitioners from a wide range of countries and organizations, who shared and discussed experiences on national and regional efforts to implement EbA and Eco-DRR measures. In this section, key findings of the report and workshop are presented.

WHAT ARE EBA AND ECO-DRR?

1. Ecosystem-based adaptation (EbA) is the use of biodiversity and ecosystem services as part of an overall adaptation strategy to help people adapt to the adverse effects of climate change. EbA aims to maintain and increase the resilience and reduce the vulnerability of people and the ecosystems they rely upon in the face of the adverse effects of climate change. The ecosystem-based approach has been recognized as an important strategy for disaster risk reduction (Eco-DRR), defined as "sustainable management, conservation and restoration of ecosystems to reduce disaster risk, with the aim to achieve sustainable and resilient development".

2. EbA and Eco-DRR enable people to adapt to the impacts of climate change and disasters by using opportunities created by sustainably managing, conserving and restoring ecosystems to provide ecosystem goods and services. EbA and Eco-DRR further aim to maintain and increase resilience and reduce vulnerability of ecosystems and people to adverse effects of climate change, and should therefore be integrated into broader adaptation and development strategies.

3. EbA and Eco-DRR overlap in practice, and both build upon and use approaches that already exist in the practices of biodiversity and ecosystem conservation, climate change adaptation and livelihood development. Examples include implementing forest and grasslands conservation to protect communities and settlements from erosion and sandstorms, or integrating vegetation into urban spaces such as in green walls and green roofs, to reduce the urban heat island effect and improve air quality.

WHY USE EBA AND ECO-DRR?

4. EbA and Eco-DRR can deliver multiple benefits beyond adaptation and reducing disaster risk. Examples include the restoration and conservation of coastal vegetated ecosystems such as mangroves for protection from storm surges, which also enhances carbon sequestration as well as community engagement and livelihood opportunities. Many other examples and case studies are provided in this report.

5. Other benefits include the potential cost-effectiveness of EbA and Eco-DRR approaches, and their contribution to sustainable livelihoods by maintaining the ecosystem services that provide clean water, food and fibre; supporting poverty reduction; heritage conservation; and preservation of local identities.

6. Quantifying the economic benefits of EbA and Eco-DRR may be difficult given the nascent implementation stage of programmes and activities, and given that non-monetary benefits, such as cultural, spiritual, research or educational benefits, can be difficult to quantify. However, economic valuation has been shown in several cases to effectively demonstrate costs and benefits of EbA and Eco-DRR measures, and should be part of a suite of measures and incentives to encourage the implementation of ecosystem-based approaches when appropriate.

7. Costs and benefits may also not be distributed equally among stakeholders or sectors of society, creating incentives for some to implement EbA, but not for others. Methodologies for understanding how the benefits and costs of EbA are distributed are therefore essential for evaluating EbA benefits.

8. Communicating the benefits of EbA and Eco-DRR requires a planned, systematic approach to understanding the interests of stakeholders and beneficiaries, and approaches need to be tailor-made to the local context, culture and traditions.

TRADE-OFFS AND THRESHOLDS OF EBA AND ECO-DRR

9. The consideration of trade-offs or unintended consequences when implementing EbA and Eco-DRR should be present throughout the risk assessment, scenario planning, and adaptive management approaches for EbA and Eco-DRR implementation. In addition to monitoring the short-term provisions of services, managers should also monitor the long-term evolution of slowly changing variables.

10. There may be limitations to using ecosystem-based approaches for adaptation to climate change or disaster risk reduction. Ecosystems are subject to climate change impacts, and therefore ecosystem-based approaches can also be vulnerable to climate change. EbA and Eco-DRR should also be considered within overall integrated adaptation or disaster risk reduction (DRR) strategies.

IMPLEMENTING, MONITORING AND EVALUATION

11. Project implementation can be hampered by different understandings of concepts and different values regarding ecosystems and biodiversity. In achieving adaptation and DRR objectives, it is important to be tolerant and flexible with different terminologies, and strive for maximum implementation on the ground.

12. Increased engagement is needed between the scientific and development communities, and project executors, in developing and implementing EbA and Eco-DRR policies and activities, making use of available guidance to ensure optimal and appropriate use of ecosystems for adaptation and DRR.

13. Eco-DRR and EbA are cross-disciplinary fields and require effective engagement and coordination of multiple stakeholders such as engineers, academics, local and indigenous communities, civil society and the private sector. EbA and Eco-DRR would benefit from effective mechanisms for promoting co-production of knowledge between stakeholders and channeling this knowledge into decision-making.

14. Guidelines on implementing EbA and Eco-DRR at the local and sectoral levels can aid in the increased use of ecosystem-based approaches and effective implementation of policy.

Assessing Vulnerabilities, Impacts, Hazards & Risks

15. EbA and Eco-DRR options should be selected and implemented based on guidance from vulnerability assessments that take into consideration the underlying drivers of change, existing policies, and community perceptions. For example, drivers of vulnerabilities may include limited access to land or land tenure, poor land-use planning, and unsustainable practices by communities and land users.

16. Limits to be EbA and Eco-DRR must be recognized in addressing adaptation and disaster risk reduction. Ecosystems can only support adaptation if they maintain functionality under a changing climate; thus it is important to analyse potential vulnerabilities of the EbA options themselves to climate change impacts.

17. In promoting adaptation to climate change, it is important to consider unifying frameworks and concepts that recognize the linkages between people and ecosystems as integrated socioecological systems, rather than viewing adaptation through only a social or human lens.

18. Care is needed to avoid conflating two strongly and closely related processes: 1) the identification of vulnerable ecosystems which need to be protected and managed for biodiversity conservation; and 2) the identification

of ecosystems, whether they are vulnerable or not, that can support people as they adapt – in the latter case, it is important to also assess people's vulnerability to climate change.

Integrating EbA and Eco-DRR into Planning and Policy

19. The international policy arena supports and promotes ecosystem-based approaches to adaptation and disaster risk reduction, including the Sustainable Development Goals (SDGs) recently adopted by the UN General Assembly. The SDGs include making cities inclusive, safe, resilient to disasters and sustainable (SDG 11), taking urgent action to combat climate change and its impacts (SDG 13), conserve and sustainably use oceans, seas and marine resources for sustainable development (SDG 14), and sustainably manage forests, combat desertification, halt and reverse land degradation, and halt biodiversity loss (SDG 15), in addition to a number of other proposed goals related to sustainable development, poverty reduction, biodiversity conservation and sustainable use.

20. EbA and Eco-DRR can be scaled up through effective mainstreaming into policy and practice. This needs to take place at multiple levels of policymaking, planning, programming, budgeting, and implementation. Embedding EbA and Eco-DRR into all relevant sectors, ministries and national plans can provide an enabling framework and direct funding towards implementation.

21. Mainstreaming of EbA and Eco-DRR is most effective when top-down and bottom-up approaches converge. It is important to engage indigenous peoples and local communities as well as practitioners in policymaking processes, and ensure that knowledge, lessons and experience feed into policymaking processes.

22. Many countries have mainstreamed EbA and Eco-DRR into national plans, strategies and targets, including national biodiversity strategies and action plans (NBSAPs) under the Convention on Biological Diversity (CBD), national adaptation programmes of action (NAPAs) under the United Nations Framework Convention on Climate Change (UNFCCC), disaster management plans, development policy, and drought relief policy. Case studies of mainstreaming EbA and Eco-DRR through these national plans, strategies and targets are provided in this report.

23. Institutional arrangements and structures to enhance coordination across sectors are critical. EbA and Eco-DRR are cross-sectoral and therefore can be best led by a government body that has coordinating powers over sectoral ministries.

24. Capacity-building for Eco-DRR/EbA for different stakeholders at different levels is needed in order to support mainstreaming efforts. Awareness among national and sectoral policymakers and decision makers could be further enhanced, and technical skills need to be developed in many countries to enable more effective implementation of Eco-DRR and EbA approaches.

Synergies and Cooperation

25. Conserving, restoring and sustainably managing ecosystems can deliver on a number of national, regional and international development priorities and obligations, including enhancing people's resilience to climate change and disasters, supporting biodiversity, and protecting food, water and livelihood security, especially of vulnerable populations.

26. Cooperation among ecosystems/biodiversity, adaptation, development and disaster reduction communities results in a greater ability to design interventions that deliver multiple benefits.

27. Strong coordination between focal points for multilateral environmental agreements (MEAs) such as the Ramsar Convention, United Nations Convention to Combat Desertification (UNCCD), UNFCCC, and CBD can help to ensure synergies between MEAs are harnessed.

28. Knowledge-sharing should be scaled up at the local, national, regional and global levels between and across different disciplines, and there should be continued use of knowledge-sharing platforms such as the Nairobi work programme under the UNFCCC, or the Paris Committee on Capacity-building established at the twenty-first session of the Conference of the Parties to UNFCCC (UNFCCC COP21).

29. Designing interventions for multiple benefits can be supported by creating space and incentives for collaboration and dialogue about trade-offs, establishing political commitment to integrated approaches, clarifying roles and responsibilities of various institutions, and encouraging financial support to integrated action.

Monitoring and Evaluation

30. Monitoring and evaluation are important policy instruments that can enable review of policies and plans based on progress made and challenges encountered. It is important to consider both risk-informed decision-making and opportunity-informed decision-making.

31. A variety of innovative tools for monitoring and evaluation have been developed; for example, the CBD and the Biodiversity Indicator Partnership have developed a series of factsheets and potential indicators to assist with national implementation of activities.

Opportunities and Entry-points for EbA and Eco-DRR Implementation

32. Coastal vegetation restoration and conservation can provide carbon sequestration benefits, being important opportunities for implementation of EbA and Eco-DRR.

33. Disasters can provide an opportunity to "build back better", and to incorporate opportunities provided by nature and ecosystems to reduce disaster risk, such as mangrove conservation initiatives.

34. Opportunities to cooperate with the private sector exist and can be enhanced, such as through initiatives that engage the insurance sector in providing support for policy reform, land-use planning, capacity-building and technology transfer.

35. Multidisciplinary collaborations to enhance health and conservation initiatives can provide impetus for implementation of EbA and Eco-DRR measures to contribute to increasing resilience of communities in terms of health and well-being.

CONTRIBUTION OF INDIGENOUS PEOPLES AND LOCAL COMMUNITIES

36. Indigenous peoples and local communities (IPLCs) have long managed variability, uncertainty and change through multigenerational histories of interaction with the environment.

37. Traditional knowledge is an important part of the ecosystem approach, can complement science, and bridge gaps in information. Indigenous, traditional and local knowledge systems – and forms of analysis and documentation such as community mapping – can play a significant role in identifying and monitoring climatic, weather and biodiversity changes and impending natural hazards, similar to early warning systems.

38. Effective EbA and Eco-DRR should consider the kind of support that communities need for adaptation and DRR (e.g. through needs assessments). Taking into account the differentiated needs of indigenous peoples and local communities (IPLCs) is necessary since interventions that do not consider needs, roles, aspirations, etc. can be detrimental to IPLCs' livelihoods and cultures. Processes should ensure prior and informed consent and government and other institutional support, including resource mobilization, promotion for community-led initiatives, and respect for local forms of governance.

39. Further awareness and protocols are needed regarding the processes of consultation and community engagement throughout all steps of the project, including inception and planning. Involving communities creates ownership of processes that in turn can ensure the sustainability of the project in the long run.

GENDER MAINSTREAMING

40. Different genders use and value ecosystems differently, which is an essential consideration for EbA and Eco-DRR activities, when assessing vulnerabilities to climate change, and associated risks.

41. Gender mainstreaming should thus be a significant aspect of adaptation and disaster risk reduction planning and implementation processes in order to ensure success and sustainability of policies, programmes and projects.

42. The inclusion of all segments of society – men, women, children, minorities and ethnic groups – is important at all stages of decision-making.

43. There is a need for capacity-building to understand gender issues for effective implementation of EbA and Eco-DRR initiatives, for monitoring and evaluation of the impacts of gender mainstreaming, and for associated budgeting/resource mobilization for these activities.

BACKGROUND AND MANDATE

Climate change is a recognized threat to the well-being and livelihoods of humans and ecosystems across the globe. Climate change also leads to increases in climate hazards and in the vulnerability of communities to natural hazards, thus increasing disaster risk. Among projected changes in climate and weather, models project substantial warming in temperature extremes by the end of the 21st century, and it is likely that the frequency of heavy precipitation will increase in the 21st century over many areas of the globe (IPCC 2012). It is reported with high confidence that increasing exposure of people and economic assets has been the major cause of long-term increases in economic losses from weather- and climate-related disasters (IPCC 2012).

Policymakers are increasingly calling for an ecosystem-based approach to climate change adaptation (EbA), which "incorporates biodiversity and ecosystem services into an overall adaptation strategy to help people to adapt to the adverse effects of climate change" (SCBD 2009). More recently, the ecosystem-based approach has been recognized as an important strategy for disaster risk reduction (Eco-DRR), defined as "sustainable management, conservation and restoration of ecosystems to reduce disaster risk, with the aim to achieve sustainable and resilient development" (Estrella and Saalismaa 2013).

Healthy and functional ecosystems help reduce climate change vulnerability and disaster risk by:

a) Reducing physical exposure to hazards by serving as protective barriers or buffers and so mitigating hazard impacts, including in wetlands, forests and coastal ecosystems; and

b) Reducing socioeconomic vulnerability to hazard impacts: In addition to protective and hazard regulatory functions of ecosystems, they also sustain human livelihoods and provide essential goods such as food, fibre, medicines and construction materials, which strengthen people's resilience to disasters.

While advocacy for EbA and Eco-DRR is increasing, more information is needed to inform international, regional and national policymaking, including examples of implementation of EbA and of Eco-DRR within broader strategies, examples of their joint implementation, linkages and synergies, and policy issues. In decision XII/20, the Conference of the Parties (COP) to the Convention on Biological Diversity (CBD) requested the Executive Secretary to compile experiences with ecosystem-based approaches to climate change adaptation (EbA) and disaster risk reduction (DRR) and to share them through the clearing-house mechanism (paragraph 7 (c)).

This report responds to decision XII/20 of the Conference of the Parties, and aims to address the knowledge gaps in EbA and Eco-DRR in the following ways:

a) Compiling country experiences, activities and targets related to EbA and Eco-DRR through a review of fifth national reports to the Convention, national biodiversity strategies and action plans (NBSAPs), projects supported by the Global Environment Facility (GEF), other information submitted by Parties and organizations, input received at the CBD technical workshop on EbA and Eco-DRR (Sandton, South Africa, 28 September – 2 October 2015), as well as relevant academic literature and publications;

b) Providing an analysis and synthesis of information on EbA, and on Eco-DRR, bringing together research, theory and practice in the fields of EbA and Eco-DRR. Via case studies from the compilation and a broader literature review, this report presents examples of how both EbA and Eco-DRR are being addressed nationally, regionally and globally, drawing from a wide variety of contexts (environment, conservation, humanitarian and rural and urban development). Challenges in implementation and lessons learned, opportunities for synergies, and areas for further research are discussed.

Much of this work draws on information from several comprehensive studies, compilations, frameworks and syntheses of EbA and Eco-DRR experiences. These include Birkman and von Teichman 2010, Doswald and Estrella 2014, proceedings of the UNFCCC EbA technical workshop held in 2013 in Dar es Salaam, Tanzania (UNFCCC 2013), an Eco-DRR case study compendium (Nehren et al. 2014) and other sources that are referenced throughout

and in the "References" section. This report seeks to complement these studies with information reported by Parties to the CBD in submissions and in their fifth national reports, and by compiling information from other projects/databases of key organizations.

In addition to EbA and Eco-DRR, several related approaches share the same underlying rationale of working with nature for people. These include green infrastructure (GI), nature-based solutions, natural water retention measures, ecological infrastructure, ecosystem infrastructure, natural infrastructure, or building with nature. These terms have often evolved independently in different policy fields.

This report was developed with the input and guidance of a technical reference group, involving experts and practitioners from the following organizations: BirdLife International, Conservation International, the Convention on the Conservation of Migratory Species (CMS), the Food and Agriculture Organization of the United Nations (FAO), the International Union for the Conservation of Nature (IUCN), the Ramsar Convention, the Nature Conservancy (TNC), the United Nations Development Programme (UNDP), the United Nations Environment Programme (UNEP), the United Nations Framework Convention on Climate Change (UNFCCC), the United Nations Office for Disaster Risk Reduction (UNISDR), the World Meteorological Organization (WMO), and the World Wildlife Fund (WWF).

The intended audience for this report is Parties to the CBD, to UNFCCC and UNCCD, and to other biodiversity-related conventions; intergovernmental and international organizations; as well as planners, policymakers and practitioners.

1. INTRODUCTION

1.1 RESPONDING TO CLIMATE CHANGE

Climate change is a recognized threat to the well-being and livelihoods of humans and ecosystems across the globe. The impacts of climate change can be subtle or drastic, from the slowly shifting ranges of species to the destruction of property and livelihoods by increasingly frequent extreme weather events. The latest assessment of the Intergovernmental Panel on Climate Change (IPCC) indicates that observed changes in the climate system are unprecedented over decades to millennia – the atmosphere and ocean have warmed, the amounts of snow and ice have diminished, sea level has risen, and the increased concentrations of greenhouse gases are leading to ocean acidification (IPCC 2013).

The impacts and risks of climate change pose multiple challenges to the global sustainable development agenda. They impede progress on achieving sustainable development and can disproportionately affect vulnerable sectors of society and communities, particularly in least developed countries (LDCs) and small island developing States (SIDS) (Rio Conventions 2012). Livelihoods in many small island developing States depend on healthy coral reefs, which have the additional function of protecting coasts from storm surges and waves. However, ocean warming and ocean acidification exacerbate other pressures on corals, such as pollution, overexploitation and invasive species, and if current trends continue coral reefs may become one of the first unique ecosystems to reach an irreversible tipping point (IPCC 2013; Secretariat of the Convention on Biological Diversity 2014).

The establishment of the Rio Conventions[2] in 1992 at the Earth Summit marked a key milestone in global sustainable development through addressing biodiversity conservation and sustainable use, desertification, and climate change. Subsequent road maps for action carved out by Parties to the three conventions have set the stage for current and future national planning and implementation:

a) The Strategic Plan for Biodiversity 2011-2020 and the Aichi Biodiversity Targets, under the Convention on Biological Diversity (CBD), aim to halt the loss of biodiversity to ensure ecosystems are resilient and continue to provide essential services, thereby securing the planet's variety of life and contributing to human well-being and poverty eradication.

b) The ten-year strategy of the United Nations Convention to Combat Desertification 2008-2018 seek to reverse and prevent desertification/land degradation and to mitigate the effects of drought in affected areas in order to support poverty reduction and environmental sustainability.

c) The Cancun Adaptation Framework, adopted in 2010 as part of the Cancun Agreements, under the UN Framework Convention on Climate Change (UNFCCC), aims to enhance action on adaptation, reducing vulnerability and building resilience in developing country Parties, and taking into account the urgent and immediate needs of those developing countries that are particularly vulnerable.

The United Nations Conference on Sustainable Development in 2012 (Rio+20) marked the twentieth anniversary of the Rio Conventions. Governments renewed their commitment to sustainable development in the Rio+20 outcome document, "The Future We Want", and agreed to launch a process to establish sustainable development goals to be encompassed within the 2030 Agenda for Sustainable Development, building upon the Millennium Development Goals. The Sustainable Development Goals, adopted by the United Nations General Assembly in September 2015, include taking urgent action to combat climate change and its impacts (SDG 13), making cities inclusive, safe, resilient to disasters and sustainable (SDG 11), conserving and sustainably using oceans, seas and marine resources for sustainable development (SDG 14), sustainably managing forests, combating desertification,

2 Convention on Biological Diversity, United Nations Convention to Combat Desertification, and United Nations Framework Convention on Climate Change.

halting and reversing land degradation, and halting biodiversity loss (SDG 15), in addition to a number of other goals related to sustainable development, poverty reduction, biodiversity conservation and sustainable use.

1.2 THE CONTEXT FOR ECOSYSTEM-BASED ADAPTATION

There are various interpretations of EbA, but all share the rationale of working with nature, and most converge on the principle of sustainable management, conservation and restoration of ecosystems, as part of an overall adaptation strategy.

The Conference of the Parties to the CBD, in decision VII/15, in 2004, encouraged the management of ecosystems for climate change adaptation and mitigation; the term ecosystem-based adaptation was coined later.

The Second Ad Hoc Technical Expert Group on Biodiversity and Climate Change described ecosystem-based adaptation as

> "the use of biodiversity and ecosystem services as part of an overall adaptation strategy to help people to adapt to the adverse effects of climate change. . . . It 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. Ecosystem-based adaptation is most appropriately integrated into broader adaptation and development strategies" (SCBD 2009).

Ecosystem-based approaches for adaptation are encouraged in decision XII/20 of the Conference of the Parties to the CBD and are also referred to in other recent decisions X/33, XI/19, XI/21.

The concept of ecosystem-based adaptation (EbA) was first introduced into the UNFCCC negotiations at the fourteenth session of the Conference of the Parties (COP) to the UNFCCC in 2008. In 2010, the Cancun Adaptation Framework recognized the need to enhance the implementation of adaptation actions advocating an approach that includes transparency, stakeholder participation, gender sensitivity, consideration of vulnerable groups, communities and ecosystems, use of indigenous knowledge and the best available science, and integration of adaptation into relevant social, economic and environmental policies and plans (UNFCCC decision 1/CP.16).

Conservation practice is often considered to be EbA, with the rationale that conservation enhances resilience of ecosystems to climate change impacts. However, typical conservation practice, while providing other values and benefits such as increased biodiversity, differs from EbA. EbA specifically aims to reduce both current and future impacts of climate change, based on the identification or assessment of vulnerabilities of a social-ecological system that includes both people and ecosystems (WWF 2013). For example, a protected area that is created to save the habitat of a particular species would not be considered an EbA measure, since the motivation is the conservation of a species and not helping people adapt to the adverse impacts of climate change, whereas a protected area that conserves a wetland in order to mitigate flash floods that damage crops or property is an example of EbA.

EbA builds upon and uses approaches that already exist in the practices of biodiversity and ecosystem conservation, climate change adaptation and livelihood development. EbA draws from the related approaches of community-based natural resource management (CBNRM), community-based adaptation (CBA), and climate change-integrated conservation strategies (CLICS), but is unique in that it aims for the combined achievement of all three outcomes, as conceptualized in Figure 1 (Midgley et al. 2012).

Examples of EbA include restoration of floodplains for flood protection and water storage; greening of cities to counter the heat island effect; crop diversification with indigenous varieties that are resistant to climate change; creating protected areas to enhance ecosystem resilience and for continued provision of essential ecosystem services such as erosion control, beach stabilization and water retention; sustainable management of grasslands and rangelands to enhance pastoral livelihoods and increase resilience to climate-induced drought and flooding; or training activities to enhance knowledge of utilizing ecosystems to adapt to the impacts of climate change.

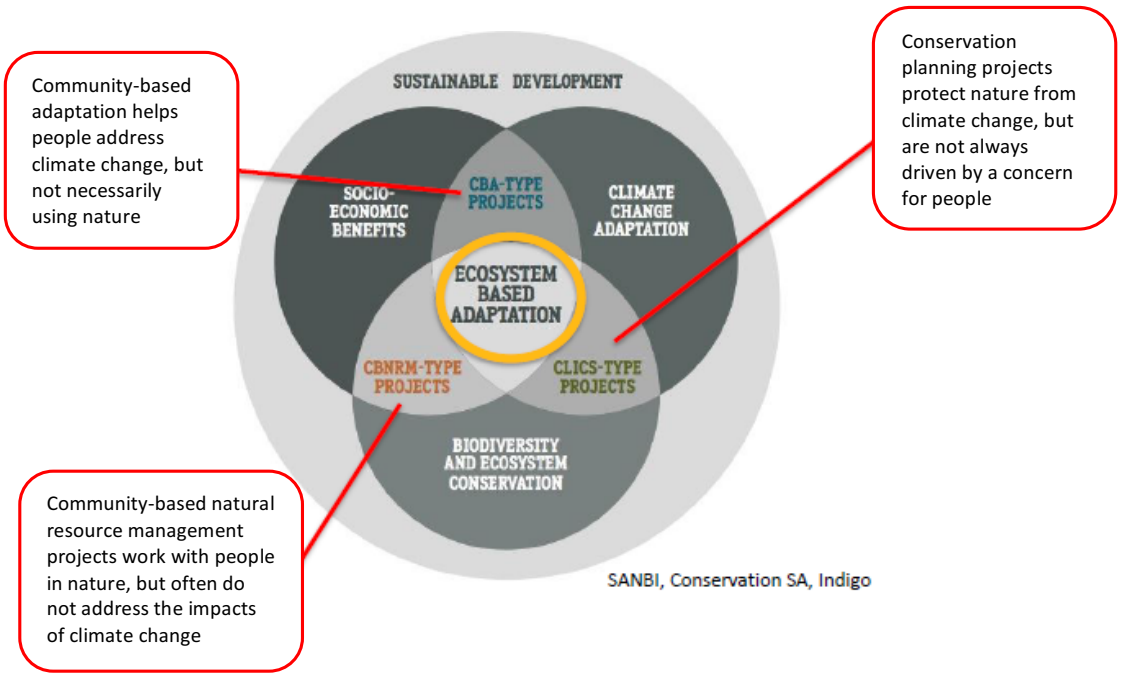


Figure 1: Linkages between EbA and other fields of practice within the overall context of sustainable development. EbA is shown as a three-way synergy between biodiversity and ecosystem conservation, climate change adaptation, and societal resilience (figure adapted from Midgley et al. 2012 and annotated by UNDP).

1.2.1 Multiple Benefits

EbA is gaining traction worldwide. Case studies and literature have demonstrated that EbA can be a flexible, cost-effective and broadly applicable approach for reducing the impacts of climate change (Munang et al. 2013). Some of the multiple benefits include:

a) Complementing more expensive infrastructure investments, such as prolonging the lifetime of engineered flood protection measures (Munang et al. 2013; Temmerman et al. 2013).

b) Providing adaptation and disaster risk reduction solutions that are consistent with national development and adaptation goals such as coastal protection, conservation of natural resources, sustainable development and social well-being (WWF 2013).

c) Contributing to climate change mitigation via: i) conservation or restoration of forests, coastal vegetation, or peatlands, which enhance carbon sequestration (Duarte et al. 2013), and ii) prevention of deforestation and land degradation, which aids in limiting further greenhouse gas emissions (Busch et al. 2015).

d) Engaging people and communities, helping to build trust and responsibility while maintaining livelihoods and providing potential business opportunities (Naumann et al. 2011).

Because EbA approaches have been demonstrated to deliver multiple benefits beyond climate change adaptation, such as poverty reduction, sustainable development, climate change mitigation, and disaster risk management, they have also been described as "win-win" or "no-regrets" adaptation strategies (IUCN 2014a). It is also described as "multifunctional" in the context of green infrastructure (discussed further below). However, as EbA interventions themselves are subject to climate change variability, and because there is always a possibility that a management intervention may have unintended or unforeseen impacts, the term "low regrets", rather than "no regrets", is used throughout this report.

Low-regrets EbA interventions minimize trade-offs and optimize benefits across many sectors to achieve multiple goals, including reducing vulnerability to climate change for people and nature, disaster risk reduction, sustainable development, biodiversity conservation and sustainable natural resource management.

1.3 THE CONTEXT FOR ECOSYSTEM-BASED DISASTER RISK REDUCTION

An additional challenge to sustainable development is the increasing risk of disasters resulting from climate change. Over the past 20 years, the increase in disasters due to natural hazards has mainly been caused by climate change (Birkmann and von Teichman 2010). Socioeconomic factors, in tandem with climate change, also increase disaster risk exposure – for example, risk increases as more people are located in hazard-prone locations such as coastal settlements (IPCC 2012). Population growth and urbanization are also factors that can increase vulnerability and exposure.

The International Strategy for Disaster Reduction (ISDR) was endorsed in 1999; its vision is to enable all communities to become resilient to the effects of natural, technological and environmental hazards, reducing the compound risks they pose to social and economic vulnerabilities within modern societies, and to proceed from protection against hazards to the management of risk through the integration of risk prevention into sustainable development.

The United Nations Office for Disaster Risk Reduction (UNISDR)[3] defines disaster risk reduction as the concept and practice of reducing disaster risks through systematic efforts to analyse and manage the causal factors of disasters, including through reduced exposure to hazards, lessened vulnerability of people and property, wise management of land and the environment, and improved preparedness for adverse events (UNISDR 2009).

The ecosystem-based approach has been recognized as an important strategy for disaster risk reduction. Ecosystem-based disaster risk reduction (Eco-DRR) is defined as "sustainable management, conservation and restoration of ecosystems to reduce disaster risk, with the aim to achieve sustainable and resilient development" (Estrella and Saalismaa 2013).

Examples of Eco-DRR include restoring coastal vegetated areas such as mangroves to protect shorelines from storm surges; managing invasive alien species linked to land degradation and that threaten food security and water supplies; and managing ecosystems to complement, protect and extend longevity of investments in hard infrastructure. Eco-DRR can be applied to non-climate hazards as well – coastal vegetation can in some contexts attenuate waves from tsunamis, and protection forests can stabilize slopes to prevent or mitigate landslides that might result from earthquakes.

Eco-DRR has been supported in the international policy arena in various ways:

a) The UNFCCC Cancun Adaptation Framework, adopted as part of the Cancun Agreements in 2010, and the Nairobi work programme on impacts, vulnerability and adaptation to climate change.

b) The IPCC Special Report on Extreme Events recommends investing in ecosystems, sustainable land management and ecosystem restoration and management (IPCC 2012).

c) The Sendai Framework for Disaster Risk Reduction 2015-2030, building on the Hyogo Framework for Action 2005-2015 and discussed further below (e.g., 3.2), outlines seven global targets to be achieved over the next 15 years, prioritizing "ecosystem-based approaches…to build resilience and reduce disaster risk".

3 The United Nations Office for Disaster Risk Reduction (UNISDR) is the secretariat of the International Strategy for Disaster Reduction (ISDR) (see https://www.unisdr.org/who-we-are).

d) Eco-DRR has also been endorsed in the outcomes of regional DRR platforms of Asia, Africa, Latin America and Arab states, and of the European Ministerial meeting on DRR.

Further examples of international policies, programmes, strategies and frameworks related to EbA and Eco-DRR are provided in section 3, on the policy and institutional context for EbA and Eco-DRR.

> "Applying ecosystem management for DRR and climate change adaptation is a **no-regret investment**. Sustainable ecosystems management impacts on all three fundamental elements of DRR: regulating hazards, controlling exposure and reducing vulnerability. Moreover, ecosystems provide multiple social, economic and environmental benefits – *regardless of whether a disaster materializes.*"
>
> —UNEP & PEDRR, General Assembly Thematic Debate on Disaster Risk Reduction, 2012

1.4 LINKAGES BETWEEN EBA AND ECO-DRR

In many cases, Eco-DRR activities are the same as EbA activities implemented to reduce disaster risk. Thus EbA can sometimes be considered an example of Eco-DRR, and *vice versa*. A recent review of commonalities and differences between EbA and Eco-DRR found that in practice, it is difficult to distinguish between the two – there are more commonalities than differences due to the basic shared underlying principle of utilizing the ecosystem approach and increasing the resilience of people and communities (Doswald and Estrella 2015).

Commonalities shared by both EbA and Eco-DRR include an emphasis on the ecosystem-based approach, and both often involve implementation with non-governmental organizations (NGOs), encourage participation of local communities, and involve assessment of vulnerabilities and risks(Doswald and Estrella 2015).

Participation of indigenous peoples and local communities is often promoted as a guiding principle of EbA and DRR implementation. The equivalent of community-based adaptation in disaster risk reduction is community-managed disaster risk reduction, an approach that can help communities identify the hazards they are exposed to and design effective measures to promote resilience to them (Fitzgibbon and Crosskey 2013).

Both EbA and Eco-DRR are relatively new approaches arising from broader adaptation and DRR practice, and both are in the early stages of developing assessment, monitoring and evaluation methodologies. In some countries and regions, policy frameworks that support EbA have been developed over the past several years.

Differences between EbA and Eco-DRR mirror those of general climate change adaptation and disaster risk reduction (DRR) activities. Differences include the following:

- EbA and Eco-DRR operate under different policy forums and are often undertaken by different institutions to address different types of hazards, and use different terminology to convey similar terms and concepts (Doswald and Estrella 2015).
- EbA largely addresses climate-related hazards, although there are examples of EbA interventions such as implementing protection forests that stabilize the soil to prevent landslides (which can be climate and non-climate-related). EbA interventions also aim to address slow-onset climate change impacts, such as changing precipitation patterns, rising mean temperatures, sea level rise and others, which has not been a tradition focus of DRR.
- In contrast, Eco-DRR addresses both non-climate (e.g. earthquakes, tsunamis), and climate-related (e.g. hurricanes, heat waves) natural hazards, and others kinds of hazards (see Figure 2). Eco-DRR tends to focus on rapid- and slow-onset events from which a system is expected to recover, rather than chronic and irreversible stressors to which systems must adapt such as gradually warming temperatures, sea level rise, and glacial melt.
- Eco-DRR includes components such as early warning systems, preparedness and contingency planning, response, recovery and reconstruction, which have not often been the focus of EbA (Doswald and Estrella 2015).

- While EbA and other forms of adaptation interventions have responded to both observed and projected climate trends, until recently, DRR has only addressed historical return rates of weather-related disasters to inform planning, rather than projections for changing return rates in the future. This has begun to change.

Despite their differences, EbA and Eco-DRR have many similarities because of their shared focus on ecosystem management, restoration and conservation to increase resilience of people (or to reduce risk or reduce vulnerability). At the project/operational level, they are often indistinguishable. Figure 2 highlights the convergence of EbA and Eco-DRR. Throughout this report, many examples of EbA are highlighted that could also be considered Eco-DRR measures, and vice versa. These examples are referred to as "EbA and Eco-DRR" throughout.

It is important to emphasize that EbA and Eco-DRR are not a replacement for other disaster risk reduction measures that, while not ecosystem-based, are critical to reducing disaster risk. Such non-ecosystem-based measures can include setting up seismic stations for earthquake detection, earthquake and post-disaster preparation drills, updating of building codes and infrastructures, and relocation of people and communities from areas at high risk.

In short, EbA and Eco-DRR can be cost-effective, low-regrets approaches that complement other disaster risk reduction and climate change adaptation measures while achieving other benefits to societies.

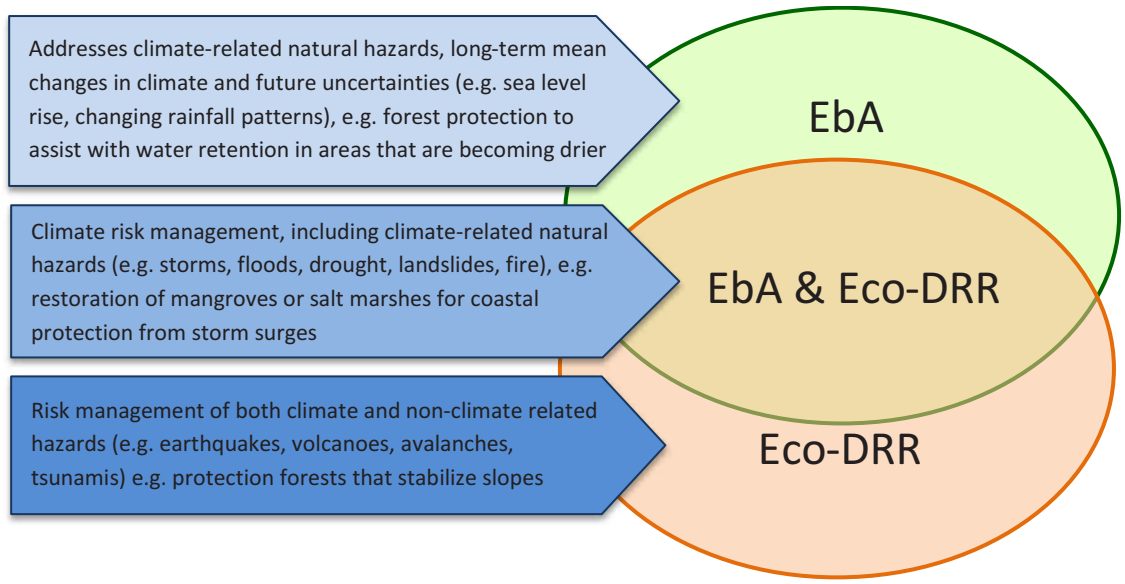


Figure 2: Overlap between ecosystem-based adaptation (EbA) and ecosystem-based disaster risk reduction (Eco-DRR) (adapted from Mitchell and Van Aalst 2008).

A signature example of a management activity achieving the goals of adaptation and disaster risk reduction is protecting or restoring coastal vegetation such as mangroves, salt marshes and seagrass. This vegetation has been demonstrated to provide coastal protection such as shoreline stabilization through attenuating wave forces. The extensive root systems of mangroves and salt marshes prevent erosion by promoting sediment binding (Beck 2014). In some cases ecosystem-based approaches to coastal flood defense can provide longer-term effectiveness than conventional coastal engineering (e.g., see Figure 3).

Coastal vegetation is also an important carbon sink and can bury organic carbon 30 to 50 times faster than terrestrial forests (McLeod et al. 2013), globally burying a similar amount of organic carbon to terrestrial forests even though the area of coastal vegetated habitats is only 3% that of forests (Duarte et al. 2013).

Maintaining the health and resilience of key ecosystems like mangroves enhances the resilience of people and communities to the impacts of climate change. Case Study 1 discusses the protection and rehabilitation of mangroves in the Sundarbans region of India and Bangladesh as an EbA and Eco-DRR strategy.[4]

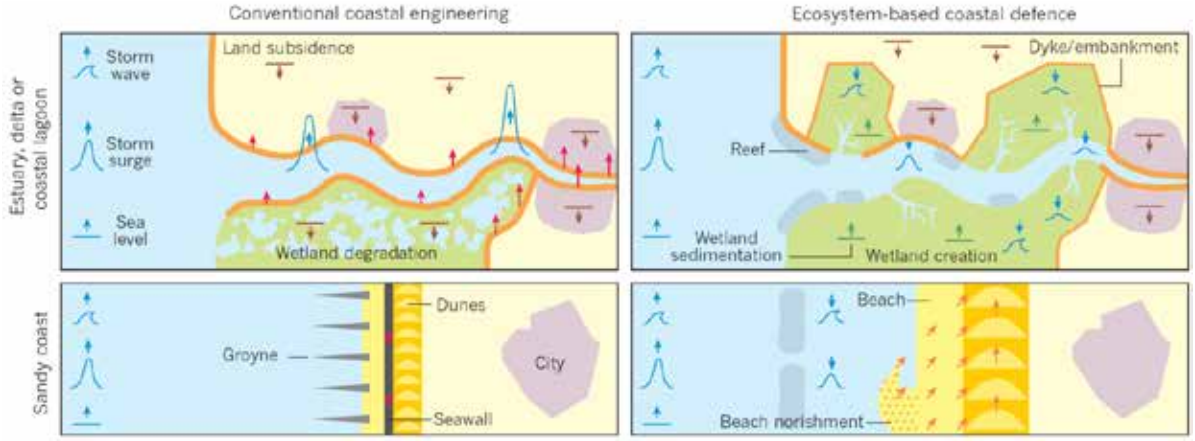


Figure 3: Example of conventional coastal engineering structures for coastal defence, compared to ecosystem-based approaches. The latter can provide longer-term sustainable coastal flood defense, by increasing wetland sedimentation and wetland creation (right panels) (Temmerman et al. 2013).

Case Study 1: Protection and rehabilitation of degraded mangrove forests of the Sundarbans

The Sundarbans region along the coast of India and Bangladesh has the largest expanse of contiguous mangrove forests in the world, stretching for 10 000 km^2 along the coast.

Aside from coastal protection, the mangroves in the Sundarbans provide nursery habitat for fish and other animals and support other important ecosystem services. In recognition of this unique, biodiverse wetland ecosystem, the Indian portion is designated as a World Heritage Site, while the Sundarbans Reserved Forest in Bangladesh is a designated Ramsar site.

The Sundarbans are prone to severe cyclones and storm surges. In an area with one of the highest population densities in the world, Cyclone Sidr in 2007 killed 3500 people and affected millions more. IPCC projections show that the severe weather events will increase as temperatures and sea levels rise (IPCC 2012), making the Sundarbans region even more vulnerable in the future.

EbA and Eco-DRR measures in the Sundarbans include protection and management of mangrove ecosystems, reducing their vulnerability to climate change and sea level rise and enabling this highly populated area to benefit from coastal protection. Other EbA measures include community-based afforestation of coastal zones, and mangrove restoration (Rahman 2014). For decades, afforestation and restoration activities in the Sundarbans have helped conserve endangered species and protect people from cyclones and storms (MacIntosh et al. 2012).

It would cost comparatively more to build hard infrastructure to protect the coastline. Estimates place costs to build coastal embankments, built to offer the same extent of protection as the mangroves, at USD 294 million in capital investment, and USD 6 million each year in maintenance (Colette 2007). In light of the multiple benefits to people from protection of mangroves, EbA approaches in the Sundarbans provide examples of a low-regrets strategy to reduce climate change vulnerability and disaster risk for people.

4 Further details on lessons learned on mangrove restoration in the Sundarbans and in other ecosystems are readily available in the literature, for example, Macintosh et al. (eds.) 2012, Sharing Lessons on Mangrove Restoration. Mangroves for the Future and IUCN (www.mangrovesforthefuture.org , www.iucn.org).

Case Study 2 highlights the use of EbA and Eco-DRR measures in a "strategic ecological security layout" to adapt to increased sandstorms and soil erosion.

Case Study 2: Addressing sandstorms - China's strategic ecological security layout

China's strategic ecological security layout includes strengthening construction of forest belts, grasslands conservation and sand fixing to prevent sandstorms and soil erosion, which are problems exacerbated by climate change. Key priorities for different regions are shown in the table below.

Strategic Ecological Security Layout ("Two Barriers and Three Belts") (from China's fifth national report)

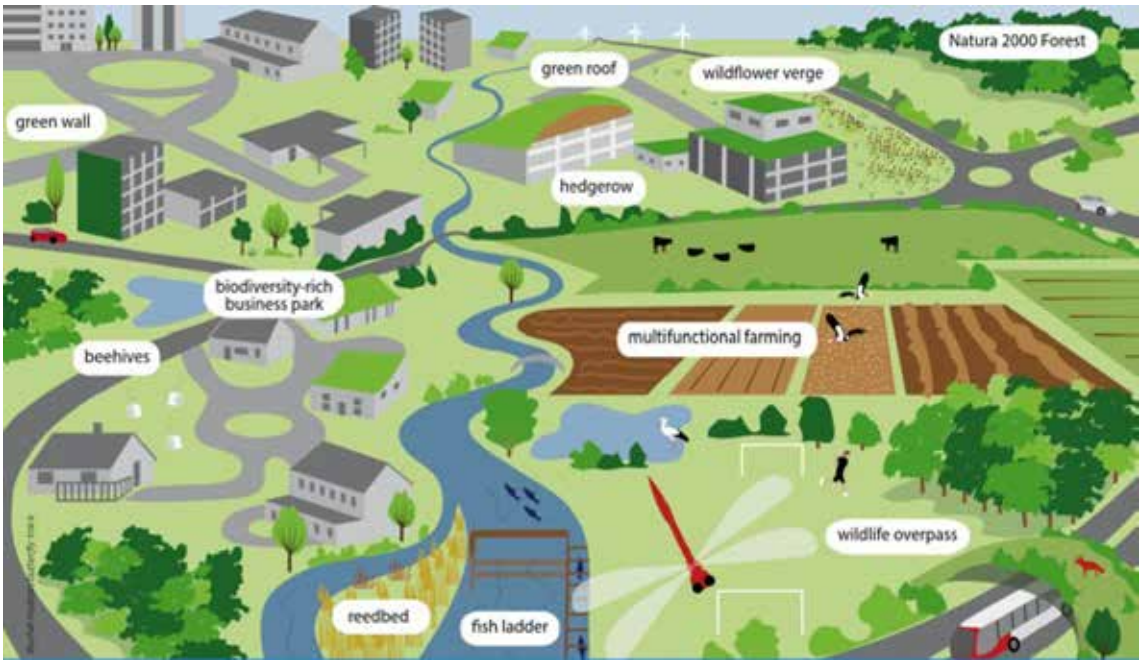
Regions	Key Priorities for Ecological Conservation
Qinghai-Tibet Plateau	To protect various, unique ecosystems to allow them to play roles in regulating water for big rivers and climate
Loess Plateau/Yunnan-Sichuan	To strengthen control of soil erosion and protection of natural habitats to ensure ecological security in the Yangtse River Basin and the middle and lower reaches of the Yellow River
Northeast China Forest Belt	To protect forest resources and biodiversity to allow northeast China plains to play the role of ecological security barriers.
North China sand control belt	To strengthen construction of forest belts, grassland conservation, sand fixing and prevention of sandstorms; and to enclose for protecting those areas where desertified land cannot be controlled for the time being; and to allow forest belts to play the role of ecological security barriers.
Hilly areas of south China	To strengthen habitat restoration and control soil erosion, so that south China and southwest China can play the role of ecological security barriers.

Although most often associated with rural and natural areas, EbA and Eco-DRR can also be used in urban areas. One type of ecosystem-based approach relevant to urban areas is green infrastructure (GI), which can be broadly defined as a strategically planned network of high quality natural and semi-natural areas with other environmental features, which is designed and managed to deliver a wide range of ecosystem services and protect biodiversity in both rural and urban settings (European Union 2013).

Case Study 3: EbA and Eco-DRR in urban areas – using green infrastructure to combat the heat island effect

Urban areas are often warmer than surrounding areas due to absence of vegetation (and lower humidity levels), and presence of asphalt which absorbs energy, creating a heat island effect. Climate change is increasing the frequency of extreme events, exacerbating the heat island effect.

An example of a green infrastructure initiative that helps to counteract the heat island effect in urban areas is the implementation of biodiversity-rich parks, green spaces, and green roofs and walls, using vegetation which can offer shade and generate moist air. The multiple benefits of green infrastructure in addition to reducing the heat island effect and providing relief during heat waves, include carbon sequestration, improved air quality, reduced rainfall runoff, increased aesthetic appeal, and increased energy efficiency. The figure below shows potential components of green infrastructure in urban areas.



— European Commission 2013

The case studies above provide examples of how ecosystem-based approaches are being used to address a wide range of climate-related hazards at both the country and regional levels, via national planning and through broad, multisectoral partnerships. While often not labelled as EbA or Eco-DRR, the activities above nevertheless use ecosystem-based solutions to adapt to climate change and reduce risk of disasters due to climate-related hazards.

2. METHODOLOGY

2.1 SOURCES OF INFORMATION

Information for this compilation and synthesis came from a wide variety of sources in order to build a meaningful picture about experiences, activities and targets on EbA and Eco-DRR. Sources included the following and are discussed briefly below:

- Fifth national reports (5NRs) to the CBD
- National biodiversity strategies and action plans (NBSAPs)
- Submissions on activities and targets related to EbA and Eco-DRR, provided to the CBD by countries and organizations in response to a request from the CBD Secretariat
- Review of EbA and Eco-DRR project portfolios funded by the Global Environment Facility and other organizations, and implemented by governments and a wide range of development and environmental organizations
- Case studies from a broader literature review
- Information from participants at the CBD technical workshop on ecosystem-based approaches to climate change adaptation and disaster risk reduction (South Africa, 28 September – 2 October 2015)

2.1.1 Fifth National Reports

National reports enable Parties to the CBD to describe measures implemented under the Convention and evaluate their effectiveness, as established in Article 26 of the Convention. Parties to the CBD adopted the Strategic Plan for Biodiversity 2011-2020 (the Strategic Plan), with a vision of a world where "By 2050, biodiversity is valued, conserved, restored and wisely used, maintaining ecosystem services, sustaining a healthy planet and delivering benefits essential for all people."[5]

The mission of the Strategic Plan is to "take effective and urgent action to halt the loss of biodiversity in order to ensure that by 2020 ecosystems are resilient and continue to provide essential services, thereby securing the planet's variety of life, and contributing to human well-being, and poverty eradication." Five strategic goals underpin twenty Aichi Biodiversity Targets to be achieved by 2015 or 2020.

Aichi Targets 14 and 15, under the strategic goal of enhancing the benefits to all from biodiversity and ecosystem services, have been identified as particularly relevant to EbA and Eco-DRR. Aichi Target 14 aims for the safeguarding and restoration of ecosystems that provide essential services, including services related to water, and contribute to health, livelihoods and well-being, taking into account the needs of women, indigenous and local communities, and the poor and vulnerable. Indicators for the Aichi Biodiversity Targets have been developed, and "trends in human and economic losses due to water or natural resource related disasters" has been adopted as an indicator for Aichi Target 14.

Aichi Target 15 aims for the enhancement of ecosystem resilience and the contribution of biodiversity to carbon stocks, through conservation and restoration, including restoration of at least 15 per cent of degraded ecosystems, thereby contributing to climate change mitigation and adaptation and to combating desertification.

In decision X/10, the Conference of the Parties to the CBD decided that the fifth national reports should focus on the implementation of the Strategic Plan 2011-2020 and progress achieved towards the Aichi Biodiversity

5 CBD Strategic Plan for Biodiversity 2011-2020 and Aichi Biodiversity Targets, https://www.cbd.int/sp/.

Targets. Guidelines propose that they should contain: a) An update on biodiversity status, trends and threats, and implications for human well-being; b) information on the national biodiversity strategy and action plan (NBSAP), its implementation, and the mainstreaming of biodiversity into national planning; and c) progress towards the 2015 and 2020 Aichi Biodiversity Targets and contributions to the relevant 2015 Targets of the Millennium Development Goals (MDGs). At the time of writing of this document, 155 fifth national reports had been submitted.

The fifth national reports helped inform a mid-term review of progress towards the implementation of the Strategic Plan, and provided key information for the fourth edition of the *Global Biodiversity Outlook* (GBO-4). In this report, fifth national reports, particularly the information on NBSAPs and progress on Aichi Targets, are assessed to compile country experiences, activities and targets related to EbA and Eco-DRR. The fifth national reports and NBSAPs, as submitted by Parties, are available on the CBD website.[6] By reviewing reports, details on EbA and Eco-DRR experiences were obtained from the perspective of the countries involved, in addition to progress on related Aichi Targets, and the types of climate-induced hazards that countries are facing.

Sixty-one reports were selected as a representative sample for comprehensive analysis (see Table 1), taking into consideration as much as possible a balance between regions and development status. This represented approximately one third of the reports submitted by parties. While multiple examples of EbA and Eco-DRR activities are drawn from the selected reports, information from other countries not listed below is also included in this report, drawn from the broader literature or other case studies.

Table 1: List of fifth national reports analysed, by region

Africa (19)		**Asia (7)**		**Central America (7)**	
Algeria	Benin	Cambodia	China	Costa Rica	Ecuador
Botswana	Burkina Faso	India	Mongolia	El Salvador	Guatemala
Burundi	Cameroon	Philippines	Tajikistan	Honduras	Nicaragua
Comoros	Congo	Thailand	Caribbean (3)	Panama	
Côte d'Ivoire	Djibouti	Antigua and Barbuda	Cuba		
Egypt	Equatorial Guinea	Dominican Republic			
Eritrea	Ethiopia				
Gambia	Liberia				
Madagascar	South Africa				
Uganda					
Europe (9)		**Middle East (3)**		**North America (2)**	
Austria	Estonia	Azerbaijan	Oman	Canada	Mexico
European Union	France	Yemen			
Monaco	Norway				
Serbia	Spain				
Sweden					
Oceania (5)		**South America (6)**			
Niue	Palau	Bolivia	Brazil		
Samoa	Solomon Islands	Chile	Colombia		
Vanuatu		Peru	Uruguay		

2.1.2 National Biodiversity Strategies and Action Plans

National biodiversity strategies and action plans (NBSAPs) are the principal instruments for implementing the Convention at the national level (Article 6 of the Convention). The Convention requires countries to prepare a national biodiversity strategy (or equivalent instrument) and to ensure that this strategy is mainstreamed into the planning and activities of all those sectors whose activities can have an impact (positive and negative) on biodiversity.

6 CBD National Reports Database: https://www.cbd.int/reports/nr5/.

At the time of writing this report, 184 of 196 (94%) Parties had developed NBSAPs in line with Article 6. Decision X/2 urged Parties to revise and update their NBSAPs to incorporate the Strategic Plan within two years of its adoption. While not all NBSAPs analysed for this report had been updated and submitted, updated information on NBSAPs were reviewed in the fifth national reports when available.

2.1.3 Submissions from Parties and Organizations

The CBD Secretariat invited Parties and organizations to submit experiences, activities and targets related to EbA and Eco-DRR (notification 2015-018).[7] Submissions came from the following Parties and organizations: Australia, Belgium, Canada, Colombia, Germany, India, Italy, Japan, Mexico; Indian Council of Forestry Research and Education, Blue Solutions Initiative of the German Environment Ministry, Jagruti Gramin Vikas Sanstha, Eklari, Royal Society, UNEP, IUCN, Tebtebba, WWF and FAO.

2.1.4 Review of EbA and Eco-DRR project portfolios

Numerous EbA and Eco-DRR projects have been funded or implemented by international organizations and multilateral fund agencies. The Global Environment Facility (GEF) is a partnership for international cooperation to address global environmental issues, including biodiversity, climate change, international waters, and land degradation, and as such has a large portfolio of EbA and Eco-DRR projects. The GEF serves as the financial mechanism for the UNFCCC, CBD, and UNCCD and other conventions, and has financed adaptation activities through three trust funds: The Strategic Priority on Adaptation (SPA), the Least Developed Countries Fund (LDCF), and the Special Climate Change Fund (SCCF).

The SPA was established in 2003, with USD 50 million, to help countries reduce vulnerability and increase adaptive capacity. The fund financed pilot adaptation projects, testing the success of adaptation planning and assessment before operationalizion of the LDCF and SCCF funds.

The Least Developed Countries Fund addresses urgent and immediate adaptation needs of least developed countries (LDCs) under the UNFCCC, with a focus on reducing vulnerabilities of essential ecosystem services, including the provisioning of water, agriculture and food security, health, disaster risk management and prevention, and infrastructure.

The Special Climate Change Fund targets mainly adaptation, although technology transfer and economic diversification are also promoted. It is open to all vulnerable developing countries (not just LDCs), and finances urgent and longer-term adaptation measures, including response strategies, policies, and measures. Activities address reducing climate impacts on health, integrated coastal management, water resource management in response to glacial retreat, and improved water resources management in response to droughts, floods, and warming.

EbA and Eco-DRR activities are also covered under the GEF biodiversity and climate change focal areas, in addition to other cross-cutting issue and programmes. To gain further detail on country and regional experiences in EbA and Eco-DRR, completed project reports were accessed from the GEF project database for the LDCF and SCCF funds, and additionally by searching for "adaptation" or "resilience" as key words to identify potentially qualifying activities. Projects with terminal evaluations included perspective of experiences and lessons learned in EbA and Eco-DRR implementation.

In addition to the GEF portfolio, information was included from a wide range of intergovernmental organizations and non-governmental organizations involved in implementation or funding, such as UNEP, UNDP, IUCN and WWF. Other sources of funding for EbA and Eco-DRR activities include the Pilot Program for Climate Resilience of the World Bank; the UNFCCC Adaptation Fund; the International Climate Initiative (IKI), a fund of the German Federal Ministry for the Environment, Nature Conservation, Building and Nuclear Safety (BMUB); the Global

7 https://www.cbd.int/doc/notifications/2015/ntf-2015-018-cc-drr-en.pdf.

Climate Change Alliance (GCCA) supported by the European Union; funding from national development agencies such as the Swedish International Development Cooperation; and private funds.

Case studies were extracted from project portfolio databases, such as the CBD Climate Change Adaptation Database[8] and UNFCCC database on ecosystem–based approaches to adaptation,[9] and Panorama and Blue Solutions (IUCN initiatives), the Ramsar Knowledge Information System, and academic literature.

In addition to multiple national projects, there are many multi-agency and regional EbA programmes. One example is the Ecosystem-based Adaptation in Mountain Ecosystems programme, a collaborative initiative of UNEP, UNDP and IUCN, and funded by BMUB through the IKI programme. The mountain ecosystem-based adaptation programme is implemented in the Nor Yauyos-Cochas Landscape Reserve in Peru, the Himalayas in Nepal (Kaski, Parbat and Syangja districts), and Mount Elgon in Uganda. Projects that identified challenges and lessons learned or that had been evaluated at some stage were prioritized in the review.

2.1.5 CBD Technical Workshop on EbA and Eco-DRR

A technical workshop on EbA and Eco-DRR was convened by the CBD Secretariat from 28 September to 2 October 2015 to review an earlier draft of this report and to share experiences on national and regional efforts to implement EbA and Eco-DRR measures. The workshop was attended by 50 participants from around the world.[10] The experiences and key conclusions from this workshop are incorporated throughout this report.

2.1.6 Analysis of Information and Scope of Review

The analysis of fifth national reports and NBSAPs enabled the extraction of national-level information on EbA and Eco-DRR experiences and targets. The submissions, review of project portfolios, literature review, and technical workshop provided further details and nuances on policy issues, implementation, and monitoring and evaluation.

Case studies were included from as wide a variety of contexts as possible (environment, conservation, humanitarian, development) on national, regional and local scales. EbA activities that primarily aimed to increase the resilience of people to climate change were distinguished from conservation projects that did not focus on enhancing people's resilience.

There were many examples of conservation projects that aimed to preserve biodiversity or habitat without consideration of climate change impacts. Other projects considered climate change impacts, but the interventions were aimed at increasing the resilience of particular species or ecosystems, rather than people, such as implementing natural corridors to facilitate species migrations. While these conservation measures are an integral component of national strategies for biodiversity conservation, they were not considered EbA *per se* as they did not primarily target reducing the vulnerability of people/communities to the impacts of climate change, and were thus not within the scope of this report.

On the other hand, several projects that were not explicitly labelled as EbA or Eco-DRR were included in the analysis, as they utilized the principle of healthy, resilient ecosystems for adaptation of people and communities to climate change. Examples of such activities include the development of approaches by pastoralists to adapt to climate variability, such as mixed species grazing, and restoration of vegetated coastlines to prevent storm surges and flooding.

8 CBD Climate Change Adaptation Database: https://adaptation.cbd.int/.

9 UNFCCC EbA Database: unfccc.int/adaptation/nairobi_work_programme/knowledge_resources_and_publications/items/6227.php

10 The 50 participants at the CBD EbA and Eco-DRR technical workshop included 26 participants from Parties, 4 representatives of IPLCs, 17 participants from organizations, 2 staff members from the Secretariat and a consultant for the Secretariat. The list of participants will be available in the separate workshop report to be posted at https://www.cbd.int/doc/?meeting=CCBWS-2015-01.

It should thus be noted that while many biodiversity and ecosystem conservation activities were not included in this present analysis because they are not targeted towards EbA objectives, this does not depreciate their value in achieving conservation objectives. At the same time, conservation should not be conflated with adaptation activities, and caution must be exercised in ensuring that the objectives of an intervention are clear before they are categorized as conservation, adaptation, or both. Conservation and EbA/Eco-DRR are both important approaches to sustainable development and human well-being, but the latter is the focus of this report.

2.2 FRAMEWORK FOR THE COMPILATION AND REVIEW

The fifth national reports were written to assess implementation of the Strategic Plan for Biodiversity 2011-2020 and progress achieved towards the Aichi Biodiversity Targets. As such, a vast amount of information was available on Parties' experiences, activities, and targets on EbA and Eco-DRR. The 5NRs were not standardized, and had varying levels of detail and structure. In order to consistently review and extract information from the reports, a framework was developed to interpret the data, as described below.

2.2.1 Framework Part A: Identification of EbA Activities and Targets

The following points were assessed:

i. Whether the report, activity, or programme includes measures of EbA (whether or not EbA is explicitly listed);

ii. Whether EbA was focused on adaptive capacity of people and communities as a primary objective;

iii. The general category of activity, according to a typology that was developed to strike a balance between detail, inclusiveness and time available. The general categories and examples are adapted from the IUCN EbA Mapping Exercise (IUCN 2014b), supplemented with examples and information from CBD Technical Series No. 41 (SCBD 2009) and the UNFCCC EbA technical workshop report (UNFCCC 2013);

iv. Progress on Aichi Targets: The review of fifth national reports focused on progress on the Aichi Targets related to EbA and Eco-DRR. While Targets 14 and 15 are particularly relevant for EbA and Eco-DRR, the achievement of other targets, including (but not limited to) Targets 5, 7, 10, 11, and 13, are also important to the achievement of EbA and Eco-DRR goals to reduce vulnerability of people to the impacts of climate change. The rationale for selecting these targets for analysis is presented in Annex 2.

Countries have described progress on the Aichi Targets both qualitatively, using terms such as low-high and poor-good, and quantitatively, by describing the percentage of implementation. Consistent descriptors were used to standardize the information from the reports. The descriptor "low" was assigned to progress described by countries as "poor implementation", "limited progress", or 0-25% implementation progress. The descriptor "fair" corresponds to 25-50% implementation, "good" corresponds to 50-75% implementation, and "very good" corresponds to 75-100% implementation (Table 2).

Table 2: Descriptors of progress on the Aichi Biodiversity Targets

Progress descriptor for Aichi Target used in this report	Corresponding country descriptor
Low	Poor, 0-25% implementation, limited progress
Fair	25-50% implementation
Good	50-75% implementation
Very good	75-100% implementation
No data available, or not assessed	

2.2.2 Framework Part B: Identification of Eco-DRR Activities and Targets

The following points were assessed:

i. Whether there is mention of disaster or hazard risk reduction in the report;

ii Whether there are targets related to DRR, and where they are found (e.g. NBSAP, NAPA, development strategy);

iii. The hazard addressed if DRR is referred to.

2.2.3 Framework Part C: Experiences, Challenges and Lessons Learned

The following points were assessed:

i. Major challenges related to implementation of EbA and Eco-DRR;

ii. Synergies among Rio Conventions (CBD, UNFCCC and UNCCD), or with other conventions;

iii. Lessons learned.

3. THE POLICY AND INSTITUTIONAL CONTEXT FOR EBA AND ECO-DRR

While the evolution of the concepts of EbA and Eco-DRR have been briefly discussed in the introduction, this section provides a more detailed overview of relevant decisions, policies and programmes related to both EbA and Eco-DRR, and country experiences with EbA and Eco-DRR policies and their integration into NBSAP, adaptation and other strategies.

International policies, strategies and frameworks often do not explicitly mention Eco-DRR or EbA, but include these concepts indirectly. For example, many agreements and conservation frameworks address risks to people or ecosystems posed by natural hazards which can be reduced by conservation, wise management, restoration and climate-informed management of ecosystems. In such cases, the linkages of policies, strategies and frameworks to EbA and Eco-DRR are illustrated.

3.1 ADAPTATION-RELATED FRAMEWORKS, DECISIONS AND RESOLUTIONS AT THE INTERNATIONAL LEVEL

The following is a summary of several policies, strategies and frameworks related to climate change adaptation which have direct and indirect references to EbA, and by extension also linkages to Eco-DRR, given similarities in practice of both EbA and Eco-DRR. More information on policies, strategies and frameworks, including linkages to EbA and Eco-DRR, is provided in Annex 3.

- The Nairobi work programme on impacts, vulnerability and adaptation to climate change (NWP) was established at the eleventh session of the Conference of the Parties to the UNFCCC in 2005 as a mechanism under UNFCCC to facilitate and catalyse the development and dissemination of information and knowledge that would inform and support adaptation policies and practices. At its seventeenth session, the Conference of the Parties to the UNFCCC, acknowledging the need to consider the role of ecosystems for enhanced action on adaptation, requested that a technical workshop on EbA be held.
- The UNFCCC Cancun Agreements, discussed in section 1.3, introduced principles for adaptation action, including the integration of adaptation into relevant social, economic and environmental policies and plans.
- The national adaptation plan (NAP) process was established under the Cancun Adaptation Framework. It enables Parties to formulate and implement NAPs as a means of identifying medium- and long-term adaptation needs and developing and implementing strategies and programmes to address those needs.
- National adaptation programmes of action (NAPAs) under the UNFCCC provide a process for least developed countries (LDCs) to identify priority activities that respond to their urgent and immediate needs to adapt to climate change.
- The Convention on Migratory Species (CMS) Resolution 11.26, "Programme of Work on Climate Change and Migratory Species", references the impacts of climate change on migratory species, including the impact on habitats and on local communities dependent on the ecosystem services provided by these species.
- The Hyderabad Call for a Concerted Effort on Ecosystem Restoration was launched by the Rio Conventions, the Ramsar Convention, and other organizations and national governments, during the eleventh meeting of the Conference of the Parties to the CBD. It called for "concerted and coordinated long-term efforts to mobilize resources and facilitate the implementation of ecosystem restoration activities on the ground for sustaining and improving the health and well-being of humans and all other species with whom we share the planet."

3.2 DRR-RELATED FRAMEWORKS, DECISIONS AND RESOLUTIONS AT THE INTERNATIONAL LEVEL

The following are policies related to disaster risk reduction, either explicitly or indirectly. There are some direct and indirect references to Eco-DRR, and by extension, also linkages to EbA. Annex 3 contains further details.

- The International Strategy for Disaster Reduction (ISDR); its vision is to enable all communities to become resilient to the effects of natural, technological and environmental hazards, and to proceed from protection against hazards to the management of risk through the integration of risk prevention into sustainable development.
- The UNCCD advocacy policy framework on drought, adopted at the eleventh meeting of the Conference of the Parties to the UNCCD in Windhoek, Namibia, urges Parties to develop and implement national drought management policies. Drought risk is closely linked to ecosystem degradation, and conservation and restoration of ecosystems can mitigate this risk.
- The Conference of the Parties to the CBD, at its twelfth meeting, in Pyeongchang, Republic of Korea, encouraged the promotion of EbA and Eco-DRR in decision XII/20.
- The Conference of the Parties to the Ramsar Convention on Wetlands adopted Resolution XII.13 on wetlands and disaster risk reduction at its twelfth meeting (Punta del Este, Uruguay), which emphasizes the "importance of conserving, restoring and wise use of wetlands for disaster risk reduction".
- In September 2015, the UN General Assembly adopted the Sustainable Development Goals (SDGs). Goal 11 aims to "make cities and human settlement inclusive, safe, resilient and sustainable", and includes targets aimed at reducing deaths and economic losses due to disasters, and adoption of policies towards climate change adaptation, resilience to disasters, and holistic disaster risk management at all levels.

The Sendai Framework for Disaster Risk Reduction 2015-2030 was adopted at the third UN World Conference on Disaster Risk Reduction, and endorsed by the UN General Assembly. Building on its predecessor, the Hyogo Framework for Action 2005-2015, adopted in 2005, the Sendai Framework outlines seven global targets to be achieved over the next 15 years.

Several key elements in the Sendai Framework have direct or indirect linkages to EbA and Eco-DRR measures. The Sendai Framework places emphasis on tackling underlying drivers of disaster, including climate change and unsustainable use of natural resources. It also calls for DRR and building of resilience to be addressed in the context of sustainable development and poverty eradication.

Moreover, the Sendai Framework addresses all types of hazards: "small-scale and large-scale, frequent and infrequent, sudden and slow-onset disasters caused by natural or man-made hazards, as well as related environmental, technological and biological hazards and risks." This multi-hazard approach includes climate-related natural hazards, highlighting that there is a role for inclusion of adaptation, EbA and Eco-DRR within DRR strategies.

The Sendai Framework calls for national targets and indicators to assess progress. A set of principles was established, calling for coherence across sustainable development and growth, food security, health and safety, climate change and variability, environmental management and DRR. Priorities for action were also established, including investing in DRR for resilience and noting that it is important to "strengthen the sustainable use and management of ecosystems and implement integrated environmental and natural resource management approaches that incorporate disaster risk reduction."

3.3 REGIONAL FRAMEWORKS AND POLICY INSTRUMENTS RELATED TO EBA AND ECO-DRR

At the regional level, several policies relevant to EbA and Eco-DRR have been established within the European Union, with several examples provided below:

- The EU Strategy on Adaptation to Climate Change aims to make Europe more climate resilient by implementing green infrastructure (GI) or ecosystem-based approaches to adaptation.
- The 2013 European Commission strategy on green infrastructure (COM/2013/0249 final) underlines that GI can make a significant contribution to the effective implementation of all policies where some or all of the desired objectives can be achieved in whole or in part through nature-based solutions.
- The Seventh Environment Action Programme (7EAP) (Decision No. 1386/2013/EU) aims to enhance ecological and climate resilience, through ecosystem restoration and GI.
- The EU Biodiversity Strategy (2011) calls for restoration of at least 15% of degraded ecosystems in the EU and aims to expand the use of GI. In addition, the European Commission will continue mapping and assessment work of GI in the context of the Biodiversity Strategy.
- The Regional Policy 2014–2020 foresees support for ecosystem-based approaches to adaptation and GI through financial instruments such as the European Regional Development Fund and the Cohesion Fund, which contribute to several policy objectives and deliver multiple benefits, in particular socioeconomic development.
- The Water Framework Directive (2000/60/EC), Nitrates Directive (91/676/EEC) and the Floods Directive (COM(2006)15) offer GI-related opportunities (for instance, by supporting actions to put in place GI to improve soil retention, act as buffer strips between agricultural production and water sources, and provide water storage during flood events) (European Environment Agency 2015).
- The Bern Convention on the Conservation of European Wildlife and Natural Habitats in its Guidance on Biodiversity and Climate Change recommends Parties to make full use of the large potential for synergies and co-benefits between biodiversity conservation and climate change mitigation and adaptation, including ecosystem-based approaches (Recommendation No. 143 (2009) of the Standing Committee).

In the Pacific region, several programmes and projects have been implemented that incorporate both EbA and Eco-DRR, including the following:

- The Pacific Regional Environment Programme Strategic Plan (2011-2015) includes two discrete targets that link ecosystems, climate change and biodiversity: one that calls for efforts to mainstream adaptation (including EbA) in development plans (CC 1.1) and a second that calls for examples of EbA in Pacific Island Countries and Territories (BEM1.1).
- The Pacific Ecosystems-based Adaptation to Climate Change (PEBACC) initiative is a five year (2014-2019) project funded by the German Government, implemented by the Secretariat of the Pacific Regional Environment Programme (SPREP) to explore and promote EbA. The goals of the project are to integrate EbA into development, climate change adaptation and natural resource management policy and planning processes in three Pacific island countries, providing replicable models for other countries in the region.
- The Pacific Adaptation to Climate Change (PACC) programme began in 2009 as a regional response to the climate change threat. It is currently the largest climate change adaptation initiative in the region, with activities in 14 Pacific island countries and territories. Examples of EbA measures being implemented include conserving reefs and coastal wetlands and forests for coastal protection in Samoa, and the development of climate-resilient crop species and varieties in various countries.

- RESCCUE is a regional cooperation project on restoration of ecosystem services and adaptation to climate change implemented by the Secretariat of the Pacific Community (SPC) and funded by the French Development Agency (AFD) and the French Global Environment Facility (FFEM). The overall goal of RESCCUE is to contribute to increasing the resilience of Pacific Island Countries and Territories (PICTs) to global change. RESCCUE supports adaptation to climate change through integrated coastal management, which include EbA measures such as ecological restoration and rehabilitation of mangroves, watersheds, and coastal vegetation. A major focus of RESCCUE is to enhance economic analyses and economic and financial mechanisms for integrated coastal management. Such programmes and projects have been implemented in other regions of the world as well, as illustrated in examples elsewhere in this report.

4. MAKING THE CASE FOR EBA AND ECO-DRR

4.1 SELECTING EBA AND ECO-DRR WITHIN ADAPTATION AND DRR STRATEGIES

There has been growing recognition that approaches to adaptation that utilize healthy or functional ecosystems can contribute to climate change mitigation and adaptation. The international policy framework for EbA is gaining traction and strengthening, as discussed above. However, making the case for ecosystem-based approaches has been challenging. Part of this difficulty is due to the lack of systematic analyses of EbA versus other kinds of adaptation approaches.

Adaptation solutions include "hard" or "grey" engineered solutions, such as the construction of sea walls, and "soft" strategies that focus on institutions, behavioural change, and policy (WWF 2013). "Green" approaches, which include EbA, focus on ecosystems and ecosystem services to help people adapt to impacts of climate change; and community-based adaptation (CBA) is a process that is led by communities, based on their priorities, needs and capacities (Reid 2015). While differing in theory, EbA and community-based adaptation, like EbA and Eco-DRR, are often identical in practice. Good EbA practices involve community participation and ownership, while good community-based adaptation practices involve the consideration of ecosystems and ecosystem services – often both approaches are used in local adaptation efforts and are indistinguishable in the field (Reid 2015).

> "Since ecosystems provide different types of services that increase human wellbeing, EbA serves the dual purpose of satisfying immediate needs and building safety nets and resilience for the future. Moreover, healthy ecosystems provide important services for DRR and can help reduce the gaps between DRR and adaptation efforts; for example, by serving as protective barriers against disasters and building local resilience by sustaining livelihoods and improving capacity to adapt to climate change."
>
> —WWF 2013

Hard solutions, such as building a sea wall, dike, or installing irrigation systems, are often promoted due to the delivery of immediate benefits and the perceived feeling of security. However, as learned from earlier disaster risk reduction efforts, engineering solutions can be costly to maintain, require large capital investment, and may even result in maladaptation in the long run by disrupting ecological processes (SCBD 2009). Large-scale engineering options can have low likelihood of failure but catastrophic consequences when failure occurs, such as when overtopped dikes in New Orleans trapped flood water in the city during Hurricane Katrina in 2005.

For example, the displacement of coastal vegetation such as salt marshes to make way for hard infrastructure removes the natural ability of marsh vegetation to buffer against the impacts of storm surges. Salt marshes have unique ecosystem-engineering capabilities that enable them to build elevation and move landward, keeping pace with sea level rise – however, the ability of salt marshes to respond to sea level rise is threatened by hard infrastructure, known as the "coastal squeeze" problem (Duarte et al. 2013).

Grey and green solutions have been combined effectively. One example practised in the United Kingdom of Great Britain and Northern Ireland (UK) and the Netherlands is managed realignment/retreat, in which old sea walls at risk from sea level rise are breached in order to restore or create mudflats and salt marsh habitat. The establishment of salt marsh vegetation then provides additional coastal protection while protecting new seawalls that are constructed landward (Roman and Burdick 2012).

In some cases, a combination of green, soft and grey/hard approaches is most appropriate to meet adaptation needs. In addition to these adaptation approaches, there are several management practices that are already employed that can (but do not always) contribute to climate change adaptation and DRR.

These approaches may differ in purpose and theory, and should not be confused with EbA. But in some cases these approaches can overlap in practice with EbA and Eco-DRR, if the goal of the approach is to reduce identified

vulnerabilities of people to the impacts of climate change. Such approaches include, but are not limited to, the following (some definitions are provided in the "Glossary and Acronyms" section):

- Community-based adaptation (CBA)
- Climate-smart agriculture (CSA);
- Integrated water resource management (IWRM);
- Protected areas management;
- Integrated coastal zone management (ICZM);
- Sustainable land and water management (SLWM);
- Sustainable forest management (SFM);
- Community-based natural resource and risk management (CBNRM);
- Green infrastructure;
- Nature-based solutions;
- Agroforestry;
- Natural water retention measures.

One way in which to inform the selection of a strategy is by measuring and evaluating effectiveness, described in more detail below. However, when the approaches are relatively new, as is the case for EbA and Eco-DRR, assessing benefits can be hampered by lack of data and standard methodologies for cost-benefit analyses and monitoring and evaluation.

There are indications that when countries have chosen EbA and Eco-DRR as adaptation options over, or in addition to, grey and grey/green solutions, it has been partly because of anticipation of multiple benefits. Other prerequisites for the choice are the existence of some evidence for effectiveness, coupled with sufficient resources for implementation. This is clear in the case of protection forests, which stabilize slopes and have been able to guard against climate-related natural hazards in some cases, such as landslides resulting from heavy precipitation events (Moos et al. 2015).

The Government of Japan, in its submission to CBD, included several examples of large-scale efforts to implement protection forests and increase research on the most effective mix of tree species, and restoring river bank vegetation to reduce the risk of floods. In the devastating wake of the Great East Japan Earthquake, the Study Group for the Restoration of Coastal Disaster Prevention Forests Related to the Great East Japan Earthquake was established, providing guidance on the creation of multifunctional coastal disaster prevention forests that incorporate the ecosystem approach, in order to reduce damage from future tsunamis.

Maintaining and improving the functionality of protection forests is also a key activity within the Bavarian climate protection programme in Germany. Because of the important role of forests in mitigating the risks posed by natural hazards, the programme aims to improve the stability and functionality of mountain forests, including by improving forest stand structures, fostering adapted species mixtures, promoting natural regeneration, preventing forest fires or controlling pests and diseases (Figure 4).

In some cases, public preference can be a strong component for selecting EbA and Eco-DRR options, in addition to evidence of benefits. This is illustrated in Case Study 4 from Switzerland, where community preference for the recreational and aesthetic aspects of implementing protection forests to guard against avalanches and landslides played a role in the selection process.

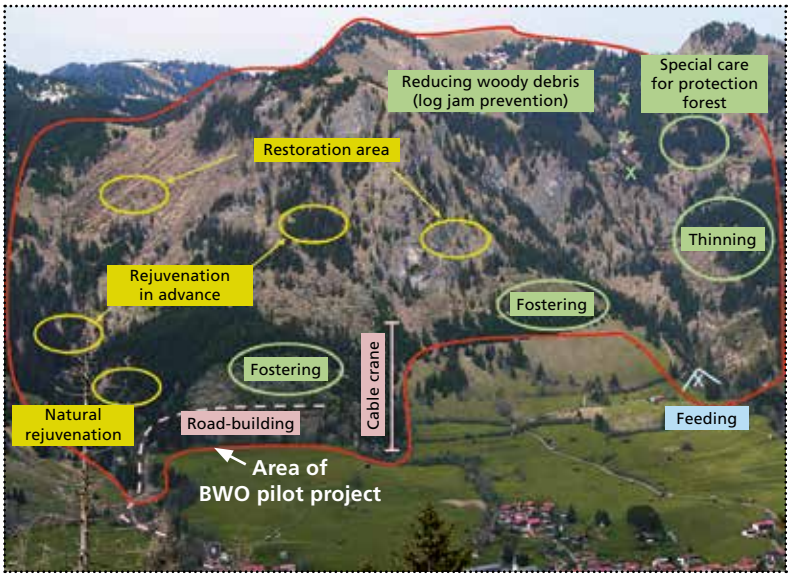


Figure 4: Example of maintaining and improving the functionality of protection forests through the Mountain Forest Initiative (Bergwaldoffensive, BWO) in Bavaria, Germany (Platform on Natural Hazards of the Alpine Convention (PLANALP) 2013).

Case Study 4: Protection forests in Switzerland to combat avalanches and landslides

In Switzerland, protection forests are a main component of its disaster risk reduction programme in the Alps to protect critical infrastructure from frequent disasters including rock fall, avalanches or landslides.

The Swiss government spends over $120 million annually on the management of its protective forests to achieve a balance between young and old trees and a mix of species to keep forests healthy and strong. The government forest office manages the protection forests even if they are owned privately. In some cases, the local government will even financially compensate private landowners in the case that they have lost income from logging.

Local people prefer to have forests for protection as they also provide places for recreation, are more aesthetic and seem less threatening than avalanche barriers or rock nets. Protection forest planning takes a timespan of 50-100 years and is based on public willingness to maintain their forests as well as a number of scientific studies, forest management guidelines and cost-benefit analyses that demonstrate that protection forests cost 5-10 times less than engineered structures over time.

—Excerpted from UNEP and CUAS 2015

Despite the limited availability of hard evidence thus far on EbA and Eco-DRR effectiveness, there have been significant advances in understanding how vegetation and ecosystems can reduce the impacts of extreme weather (e.g., Ferrario et al. 2014, Möller et al. 2014). Field testing is needed to better understand the conditions under which ecosystem-based approaches to adaptation can be most effective (Spalding et al. 2014).

There is thus a rationale for implementing EbA and Eco-DRR as "low-regrets" strategies, based on available evidence and the anticipated multiple benefits they may bring in addition to climate change adaptation and disaster risk reduction. These benefits include the contribution to sustainable livelihoods by maintaining the provisioning of ecosystem services that provide clean water, food and fibre, particularly in developing countries where populations are strongly dependent on natural resources for livelihoods. Ecosystem-based approaches also support heritage conservation and preservation of local identities, such as in forest communities (UNEP and CUAS 2015). Figure 5 demonstrates some additional benefits of EbA and Eco-DRR approaches.

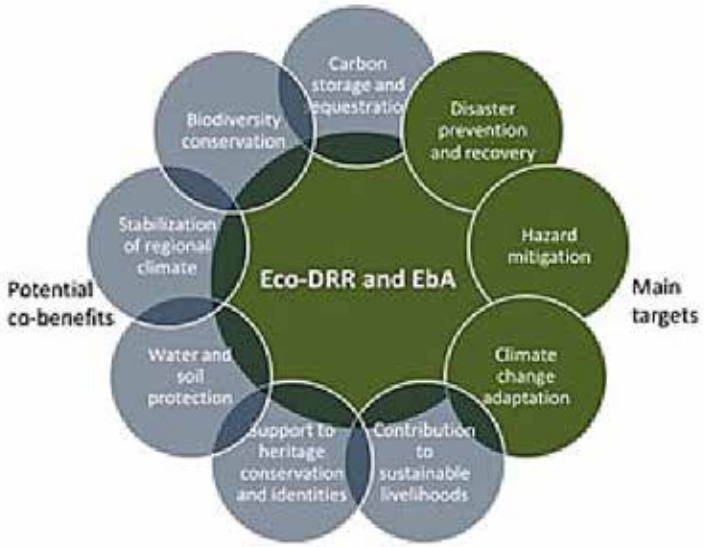


Figure 5: Examples of multiple benefits of Eco-DRR and EbA. Additional benefits include biodiversity restoration, job creation, poverty reduction, and others (UNEP and CUAS 2015).

4.1.1 Challenges and Gaps

While adopted in principle, there can be difficulty in translating knowledge and recognition of the benefits of EbA and Eco-DRR into implementation and action on the ground. Anecdotal examples are common, as seen in the fifth national reports submitted to the CBD and in reviews of case studies. Goals of EbA activities were often described broadly, such as increasing resilience, reducing flooding, ensuring food security, or building capacity. Results were often communicated qualitatively, such as "stakeholder participation increased", or "communities are more informed".

Making the case for EbA and Eco-DRR requires reviewing the evidence base already existing in the literature, including evidence from areas where EbA is implemented without being labelled as such. These include the areas of disaster risk management, sustainable land management, ecosystem restoration, and soil and water conservation (WWF 2013).

To date, there has been little attempt to systematically assemble and analyse evidence for EbA effectiveness across a range of related fields, such as natural resource management, disaster risk reduction and agro-ecology (Munroe et al. 2012). There is a need for further scientific studies on EbA effectiveness, particularly those evaluating before and after effects of EbA implementation in two comparable sites (Reid 2011).

4.1.2 Lessons Learned

Participants at the CBD technical workshop on EbA and Eco-DRR noted that many existing approaches share the same rationale as EbA. In making the case for EbA and Eco-DRR, a rationale for implementing EbA and Eco-DRR as part of overall approaches to climate change and disaster risk reduction is related to the anticipated multiple benefits they may bring. These benefits include contributing to sustainable livelihoods by maintaining the ecosystem services that provide clean water, food and fibre; supporting poverty reduction; heritage conservation; and preservation of local identities. In addition to multiple benefits, other reasons to choose EbA/Eco-DRR include cost effectiveness and avoiding environmental damage by hard infrastructure-based approaches.

Additionally, it is important to seek for synergies in implementation of the different policies and multilateral agreements such as the Sustainable Development Goals, the Sendai Framework for Disaster Risk Reduction 2025-2030, the Strategic Plan for Biodiversity 2011-2020 and its Aichi Biodiversity Targets, and the Paris Climate Agreement adopted at the twenty-first session of the Conference of the Parties to the UNFCCC.

Overall, there should be divestment from measures that have negative impacts on ecosystems, and investment in measures that support restoration and maintenance of biodiversity and ecosystem services to enhance resilience of people to the impacts of climate change.

4.1.3 Opportunities

Choosing adaptation options, whether grey, green, soft, and community-based or a combination of approaches, is a complex, multi-thematic, cross-sectoral process involving diverse stakeholders, including the private sector, scientists, citizens, NGOs and different levels of government. It is important to use a decision-making process that reflects this complexity. However, there is a lack of instruments and tools for assessing EbA and Eco-DRR at various scales and prioritizing best options. The tools that are available need to be piloted, evaluated and refined for further use.

Guiding principles have been used in adaptation to support planning and decision-making. An example of a set of principles are outlined in Figure 6 below, based on an extensive literature review and expert opinion (ETC/ACC 2010). For instance, the guidelines suggest exploring a wide spectrum of adaptation options after having identified priority concerns (further details are provided in ETC/ACC 2010). Priorities can then be identified with the help of tools such as multi-criteria analysis (MCA), cost-benefit analysis, or cost-effectiveness analysis (CEA), which are discussed further below.

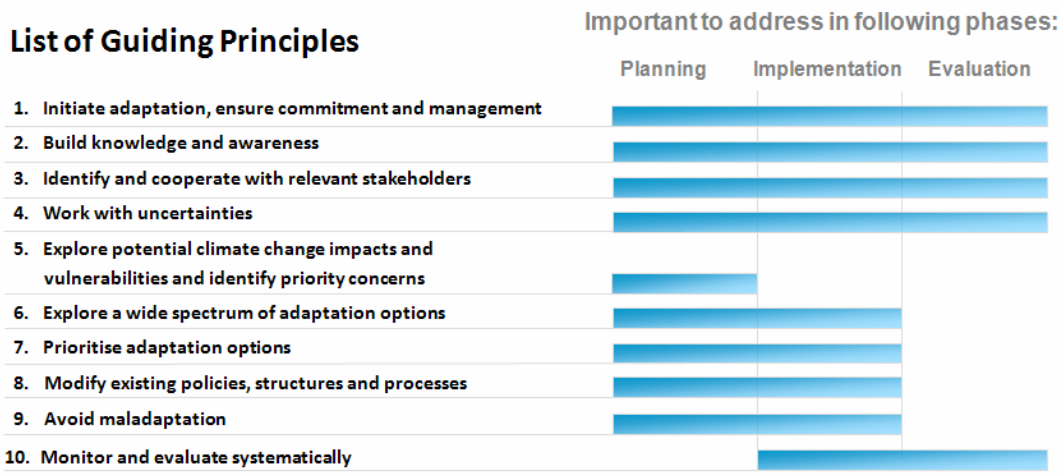


Figure 6: List of guiding principles for good practices in adaptation, for planning and decision-making, developed under the European Environment Agency (ETC/ACC 2010).

4.2 THE ECONOMIC CASE FOR EBA AND ECO-DRR

An essential component for making the case for EbA is demonstrating its economic benefits, particularly in the long term. In decision X/33, the Conference of the Parties to the CBD invited Parties and other Governments to "take into account the values of biodiversity and ecosystem services when planning and undertaking climate change related activities by using a range of valuation techniques." However, it is often difficult to express the multiple benefits in exact numbers, and examples of cost effectiveness have been limited thus far, with few case studies providing quantified economic assessments (Reid et al. 2011, Rizvi et al. 2014). As EbA is a relatively new field of practice, data on benefits are lacking, and there are no standard methodologies for tracking benefits, nor many comparisons between existing methods.

One of the most common methods of appraising adaptation options is cost-benefit analysis, also referred to as benefit-cost analysis. Cost-benefit analysis is a systematic process of identifying, valuing, and comparing costs and

benefits of a project in order to make concrete recommendations. Specifically, it is used to determine the extent to which the benefits of a given project outweigh the costs and to compare the relative merits of alternative projects in order to identify a preferred approach (Brown et al. 2014). Other methodologies include cost-effectiveness analysis (CEA), robust decision-making (RDM) and real options analysis (ROA), each has its own approach, level of uncertainties, and level of effort needed in conducting the analyses. Table 3 provides a brief outline of the advantages and disadvantages of each appraisal method.

Table 3: Methods for appraising the value of EbA and Eco-DRR activities (excerpted from Frontier Economics 2013) (CBA = cost-benefit analysis, NPV=net present value)

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

Several recent initiatives that use valuation of biodiversity and ecosystem services, or appraisal of EbA and Eco-DRR interventions, are outlined below:

a) The Economics of Ecosystems and Biodiversity (TEEB) initiative has provided data and understanding of the contribution of nature to the economies of the world; TEEB and other economic valuation studies have provided evidence that nature provides services that contribute economically to human well-being, and have recommended investment in ecosystems for climate change adaptation and mitigation (TEEB 2010).

b) The Economics of Land Degradation (ELD) Initiative provides a platform for discussion between stakeholders from the policy, science, and private sectors, focused on developing globally relevant data on the economic benefits of land. It highlights the potential benefits derived from adopting sustainable land management practices, including EbA and Eco-DRR practices, and seeks to establish a universal approach for economic analysis of land management.

c) The Secretariat of the Convention on Biological Diversity, the Global Mechanism of the UNCCD, and the OSLO consortium published a report in 2013 on "Valuing the Biodiversity of Dry and Sub-Humid Lands", explaining how valuation techniques can generate economic data in drylands, and how that may be applied in policymaking (CBD et al. 2013). Such data can provide further evidence for EbA and Eco-DRR activities aimed at increasing resilience of drylands communities to drought, land degradation and desertification induced by climate change.

d) The AdaptCost project, funded by UNEP under the Climate Change-Norway Partnership, investigated and built evidence on the potential costs of adaptation in Africa through a detailed review of estimated costs, models, and sector analysis, which was discussed at the Tunis Roundtable on the Economics of Adaptation in 2010 (Watkiss et al. 2010). A preliminary analysis of costs of EbA actions was included. The economics of EbA for Africa was identified as a future priority of the AdaptCost project.

e) Wealth Accounting and the Valuation of Ecosystem Services (WAVES) is a global partnership that aims to promote sustainable development by ensuring that natural resources are mainstreamed in development planning and national economic accounts. The partnership brings together a broad coalition of governments, NGOs, and intergovernmental organizations to implement natural capital accounting (NCA) where there are internationally agreed upon standards, and develop approaches for other ecosystem service accounts.

Case Study 5 highlights the steps taken to conduct an economic analysis of EbA and engineering options for climate change adaptation in Lami Town, Fiji. The process involved an initial assessment of vulnerabilities and the development of scenarios with full participation of stakeholders, using a range of economic analyses including cost-benefit analyses, least-cost analyses, and calculating costs of inaction.

Other cost-benefit analyses have also found that the protection and restoration of mangroves or wetlands (or "green infrastructure") can in some cases reduce the need for expensive engineering solutions (Spalding et al. 2014). Protecting natural habitats can also extend the lifetime of investments in costly hard infrastructure, such as the establishment of salt marsh vegetation to extend the lifetime of a sea wall and for additional coastal protection measures (Temmerman et al. 2013).

In Viet Nam, investing in restoration and protection of 12,000 hectares of mangroves cost the Vietnamese Red Cross approximately USD 1.1 million. It was estimated to cost far more – USD 7.3 million - to pay for dike maintenance had the restoration initiative not taken place. In addition to coastal protection, other benefits included diversifying livelihoods by enabling families to sell crabs, shrimp, molluscs and seaweed that thrive in the mangroves, and increasing their protein intake as a result. The coastal protection benefits were realized after Typhoon Wukong in 2000, where areas with the restored and protected mangroves remained relatively unharmed in contrast to neighbouring provinces which suffered losses in lives, property and livelihoods (Reid et al. 2011).

Case Study 5: An economic analysis of ecosystem-based adaptation and engineering options for climate change adaptation in Lami Town, Fiji.

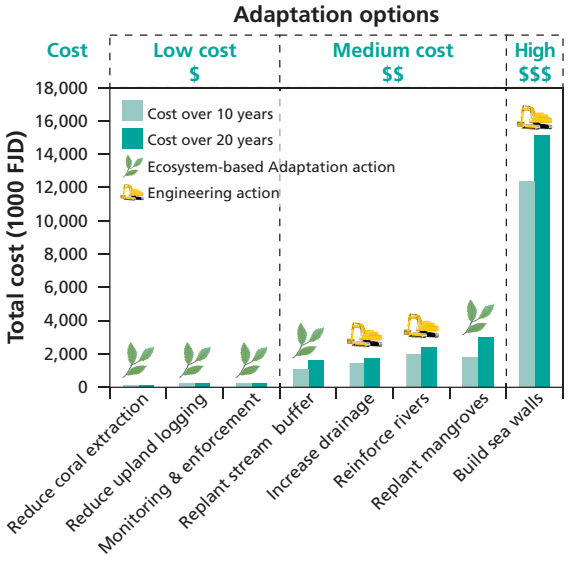
A vulnerability and adaptation assessment of Lami Town, Fiji, demonstrated vulnerabilities to shoreline, riverbank and inland erosion, and potential solutions. To further analyse adaptation options, a cost-benefit assessment of four adaptation scenarios was conducted. These scenarios represent the spectrum of ecosystem-based and engineering adaptation options to reduce vulnerability to storms, which was identified by the Lami Town Council as the principal vulnerability concern.

Key activities included:

- Identifying key areas of vulnerability and possible adaptation options through a vulnerability assessment process with community involvement.
- Classifying potential adaptation activities, including EbA, social/policy and engineering options
- Determining costs for the potential adaptation activities, and performing a least-cost analysis
- Calculating the cost of inaction, or "status quo", including health, business, and household costs, resulting from storms, some of which can be avoided by adaptation actions
- Developing scenarios ranging from EbA to engineering options
- Conducting a cost-benefit analysis of each scenario

Results showed that the ecosystem-based approaches cost less than the engineering options when considering both 10-year and 20-year timelines. However, taking any action to protect the coastal community from storms — either ecosystem-based adaptation or engineering — was preferable to not taking action at all.

-—Rao et al. 2013



The UK Climate Change Risk Assessment identified risks and opportunities climate change is likely to bring to different sectors. Flood risk is predicted to increase, affecting properties, agriculture, health, transport, energy, business, and the natural environment. The Economics of Climate Resilience (ECR) was commissioned by the UK Government (Defra and the Devolved Administrations (DAs)) to inform the UK's first national adaptation programme. In the first phase, evidence was provided to assist policymakers and other stakeholders in understanding the extent of current and expected adaptation actions, the relative effectiveness of those actions, and the barriers to their implementation. The second phase focused on how robust decisions could be made when considering alternative adaptation actions. A framework was developed for gathering data and selecting the most appropriate methods for appraising adaptation actions, as outlined in Figure 7.

The conclusions of the UK study were that in the context of flood risk management, in the majority of cases, an appraisal method based on the principles of robust decision-making (RDM) offers practitioners the most reliable approach to choosing between alternative adaptation options because of its comprehensiveness and ability to deal with deep uncertainty. Case Study 6 below from Pickering, North Yorkshire, UK, illustrates using robust decision-making to appraise natural flood defence adaptation measures.

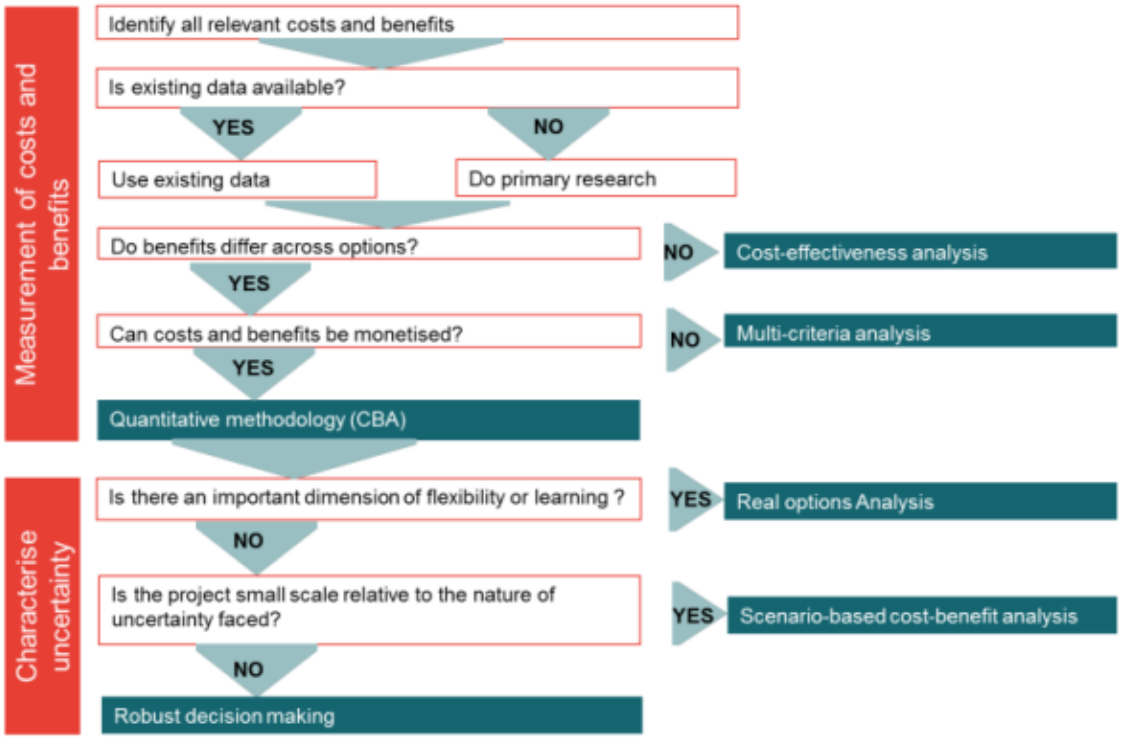


Figure 7: Framework for gathering data and selecting the most appropriate methodology for appraising adaptation (Frontier Economics 2013).

Case Study 6: "Slowing the Flow": Using robust decision-making to appraise natural flood defence adaptation measures in Pickering, North Yorkshire, UK

In the "Slowing the Flow"" project, a package of flood defence measures was proposed for the Pickering area in North Yorkshire, UK, which has suffered from £7 million of damage to businesses, homes, and local infrastructure. The hybrid defence measures included EBA/Eco-DRR activities such as planting riparian and floodplain woodlands, establishing no-burn buffer zones along moorland streams, and restoring streamside buffer zones. Robust decision-making (RDM) was selected as the most appropriate appraisal method for potential adaptation actions to manage flood risk. The results of the RDM analysis showed that the package of proposed flood defence measures was largely beneficial, driven by the co-benefits created by the natural measures. Sensitivity analyses were performed in order to test the robustness of the results and also identify the conditions under which the natural flood defence measures are cost effective. This case study also provides an example of where hybrid engineering and EbA approaches were chosen due to both cost-effectiveness and acceptability to the local community, which was opposed to the visual impacts that would have resulted from the initially proposed hard-engineered approach.

— Frontier Economics, 2013

4.2.1 Challenges and Gaps

The review of fifth national reports indicated that across the EbA activity spectrum, valuation and cost-benefit analyses ranked very low in terms of Parties' reported activities, representing only 3% of all EbA activities. When reviewing a similar number of studies in the broader literature, and submissions from organizations, the figure rose to 8%. This small figure may reflect the fact that these types of analyses have been beyond the reach of most countries and institutions due to the significant data, financial resources and technical expertise required to

conduct them. In fact, these analyses tend to be conducted by well-resourced institutions or partnerships. Lack of resources, both technical and financial, may impede countries' abilities to analyse economic benefits of EbA.

Given the early implementation stage of EbA programmes and activities, there is also a lack of data on the economic value of non-economic benefits (e.g., soil retention, cultural value, biodiversity conservation, etc.) to inform valuation and cost-benefit analyses.

4.2.2 Lessons Learned

With regards to making the economic case for EbA and Eco-DRR, participants at the CBD technical workshop on EbA and Eco-DRR noted that:

1. Economic valuation methods such as cost-benefit analysis and cost-effectiveness analysis can vary in scope of assessment and cost. A quick assessment may suffice and is often much less expensive, whereas complex assessments can be costly.
2. Costs and benefits need to be captured more broadly, including unintended impacts of an intervention and opportunity costs that may result from its implementation.
3. The interpretation of the results of some economic analyses is dependent on values which may differ for decision makers and stakeholders; for example, labour can be reported as a cost, but can also be seen as a benefit from the perspective of job creation.
4. Other values that are non-economic or non-quantifiable are also important to consider when planning and undertaking climate change-related activities.
5. Costs and benefits may also not be distributed equally among stakeholders or sectors of society, creating incentives for some to implement EbA, but not for others (Rizvi et al. 2014). Methodologies for understanding how the benefits and costs of EbA are distributed is therefore essential for evaluating EbA benefits.
6. Valuation should be part of a suite of measures and incentives to encourage the implementation of ecosystem-based approaches when appropriate.

> Economic valuation as a tool in decision-making should not be used alone. Decision-making processes should balance economic information and non-monetary values, such as the cultural and spiritual values, ascertained from engagement with experts and local stakeholders
>
> — IUCN 2014

4.2.3 Opportunities

Costs and benefits of EbA activities need to be evaluated in order to effectively make the case for implementing EbA. While data gaps and lack of capacity may impede such efforts, innovative tools and frameworks are currently being developed and tested.

One example is the InVEST (Integrated Valuation of Environmental Services and Trade-offs) suite of modelling tools which maps, quantifies, and estimates the value of ecosystem services, helping decision makers to evaluate the economic and spatial impacts of development and climate change. InVEST combines spatial and biophysical models with economic techniques (e.g. avoided damage cost or market valuation) to value ecosystem services, improving upon traditional cost-benefit analysis methods by addressing variation in the distribution of costs and benefits across an area (Rosenthal et al. 2013). InVEST has been piloted in several countries, including Belize, where it was used develop a national integrated coastal zone management plan.

Another example is a screening methodology currently proposed for evaluating the role of green infrastructure for mitigating vulnerability to weather and climate-related natural hazards in Europe, as outlined in a recent report of the European Environment Agency (EEA 2015). The results of an initial assessment addressing landslides, avalanches,

floods, soil erosion, storm surges and carbon stabilization have shown that it is possible to use ecosystem services to assess green infrastructure activities and identify potential areas for conservation and restoration.

The development of decision-making tools such as InVEST, screening methodologies for assessing green infrastructure potential, and valuation of ecosystem services, is rapidly evolving. Many advances are anticipated in the future. For example, InVEST currently provides options in an assumed stable climate and therefore does not account for vulnerability of ecosystems to climate change. To address this shortcoming, Natural Capital Project partners, Stanford University and WWF, are working with the Center for Climate Systems Research at Columbia University to begin integrating climate risk information into ecosystem service models. Continued development and refining of valuation methods and tools is necessary to help countries better evaluate adaptation options and demonstrate the economic value of ecosystem-based approaches to adaptation and disaster risk reduction.

4.3 COMMUNICATING EBA AND ECO-DRR: DEVELOPING CAPACITY AND DISSEMINATING KNOWLEDGE

Successful implementation of EbA and Eco-DRR actions require that practitioners and policymakers communicate effectively with a diverse range of stakeholders. This involves communicating complex concepts such as uncertainty and probabilistic information, ecosystem services and their value, and often very technical scientific data. Effective communication also depends on a strong understanding of local values, knowledge and perspectives, as discussed further in section 7.

The Capacity for Disaster Reduction Initiative (CADRI), created in 2007, provides an example of a strategic communications strategy for DRR. CADRI is an inter-agency programme of UNDP, UNICEF, WHO, and other partners. CADRI provides advisory services to national authorities and organizations on capacity assessments and strategy development, assists in training and facilitation services, generates learning packages and capacity development methodologies, and promotes knowledge exchange and networking to foster partnerships and to disseminate good practices. As of 2013, CADRI supported 18 countries to undertake National Disaster Risk Reduction Capacity Assessments, of which nine countries have National Plans of Action in Capacity Development for Disaster Risk Reduction.

Findings from an independent evaluation indicated that during the first implementation phase (2007-2012), CADRI successfully brought together representatives of UN organizations and national stake-holders to develop a robust and coordinated framework for capacity development for DRR. CADRI developed a capacity development concept and methodology that was operationalized in a number of countries, with a focus on capacity assessments, prioritization of capacity development needs, and action planning.

Strategic presentation of EbA and Eco-DRR options are a crucial part of national and regional strategies and programmes for climate change adaptation. An example from South Africa's fifth national report is presented below.

Case Study 7: Making the case for biodiversity in South Africa

The "Making the Case for Biodiversity" project was undertaken in South Africa with the help of marketing and communications experts. It resulted in a framework identifying the indicators for local government actions that are supportive of sustainable management, restoration of ecosystems, and related job creation, and are prioritized for effective climate change adaptation and disaster risk reduction, especially in relation to water security.

Case studies were compiled and presented to appeal to audiences on a personal level, to provide good narrative evidence, and to facilitate emotional investment. An example of a project including both EbA and Eco-DRR-related activities is the assessment of impacts and vulnerability in the Eden district municipality, and identification of opportunities to adapt to the negative impacts of climate change on water resources. Opportunities for EbA and Eco-DRR activities include restoring wetlands and grasslands surrounding rivers, and clearing invasive alien species along the river banks and surrounding grasslands, thereby releasing more water back into the river.

To make the case for these activities, the costs of disasters were presented: a 3-year drought in one area cost of R166.6 million in relief funding to help farmers feed their livestock, and flood damage in other regions cost R360 million in damages. Ecosystem restoration measures were presented as a relatively small investment with massive returns in water yields, in contrast to engineering solutions such as desalinization, which is costly and energy intensive. Restoration also yields the additional co-benefits of boosting socioeconomic resilience by helping job creating agribusinesses to respond to risks posed by climatic and other environmental change.

This project involved an initial research and development phase that evolved into a sector-wide communication campaign that was tested at the seventeenth session of the Conference of the Parties to the UNFCCC, in Durban, South Africa. The Making the Case for Biodiversity project highlighted the need to show how biodiversity is relevant to the government's current priority issues – for South Africa these are job creation, poverty alleviation and rural development.

— excerpted from South Africa's fifth national report and "A Flower in the Heart of Eden", Case Study 7 in the "Making the Case for Biodiversity" project

5. TRADE-OFFS, THRESHOLDS AND LIMITATIONS

5.1 TRADE-OFFS

Trade-offs, in the context of EbA and Eco-DRR, may arise when an activity protects one group of people at the expense of another, or favours a particular ecosystem service over another. Some trade-offs are the result of deliberate decisions; others occur without knowledge or awareness. Analysing potential trade-offs when implementing EbA and Eco-DRR is critical in order to prevent maladaptation (Rodriguez et al. 2009).

Examples of trade-offs include the following:

- Using wetlands for coastal protection may require emphasis on silt accumulation and stabilization, possibly at the expense of wildlife values and recreation (BirdLife International 2009);
- EbA measures in urban areas may be perceived as a trade-off between ecosystems and urban development needs (UNEP 2014);
- The management of a forest to reduce landslides or erosion may also affect water quality downstream or limit recreational use;
- Restoration activities with a short-term focus on agricultural production can lead to the longer-term loss of soil quality (Rodriguez et al. 2006);
- Protection forests to stabilize slopes may utilize species that result in a trade-off with recreational opportunities or other services.

Trade-offs can also occur when setting targets and indicators for monitoring and evaluating EbA and Eco-DRR – for example, the best indicators may not be the most measurable, or particular goals may not attract funding, or appeal to policymakers (Mitchell et al., Overland Development Institute 2013).

In the review of fifth national reports and NBSAPs, trade-offs were rarely mentioned in relation to biodiversity conservation, EbA or DRR measures, suggesting that there has been limited experience to date of evaluating and considering potential trade-offs. Much of the broader literature contains examples of trade-offs encountered when evaluating ecosystem services in the context of broad conservation planning objectives, with fewer examples of trade-offs encountered or described in EbA and Eco-DRR implementation.

In the Great Green Wall Initiative, which aims to enhance resilience of West African and Sahelian countries, trade-offs occur between multiple uses such as demand for rich floodplains for grazing or crops, or woodlands' value for fuelwood versus watershed function and protected areas (GEF 2011). The Great Green Wall Initiative aims to address these trade-offs by improving land use planning via grazing reserves and conservation areas.

There has been an impetus to restore mangroves for habitat, biodiversity, and, particularly, for coastal protection properties. In some cases this has led to some short-sighted planning, for example, planting mangroves in areas not favourable for growth such as on tidal mudflats, using species that did not grow well in the area. This has not only led to a waste of resources, but a loss of tidal mudflat ecosystem services. Even with the right species, mangrove afforestation on mudflats can favour the shoreline stabilization ecosystem services over tidal flat services. In some cases, as noted by participants at the CBD technical workshop on EbA and Eco-DRR, planting mangroves also displaced seagrasses – which also provide carbon sequestration and wave attenuation services, in addition to habitat for various species. Displacement of some species as a result of mangrove afforestation has been documented in some cases (e.g. Lewis 2001).

Trade-offs can also occur in making the choice between long and short-term benefits, as illustrated in the case study below.

Case Study 8: Trade-offs between short and long-term benefits: coffee production

Ecosystem services such as pollination, pest control, climate regulation, soil stabilization, and nutrient sequestration are generally greater in shaded coffee farms, but many coffee-growing regions are removing shade trees from their management because of the significant up-front labour investment needed for their establishment (Jha et al. 2014).

Practices such as using cover crops can thus require farmers to make difficult trade-offs between the adaptation benefits they can provide in the longer term (enhanced resilience to climate change, provisioning of essential ecosystem services) and the initial large investment needed to establish and maintain the cover crops.

The long-term benefits of using shade trees include timber production, increasing the nutrient content of, and enhancing resilience to climate change. However, coffee yield per hectare is lower compared to not using shade trees. Because coffee yields are typically assessed independently from yield of timber, other crops, or ecosystem services, it may be difficult for governments and conservation institutes to weigh the benefits of diversified farming approaches (Méndez et al. 2009).*t*

5.2 THRESHOLDS AND LIMITATIONS

While EbA and Eco-DRR have been promoted as cost-effective, low-regrets measures that can yield multiple benefits, it is important to recognize the potential limitations of using ecosystem-based approaches for adaptation or DRR. Ecosystems are subject to climate change impacts, and therefore ecosystem-based approaches can also be vulnerable to change, which should be accounted for when planning activities.

While acknowledging potential thresholds and limitations of EbA and Eco-DRR, they should be considered within overall integrated adaptation or DRR strategies. Case Study 9 demonstrates how protection forests combined with other measures are helping people adapt to climate impacts in the Alps.

Case Study 9: Ecosystem-based approaches within an overall adaptation/DRR strategy in the Alps

Rising temperatures, shrinking glaciers and melting permafrost are exacerbating existing risks of avalanches, rockfalls, and floods, and presenting new risks such as glacial lake outburst floods in the Alps. The regional Platform on Natural Hazards of the Alpine Convention (PLANALP) develops approaches for the integrated reduction of natural hazards, identifies best practice and intensifies the cross-border exchange of knowledge and experience, cooperating closely with relevant international and national institutions.

PLANALP's strategy for adaptation to climate change includes integrated climate-proof risk management measures, such as the ecosystem-based approach of maintaining and improving the functionality of protection forests. This EbA approach is integrated within an overall adaptation and DRR strategy that includes other essential measures, such as:

- Preparing for emergency intervention;
- Reviewing the climate change fitness of existing structural protection measures;
- Enhanced coordination between spatial planning and risk management;
- Setting up and optimizing long-term monitoring and warning systems;
- Establishing a risk culture and initiating risk dialogue;
- Strengthening individual preparedness and precaution.

5.3 LESSONS LEARNED: TRADE-OFFS AND THRESHOLDS

The consideration of trade-offs should be present throughout the risk assessment, scenario planning, and adaptive management approaches for EbA and Eco-DRR implementation. In addition to monitoring the short-term provisions of services, managers should also monitor the long-term evolution of slowly changing variables. Policies can then be developed to take into account trade-offs at multiple spatial and temporal scales, and to minimize the effects the effects of ecosystem service trade-offs (Rodriguez et al. 2006).

Tools such as InVEST (Integrated Valuation of Environmental Services and Trade-offs) can assist decision makers in identifying potential trade-offs in provisioning of ecosystem services under different scenarios. Other tools and guidance are needed to assist in trade-off analysis for EbA and Eco-DRR implementation.

6. IMPLEMENTING EBA AND ECO-DRR

6.1 ASSESSING VULNERABILITIES, IMPACTS, HAZARDS AND RISKS

Central to implementation of EbA and Eco-DRR are prior assessments of vulnerabilities, impacts, hazards and risks related to climate change and disaster risks. While conceptually similar in both EbA and Eco-DRR, this planning phase utilizes different terminology and some differences in focus or approach.

In EbA, impact and vulnerability assessments usually focus on livelihoods, human vulnerability and ecosystems (e.g. impacts of climate change on biodiversity loss and ecosystem integrity), and developing future change scenarios (Doswald and Estrella 2015).

> The Conference of the Parties to the Convention on Biological Diversity invited Parties and other Governments to assess the threats and impacts of climate change on biodiversity and biodiversity-based livelihoods and identify regions, ecosystems and components of biodiversity, that are vulnerable to climate change.
>
> —decisions IX/16 and X/33

A generic framework for climate change adaptation is illustrated in Figure 8, showing the four major elements of the adaptation process: prior assessment, planning of adaptation actions, implementing, and monitoring and evaluation.

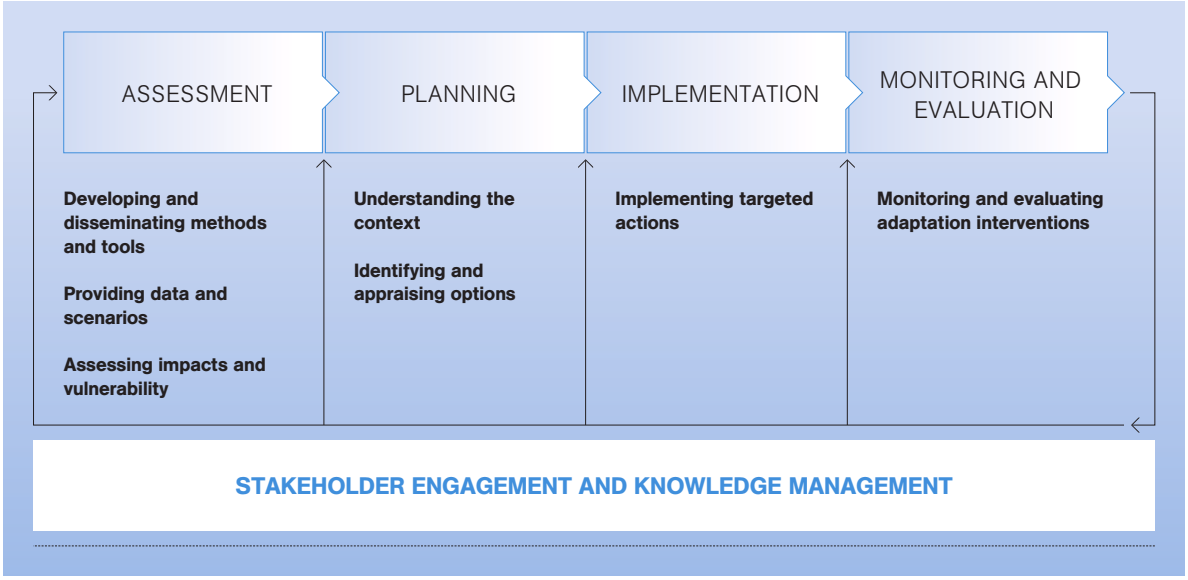


Figure 8: The adaptation process, beginning with an assessment of climate risks and vulnerability (UNFCCC 2011).

Similarly, planning and implementation of Eco-DRR includes prior disaster risk assessments (DRA). These usually start with a focus on hazards, exposure and vulnerabilities as core elements to understanding disaster risk, but also assessing linkages to environmental conditions and natural resource management (Doswald and Estrella 2015). Figure 9 shows the typical disaster management cycle, and a modified cycle (or spiral) that incorporates the ecosystem approach.

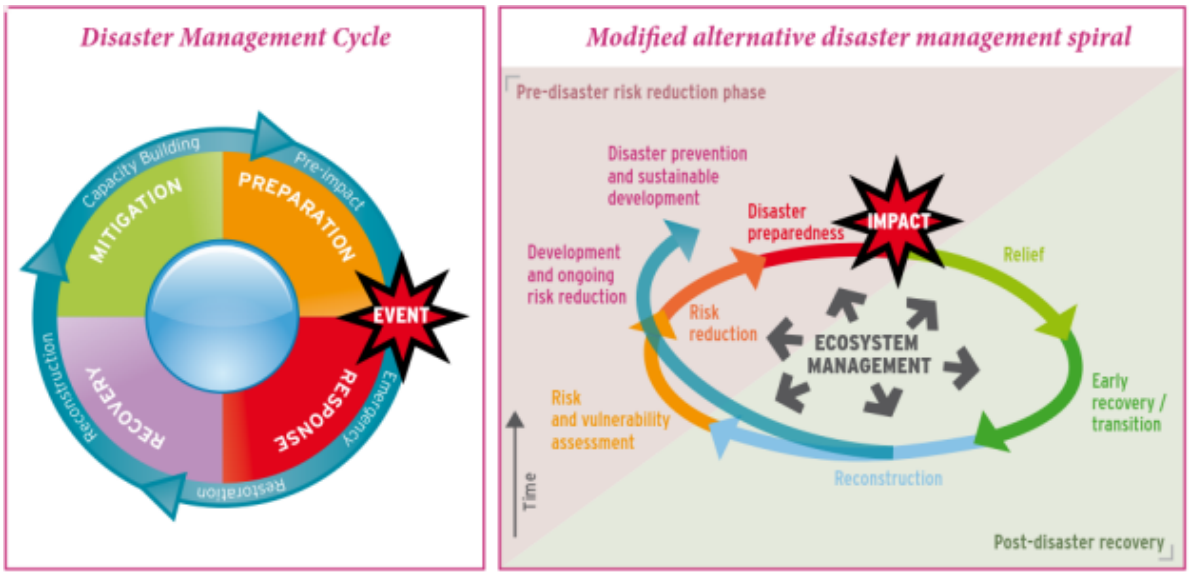


Figure 9: The traditional disaster management cycle (left panel), and disaster management cycle modified to incorporate ecosystem management (Sudmeier-Rieux 2013).

The review of fifth national reports, NBSAPs, review of project portfolios and case studies from the broader literature indicated that many countries have identified vulnerabilities, impacts and exposure to climate change impacts and hazards. Some assessments were conducted in the context of the UNFCCC national adaptation plan (NAP) and national adaptation programme of action (NAPA) processes. Examples include:

a) In Burkina Faso's NAPA, developed as part of the "Strengthening Adaptation Capacities and Reducing the Vulnerability to Climate Change" GEF-funded project, the agro-forest-pastoral sector was identified as the sector most affected by climate change.

b) In Mongolia, ecological threat assessments were conducted in the Gobi, steppe and Khangai mountain regions (reported in Mongolia's fifth national report).

c) In Ecuador, assessment of vulnerabilities and impacts was conducted as part of a project on water governance, utilizing diverse tools such as climate change scenarios, models, and vulnerability studies, which were used to increase capacity to manage water and agricultural resources (reported in Ecuador's fifth national report).

d) In a workshop on "Assessing the impacts of climate change on Madagascar's biodiversity and livelihoods", results of prior surveys in communities were combined with technical session discussions to identify vulnerable livelihoods and potential adaptation options for agriculture and husbandry, forestry and fishing (Conservation International and WWF 2008).

Experiences in assessing vulnerabilities at the country level, with the goal of developing a more generalizable method for vulnerability assessments, are illustrated in Case Study 10.

A scenario is a "plausible and often simplified description of how the future might develop based on a coherent and internally consistent set of assumptions about driving forces and key relationships. Scenarios may be derived from projections, but are often based on additional information from other sources, sometimes combined with a narrative storyline" (IPCC 2007). Using scenarios can help stakeholders to assess vulnerabilities under a range of plausible climate futures, and to identify options, including ecosystem-based approaches, that will succeed under multiple scenarios, as well as options that will not work in any scenario (WWF 2013). Scenario planning helped inform vulnerability to flooding in Tonle Sap, Cambodia, discussed below in Case Study 11. Examples of guidance on scenario development are available in Annex 4.

Case Study 10: Coastal resilience to climate change in Cameroon, Fiji and Tanzania: developing a generalizable method for assessing vulnerability and adaptation of mangroves and associated ecosystems

A generalizable methodology for climate change vulnerability assessments and adaptation was developed in Cameroon, Fiji and Tanzania as part of the GEF-funded project "Coastal Resilience to Climate Change". The project aimed to build the capacity of stakeholders to adopt and apply the assessment in other sites and countries.

At the start of the project, there was limited understanding and capacity for vulnerability assessment and adaptation. By the end of the project, partners and stakeholders had gained considerable understanding and skills regarding these issues, as evident in the technical reports produced, continuation of activities in the post-project period, and uptake of elements of the project results in other initiatives. It was evident that the project had also succeeded in increasing awareness among a wide cross-section of stakeholders about climate change impacts on mangrove ecosystems and the human communities that rely on them.

The project was not without challenges, which included lack of in-country expertise, high staff turnover, poor communication among project partners, and limited technical guidance to the countries.

A major outcome was that by directly engaging stakeholders at local and national levels in the execution of the project as well as through targeted training workshops, the project has laid a strong foundation for climate change vulnerability assessments and adaptation of mangroves within the three countries and also helped to incorporate some of their needs.

—GEF Portfolio, Project ID 2092

Case Study 11: Using scenarios in assessing vulnerabilities in Tonle Sap, Cambodia

In Cambodia, climate change is altering rainfall patterns, resulting in a longer, hotter dry season for the region around the Tonle Sap, the largest freshwater lake in Southeast Asia. As a result, the lake's floodplain is shrinking and impacting fishery yields and freshwater availability. High levels of deforestation and the construction of several dams pose other threats.

Approximately 1.2 million people depend on the Tonle Sap for food and freshwater. In order to increase the resilience of the ecosystem to altered precipitation patterns and reduce vulnerability of people, the project aims to restore and protect the region's freshwater ecosystems.

Vulnerability to flooding was assessed using a range of climate change scenarios, and areas were identified where management was most likely to be able to continue delivery of ecosystem services. Based on this information, restoration measures were implemented in flooded forests, including replanting schemes and community fisheries.

—Government of Cambodia (Fisheries Administration), Conservation International
(https://unfccc.int/files/adaptation/application/pdf/37eba.pdf)

6.1.1 Challenges and Gaps

Lack of local climate data was often cited as a challenge in assessing vulnerabilities and risks to prepare adaptation strategies. Future climate change projections are often not available at a local scale where field-level interventions are generally implemented (Doswald and Estrella 2015). The ability of current climate models to predict extreme events is limited, although improving.

As reported for other stages of EbA and Eco-DRR implementation, lack of financial, technical and human resources was often cited by countries as a barrier to effective assessments of vulnerabilities and impacts.

6.1.2 Lessons Learned

EbA and Eco-DRR options should be selected and implemented based on guidance from vulnerability assessments, taking into consideration underlying drivers of change, existing policies, and community perceptions. For example, in the agricultural sector, climate impacts affect production and can result in reduced yields, which impact food security and the economy. In addition, land use can also have impacts on production, on ecosystems and the economy. Policy decisions can also influence change in a supportive way, or in a maladaptive way by, for example, promoting monocultures of crops poorly adapted to local conditions or causing agriculture to expand into other land cover types.

Even if ecosystems are well managed and healthy now, they are nonetheless vulnerable to climate change in the future, and this should be taken into consideration in assessing vulnerability.

In promoting adaptation to climate change, it is important to consider unifying frameworks and concepts that recognize the linkages between people and ecosystems as integrated socioecological systems, rather than viewing adaptation through only a social or human lens. People are part of ecosystems, and human and ecosystem vulnerabilities interact and impact on each other both positively and negatively.

Care is needed to avoid conflating two strongly and closely related processes: i) the identification of vulnerable ecosystems which need to be protected and managed for biodiversity conservation; and ii) the identification of ecosystems, whether they are vulnerable or not, that can support people as they adapt – in the latter case, it is also important to assess people's vulnerability to climate change. EbA or Eco-DRR do not necessarily focus on reducing the vulnerability of ecosystems. The main focus of EbA and Eco-DRR is to help vulnerable populations of people to adapt to climate change.

6.1.3 Opportunities

Several frameworks and planning tools have been developed to provide operational guidance on EbA, including the assessment stage. As vulnerability assessments and disaster risk assessments are relatively new in development, identifying principles of effective assessments will be helpful.

Some tools available for countries to use include the UNEP Ecosystem-based Adaptation Guidance (UNEP 2012); the Community-based Risk Screening Tool – Adaptation and Livelihoods (CRiSTAL) by IISD, IUCN and the Stockholm Environment Institute; the IUCN Learning Framework on EbA (IUCN 2013); and the WWF Operational Framework for EbA, which was developed for and field tested in the Greater Mekong Sub-region (WWF 2013). RiVAMP is a tool which aims to develop an assessment methodology that integrates ecosystems and climate change factors in the analysis of disaster risk and vulnerabilities. Some of these tools are described in greater detail in Annex 4, and are included as resources to consult in the References section.

The importance of effective communication to make the case for EbA and Eco-DRR is highlighted above in section 4. Innovative communication strategies can also be harnessed for the purpose of assessing vulnerabilities.

There appear to be more innovative communication strategies developed for disaster risk reduction specialists than for adaptation practitioners – perhaps due to the urgency of crisis response to save lives. For example, the Code for Resilience global initiative connects technical experts with mentors and sector specialists to create tech-based tools that help reduce disaster risk.[11] A global competition launched in 2014 challenged software developers across the world to create useful mobile phone application to strengthen community resilience to natural disasters. Many of the applications are more relevant to evacuation procedures and emergency responses. However, an example of an application also useful for EbA purposes is Jakarta's Flood Alert application (from Indonesia), which monitors 14 sluices for current water levels, changes in the past six hours, and other measures. Users get the latest information

11 http://www.codeforresilience.org/.

about the sluices' condition and the chances of upcoming floods in specific locations, which can be shared through social media to inform and prepare others in the area.

6.2 INTEGRATING EBA AND ECO-DRR INTO PLANNING AND POLICY

The tenth meeting of the Conference of the Parties urged Parties and other governments to use revised and updated NBSAPs as instruments for the integration of biodiversity targets into national development and poverty reduction policies and strategies, economic sectors and spatial planning processes (decision X/2). Parties were also invited to integrate ecosystem-based approaches for adaptation into relevant strategies, including adaptation strategies and plans, national action plans to combat desertification, NBSAPs, poverty reduction strategies, disaster risk reduction strategies and sustainable land management strategies (decision X/33).

The Sendai Framework for Disaster Risk Reduction 2015-2030 (Sendai Framework) was the first major agreement of the post-2015 development agenda. The adopted framework contains seven targets and four priorities for action, which provide impetus for governments to strengthen and invest in disaster risk governance, prioritizing "ecosystem-based approaches…to build resilience and reduce disaster risk".

A review of the fifth national reports, NBSAPs, literature and project portfolios unveiled details and lessons learned from several case studies of integrating EbA and Eco-DRR into national policies, outlined below.

6.2.1 National Plans and Strategies

National Biodiversity Strategies and Action Plans (NBSAPs)
Yemen's NBSAP contains objectives to enhance the local community and ecosystems' resilience against natural disasters through strengthening disaster preparedness, renovation of terraced agriculture, riverbank protection, establishment of flood protection structures, and restoration and conservation of degraded watersheds, rangelands, forest, and coastal wetlands.

One of the five strategic goals for biodiversity outlined in Jordan's NBSAP is enhancing the national understanding of dryland ecosystem benefits to national resilience, economic sustainability and local livelihoods. More information on NBSAPs is presented in the section on national targets below.

National Adaptation Programmes of Action (NAPAs)
Established by the UNFCCC in 2001, national adaptation programmes of action (NAPAs) provide a process for least developed countries (LDCs) to identify priority activities that respond to their urgent and immediate need to adapt to climate change – those for which further delay would increase vulnerability or costs at a later stage.

In Samoa, climate-induced disasters affect food production, water availability, watershed health, and biodiversity resources. Tourism is threatened by beach erosion, saline intrusion, and degradation of coastal ecosystems. Samoa was one of the first LDCs to prepare and submit a NAPA, which integrates EbA into five out of nine priority projects. EbA activities include integrated watershed management and restoration of coastal springs, sustainable management of forests, and diversified farming systems to enhance resilience to drought (Chong 2014). The EbA activities have been implemented under the Least Developed Countries Fund and the Adaptation Fund.

In Cambodia, 3 of 20 high-priority projects included in the NAPA are EbA and Eco-DRR such as rehabilitation of the upper Mekong waterways to restore flood mitigation capacity, vegetation planting to protect flood damage, and community mangrove restoration to stabilize shorelines, prevent seawater intrusion, and provide biodiversity products for coastal communities (Cambodia's NAPA, Chong 2014).

In the Maldives, the NAPA contains a complete vulnerability assessment of coral reef biodiversity. Activities within the NAPA to promote the adaptation of reef biodiversity include the establishment of marine protected areas and enforcement of the coral mining ban.

Case Study 12: EbA activities in Madagascar's national adaptation programme of action

Madagascar is one of the most biologically diverse places on Earth, with one of the highest rates of endemism. Forests cover 22.6% of the national territory. Biodiversity distribution, species and populations are vulnerable to increased extreme events such as droughts and cyclones leading to soil erosion. Health conditions, access to water and related primary needs are expected to be negatively impacted by climate change. Livelihoods and overall national productivity will also be impacted, in addition to an increase in sociocultural and boundary conflicts and threats to agricultural activities, which may drive migration towards urban areas or areas where there is better access to water. Adaptation strategies should take into account recurrent poverty as well as biodiversity vulnerability and provide activities that combine diverse ecosystem resilience with community benefits.

The national adaptation programme of action (NAPA) of Madagascar identified two priority adaptation strategies related to the forest sector:

i. Reforestation of rural areas with their specific reforestation plans based on locally appropriate species (estimated projects costs: USD 74,250). Conserving corridors and connecting isolated forest blocks to have continuous forest migration routes are critical to maintaining resilience in the face of future climate change;

ii. Promoting the transfer of forest management to local communities (estimated cost USD 94,980).

Agroforestry is also being implemented in the deforested hillsides of Madagascar, which are the focus of reforestation efforts. The massive erosion gullies or "*lavaka*" have a beneficial funneling effect of water and nutrients that result in rich, fertile soils at their base. Local communities are now practising agroforestry at the base of the "*lavaka*".

The products of the agroforestry system (vanilla, cloves and coffee) provide local people with important cash income, as well as other non-timber forest products such as honey. Agroforestry cultivation conserves the forest habitat for the unique flora and fauna of Madagascar. The rice terraces, moreover, stabilize the fragile soils and prevent erosion.

- Government of Madagascar, submitted at the CBD technical workshop on EBA and Eco-DRR

Tanzania has identified eight projects within its NAPA that have a direct or indirect link to EbA and Eco-DRR measures. These include catchment conservation and sustainable use, forest fire prevention and wildlife extension services (SCBD 2014).

National Adaptation Plans (NAPs)

The national adaptation plan (NAP) process was established under the Cancun Adaptation Framework of the UNFCCC. It enables Parties to formulate and implement national adaptation plans as a means of identifying medium- and long-term adaptation needs and developing and implementing strategies and programmes to address those needs. It is a continuous, progressive and iterative process. As most NAPs are still under development, there were fewer examples available of NAPs that included EbA actions. Colombia's experience with promoting EbA and Eco-DRR within the framework of the NAP is described below.

Case Study 13: EbA activities in Madagascar's national adaptation programme of action

Colombia´s national adaptation plan to climate change has been developed as a dynamic process that started at 2011. The NAP defines guidelines for country sectors and territories to develop actions to reduce vulnerability and include climate change and climate variability in their planning processes, through the development and implementation of territorial and sectoral adaptation plans.

Colombia's NAP promotes EbA and Eco-DRR approaches by identifying vulnerable socioecological systems, concentrating efforts towards analysing impacts of climate change in combination with other drivers of change and loss of biodiversity and ecosystem services. To date, Colombian entities have formulated 11 territorial climate change adaptation plans. These plans assist decision makers in identifying the vulnerability of the territory and define adaptation measures to be incorporated into the different development and spatial planning instruments. EbA and the Eco-DRR measures that are currently being implemented in the NAP include:

- The rehabilitation of wetlands and their hydrology as a means to reduce risk of flooding and drought associated with climate change and variability.
- The identification and implementation of adaptation measures designed to mitigate the impacts of climate change on the water yield and hydrological regulation capacity of the wetlands and high mountain ecosystem.

The NAP also identifies key entry points for the application of EbA and the Eco-DRR approaches regarding water supply, specifically:

- Moors (páramo, Andean woodlands), wetlands, high Andean forests, cloud forests and tropical forests;
- Mitigation of the impacts of extreme events through buffer structures;
- Prevention of erosion and sediment control.

- Government of Colombia, submitted at the CBD technical workshop on EBA and Eco-DRR

National Climate Change Policy

EbA activities have been included in the Government of Niue's National Climate Change Policy, developed in 2009, which defines the position of government and other stakeholders on the issues of climate change, variability and sea level rise. The vision and goal of the climate change policy is "a safer, more resilient Niue to impacts of climate change and towards achieving sustainable livelihoods." Activities under the policy include the documentation and sharing of traditional practices regarding crop production, forestry and fisheries management, including EbA approaches.

Disaster Management Plans

The Government of Niue's Joint National Action Plan (JNAP) for Climate Change Adaptation and Disaster Risk Management[12] provides a three year plan of action to address existing gaps relating to vulnerability to climate change impacts and disasters. Developed in partnership with Pacific regional organizations (SPC/SOPAC and SPREP), the Government of Niue has identified five priority areas of attention, which form the goals in the JNAP Implementation Matrix: 1) Strong and effective institutional basis for disaster risk reduction / climate change adaptation; 2) Strong public awareness and improved understanding of the causes and effects of climate change, climate variability and disasters; 3) Strengthened livelihoods, community resilience, natural resources and assets; 4) Strengthened capacity to adapt renewable energy technologies and improve energy efficiency; and 5) Strengthened disaster preparedness for effective response.

Development Policy

Climate change has been recognized as the largest threat to sustainable development in Samoa. There is significant conservation focus on forests and trees given their role in the protection of vulnerable coastal areas,

12 https://www.humanitarianresponse.info/system/files/documents/files/NIU_Joint_NAP_CC_DRM_2012.pdf.

steep slopes and coastal infrastructure and settlements against storm surges and coastal erosion (Samoa's fifth national report).

The Strategy for the Development of Samoa 2012-2016 contains activities to strengthen community resilience, using natural systems to buffer the impact of cyclones and floods. An associated indicator is the percentage of land area covered by forests, which is relevant to slope stabilization and coastal protection.

A key strength of the adaptation process in Samoa is the integration and alignment of adaptation with the cross-sectoral "Strategy for the Development of Samoa", which also includes economic stability, growth, employment, education, and health. Additionally, the incorporation of customary law and practice into natural resource management laws and policy has led to a strong governance system that recognizes traditional knowledge and rights. As an example, communities are permitted to develop their own fisheries by-laws and to oversee management plans (Chong 2014).

South Africa's fifth national report has indicated that mainstreaming is a major focus of work across its biodiversity, climate change and development strategies. For example:

a) The National Strategy for Sustainable Development and Action Plan (NSSDAP) includes three of five strategic priorities that reflect the need for sustaining healthy ecosystems, sustainable utilization of natural resources and the role of ecosystems in climate change adaptation.

b) Recent revisions of the National Water Resource Strategy (NWRS) and Water Pricing Strategy have recognized the importance of freshwater ecosystems for water security, as a result of engagement by the biodiversity sector in these processes.

c) The South African National Biodiversity Institute (SANBI) was accredited as South Africa's national implementing entity (NIE) to the UNFCCC's Adaptation Fund. Projects submitted include EbA and Eco-DRR elements, such as the project "Building resilience in the greater uMngeni catchment, South Africa", which focuses on building resilience of vulnerable communities in a catchment that provides water to two of South Africa's large cities: it will focus on climate-smart agriculture, climate proofing settlements with built and ecological infrastructure, and early warning systems using near real time weather stations and community monitors.

Drought Policy

In Namibia, climate change impacts are leading to land degradation. Increased temperatures and reduced rainfall are leading to loss of vegetation (due to decline in water availability) and lower crop productivity from reduction in topsoil through soil erosion. As part of an overarching effort to implement an integrated sustainable land management framework, the government is integrating climate change risks and opportunities into National Drought Policy strategies and other relevant policy instruments. Through participation in planning processes centred on the National Development Plan, including a series of national consultations, the government plans to identify and effect the necessary policy revisions at the sector and national level (UNDP 2010b).

6.2.2 National Targets

Progress towards the Aichi Targets Relevant to EbA and Eco-DRR

The review of the selection of fifth national reports and NBSAPs was an important source of information for compiling targets related to EbA and Eco-DRR, as it focused on progress on the Aichi Targets, including those directly relevant to EbA and Eco-DRR (as discussed in section 2). The Aichi Targets analysed included targets 5, 7, 10, 11, 13, 14 and 15. The rationale for choosing these targets and their linkages to EbA and Eco-DRR is provided in Annex 2.

37 countries assessed their Aichi Targets, out of the 61 fifth rational reports that were reviewed for this report. For each target assessed that was considered for this report, the majority of countries reported fair progress in implementation, and none reported very good progress (Figure 10).

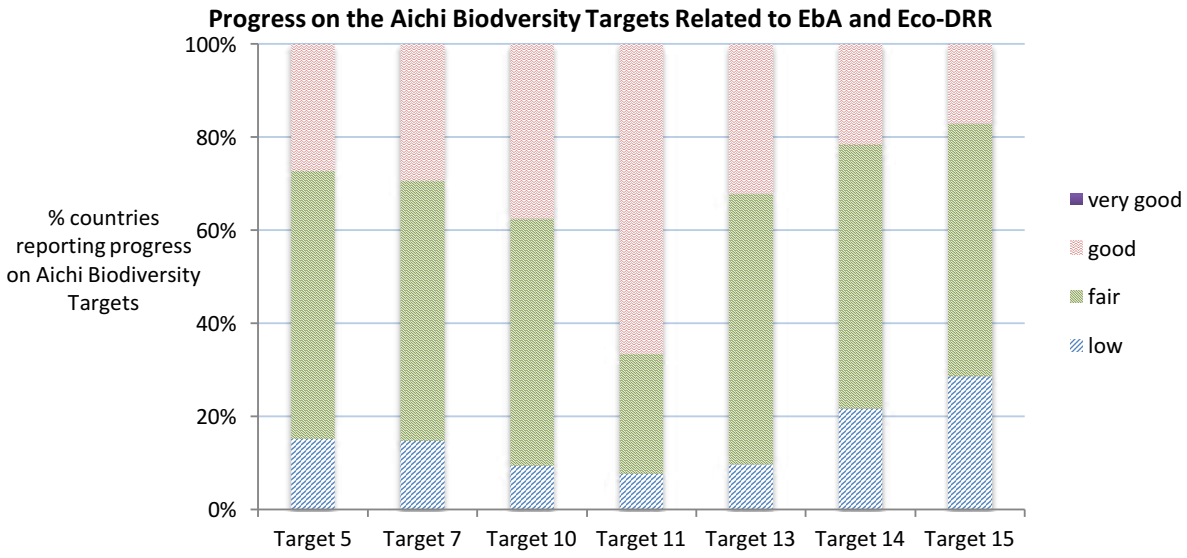


Figure 10: Progress towards achieving the Aichi Biodiversity Targets that are relevant for EbA and Eco-DRR. Values shown are percentages of reports identifying levels of progress for each Aichi Target, based on 37 reports that assessed progress, out of the 61 reports in total that were reviewed.

Global progress towards the Aichi Targets was assessed in the fourth edition of the Global Biodiversity Outlook (SCBD 2014), excerpted below for the relevant Aichi Targets: A brief excerpt of the review for the relevant Aichi Targets:

a) Target 5: Loss of forest habitats in some regions, for example the Brazilian Amazon, has been significantly slowed. However, deforestation in many other tropical areas of the world is still increasing, and habitats of all types, including grasslands, wetlands and river systems, continue to be fragmented and degraded.

b) Target 7: Increased certified forestry, especially in boreal and temperate zones, and increased adoption of good agricultural practices signify more sustainable production. Nevertheless, unsustainable practices in agriculture, aquaculture and forestry still cause substantial environmental degradation and biodiversity loss.

c) Target 10: Negative progress was reported for Target 10. Multiple land and marine based pressures on coral reefs continue to increase, although some large coral areas are being incorporated into marine protected areas.

d) Target 11: Taking current commitments into account, conserving 17 per cent of terrestrial areas by 2020 is likely to be met globally, although protected area networks remain ecologically unrepresentative and many critical sites for biodiversity are poorly conserved.

e) Target 13: Genetic diversity of domesticated livestock is eroding, with more than one fifth of breeds at risk of extinction, and the wild relatives of domesticated crop species are increasingly threatened by habitat fragmentation and climate change.

f) Target 14: Habitats important for ecosystem services, for example wetlands and forests, continue to be lost and degraded.

g) Target 15: Many countries, organizations and companies have pledged to restore large areas. Abandonment of farmland in some regions, including Europe, North America and East Asia, is enabling "passive restoration" on a significant scale.

- excerpted from GBO-4 (SCBD 2014)

The qualitative progress on the Aichi Targets evaluated shows mixed progress in achievement – which is also reflected in the analysis of information from the fifth national reports that were analysed for this report. Target 11, on protected areas, had the largest proportion of countries reporting "good" implementation, followed by Targets 10 and 13. It is not surprising that Parties are reporting good progress on Target 11, as protected areas were the activity implemented to the greatest degree in the country reports analysed. However, it must be noted that in this particular analysis, it is difficult to distinguish between "business-as-usual" protected areas implementation and conservation measures, and activities designed for the purpose of enhancing resilience of people and communities to the impacts of climate change, as there was not always enough detail in the reports to make the distinction.

While ecosystem restoration was widely reported as an EbA activity in the national reports, progress on Target 15 was low or fair, reflecting that many of the restoration initiatives were not yet implemented or had limited implementation.

Information on targets was supplemented with the "Find National Targets" database of the CBD.[13] This database maps national targets to corresponding Aichi Biodiversity Targets, from 54 NBSAPs submitted since the tenth meeting of the Conference of the Parties to the CBD. Out of these 54 NBSAPs contained in this database, 35 and 32 countries have established one or more national targets that address Target 14 and 15, respectively.

Aside from national targets aligning with the Aichi Targets, the fifth national reports and NBSAPs were also reviewed for evidence of national targets explicitly mentioning EbA and Eco-DRR. In terms of EbA there were limited examples of specific targets, although there has been more evidence of mainstreaming of overall EbA considerations into national plans, as discussed in the next section.

In the Solomon Islands, where climate change impacts threaten water resources, the fifth national report includes a target stating "By 2015, develop and adopt an Integrated Water Resources Management (IWRM) or Catchment Management Plan for at least 20% of the river systems in the Solomon Islands by reaffirming and scaling up of the current IWRM project lessons learned and to include those largest river system in the Solomon Islands including Wairaha in Malaita and Lunga in Guadalcanal."

Swaziland has proposed numerous updates to its NBSAP related to climate change. For example, the following target is proposed: "By 2015, Swaziland's climate change response strategies (e.g. NAP) fully incorporate ecosystem-based resilience such as establishing carbon sinks and controlling invasive species" (discussed further in Case Study 15).

A brief analysis of hazards faced by countries was conducted through the review of fifth national reports, NBSAPs, submissions to the CBD, and case studies from project portfolios and the broader literature. The analysis provides a brief breakdown of the hazards mentioned in the reports and literature by category (shown in Figure 11). According to this analysis, flooding and storm surges, erosion, and drought were the hazards most reported, out of the 118 sources consulted.

When considering only the fifth national reports and NBSAPs, 32 of the reports analysed (55%) included some mention of disasters or hazard risk management. However, only about two thirds of these (21 reports) had an associated disaster risk management target. These targets were reported in various ways in the national reports:

a) Solomon Islands - Priority 10 on Climate Change and Disaster Risk Management and Green Infrastructure, and associated Target 11: By 2020, 50% of the biodiversity priority areas identified in NAPA and the Climate

13 CBD "Find National Targets" database: https://www.cbd.int/nbsap/targets/default.shtml.

Change policy are operational, and a risk mitigation action plan in place, integrated with infrastructure developments and disaster risk management (source: Solomon Islands' fifth national report).

b) The Gambia, in its NBSAP, has included a target aiming to reduce the number of communities dwelling in flood-prone and watershed areas by 50%.

c) Jordan has set a national target of developing and implementing a national climate change adaptation strategy and action plan, including mainstreaming of biodiversity and ecosystems, by 2016. Associated Key Performance Indicators have been set, such as strengthening national capacities on climate change adaptation and raising awareness, with key priority actions to include stakeholder mapping on climate change and biodiversity and investigating the role of protected areas in increasing resilience to climate change impacts.

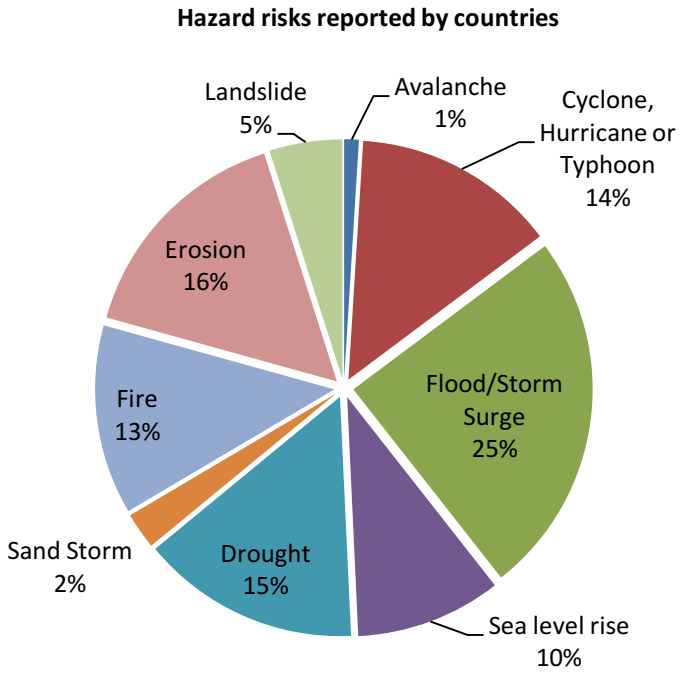


Figure 11: Breakdown of hazards reported by countries (figures are percentages of the 118 reports reviewed).

The review of fifth national reports indicated that disaster risk considerations were not always mentioned explicitly, even when examples of Eco-DRR activities being implemented were provided in the reports, and despite the fact that many countries have identified vulnerabilities to climate-related natural hazards.

Some national adaptation and disaster risk reduction targets have been developed in response to climate change impacts and the hazards identified. However, the majority of the reports reviewed for this study indicate that there is not yet a response at national level to address these hazards through specific targets related to EbA or to Eco-DRR.

Challenges and Gaps: Mainstreaming EbA and Eco-DRR

Several challenges in mainstreaming have been identified by Parties to the CBD in their fifth national reports. For example, a key challenge raised by Eritrea in its fifth national report is the lack of coordination among multiple agencies.

Other challenges include limited timeframes. As identified by South Africa in its fifth national report, mainstreaming requires institutional changes, which may take seven to ten years – which is beyond the lifetime of typical adaptation projects.

Experience in mainstreaming adaptation into development frameworks in Mozambique revealed the following challenges to mainstreaming climate change adaptation into development frameworks: i) the unavailability of long-term climate data in the most appropriate and easily usable format; ii) the inadequate capacity and tools to address the loss of soil and property in coastal cities; iii) lack of community based coastal zone management plans; and iv) the lack of climate change integrated curriculum especially at the university level (Nkem et al. 2011).

In Samoa, a key barrier to implementing EbA projects identified in the adaptation strategy is a lack of financial and human resources and data on baseline conditions, and the need for improved institutional and legal frameworks (Chong et al. 2014).

The issue of ensuring project sustainability was also discussed at the CBD technical workshop on EbA and Eco-DRR. One participant commented that most efforts on Eco-DRR and EbA were project-based, and raised the concern of ensuring sustainability beyond the project lifetime. Linked to this issue is the challenge of scaling up field interventions to increase the geographic scope and impact of interventions, facilitate replication, or expand into national-level programmes and plans.

Participants also noted that factoring in incentives to ensure long-term buy-in or ownership of the interventions was considered key to project sustainability. However, incentives need to be carefully targeted to specific stakeholders, such as national government ministries, households, etc. On the other hand, perverse incentives, such as those stemming from some subsidies or tax exemptions, should be eliminated.

Lessons Learned: Mainstreaming EbA and Eco-DRR

Integrating and mainstreaming EbA and Eco-DRR will require bringing together different actors and expertise across sectors and encouraging multidisciplinary approaches at the project implementation and policy levels (Doswald and Estrella 2015).

Participants at the CBD technical workshop on EbA and Eco-DRR identified several entry points for mainstreaming EbA and Eco-DRR, including NBSAPs, wetland management plans, NAPs, and productive sectors (e.g. agriculture, tourism, etc). The institutional set-up is important for mainstreaming Eba / Eco-DRR into policies and practice, in addition to having the right enabling conditions.

Case Study 14: Mainstreaming EbA and Eco-DRR into the national development strategy of the Cook Islands

The Cook Islands has mainstreamed Eco-DRR and EbA approaches into its national development strategy. National adaptation and DRR plans are already integrated, which has made mainstreaming of ecosystem-based approaches easier. In addition, the Prime Minister's Office includes the disaster management, climate change and development planning departments, which has facilitated integration and coordination into the national development plan.

A game-changing event also took place which facilitated this process of mainstreaming: the collapse of the black pearl industry due to toxic chemicals in the water, which enabled application of ecosystem-based approaches. This event helped foster the idea that other alternatives were needed for improved ecosystem management.

The development and review of national adaptation plans and national biodiversity strategies and action plans presents an important opportunity to promote EbA and Eco-DRR. NAPs and NBSAPs can be effective instruments for mainstreaming ecosystem-based approaches for adaptation and disaster risk reduction into development plans and processes, and into sectoral policies. There are similarities in these processes and considerable opportunity for them to be mutually reinforcing.

In the development of its national adaptation plan, Brazil engaged 15 different Ministries, established sectoral networks, and facilitated direct public dialogue with representatives from the private sector, Federation States, NGOs and broader civil society. One of the underlying principles for the NAP is that EbA and ecosystem services

considerations must be integrated into actions, plans, strategies and public policies across sectors. Of 66 adaptation measures recommended for implementation in Brazil, 24 are EbA measures.

Mainstreaming of EbA and Eco-DRR is often well understood at the national level and at the level of field implementation. Challenges may arise when translating policies into plans, programmes, and budgets. EbA and Eco-DRR approaches are multidisciplinary and require intersectoral collaboration. Mainstreaming of EbA and Eco-DRR into policies and practice includes strategically targeting action between national and local-level implementation, and clearly defining the governance level for mainstreaming. It is also important to articulate the main objectives of undertaking mainstreaming, and for EbA and Eco-DRR to be embedded in national development plans in order to provide an enabling framework for local-level implementation and facilitate access to funds

The importance of ensuring a balance between top-down and bottom-up approaches was stressed by participants at the CBD EbA and Eco-DRR technical workshop. Participants specifically recognized the important role of local communities and indigenous peoples in ensuring that experience and lessons learned from projects on the ground feed back into policymaking processes. Representatives from local communities and indigenous peoples, and practitioners, must therefore be part of decision-making.

It is also important to recognize immediate and long-term needs and address trade-offs when implementing EbA and Eco-DRR actions (addressed further in section 6 on Policy Issues). The limits of EbA and Eco-DRR should be clearly articulated and acknowledged, and they should be part of broader climate change adaptation and DRR strategies.

Developing guidelines to facilitate national and local-level implementation is also needed, e.g. Japan's Ministry of Environment is developing guidelines for local governments to implement Eco-DRR on the ground. The use of existing regulatory processes in the country, such as environmental impact assessments (EIAs), could help support mainstreaming of biodiversity priorities, Eco-DRR. For instance, Malawi is undertaking a review of its EIA guidelines which will enable EbA and Eco-DRR strategies to be considered during the project approval process.

Lessons learned in multi-stakeholder engagement that adds value to EbA and Eco-DRR
EbA and Eco-DRR are inherently interdisciplinary and cross-sectoral and thus call for an institutionalized multi-stakeholder process. Stakeholder engagement can be improved through long-term relationship-building between actors, and identifying and working with a clear champion who has the mandate to bring all key actors together.

CBD national focal points can, and should, take a leading role for the coordination and mainstreaming of EbA and Eco-DRR and strategies, in collaboration with other national environmental focal points from the Ramsar Convention, UNCCD and UNFCCC, and other MEAs.

Efforts should be made to engage with the disaster risk reduction/disaster management sector as it has established institutions from national to community levels. In some countries, such as Honduras, the same key actors undertake both climate change adaptation and DRR work.

Other key actors to engage include:

- Academia can play an important role in linking scientific research with policy; e.g. coordinating the production of data, such as Honduras's National Observatory.
- The role of the private sector should be clearly defined e.g., through guiding principles for private sector engagement. Public-private partnerships for EbA and Eco-DRR should be further explored.
- Engineers can provide technical expertise in testing regulating services of ecosystems, and can help design natural infrastructure solutions for DRR or climate change adaptation.
- Local communities and indigenous peoples should be engaged, ensuring the principles of prior and informed consent are followed. Multiple local representatives should also be engaged, building on their traditional knowledge and practice. Active participation of communities in decision-making should be institutionalized.

- Economists can be enlisted to analyse costs and benefits of EbA and Eco-DRR activities.
- Marketers and communicators have the expertise to develop effective communications strategies around EbA and Eco-DRR.

Multi-stakeholder engagement is key for the co-production of knowledge[14] and for establishing shared experiences of EbA and Eco-DRR at national and local levels.

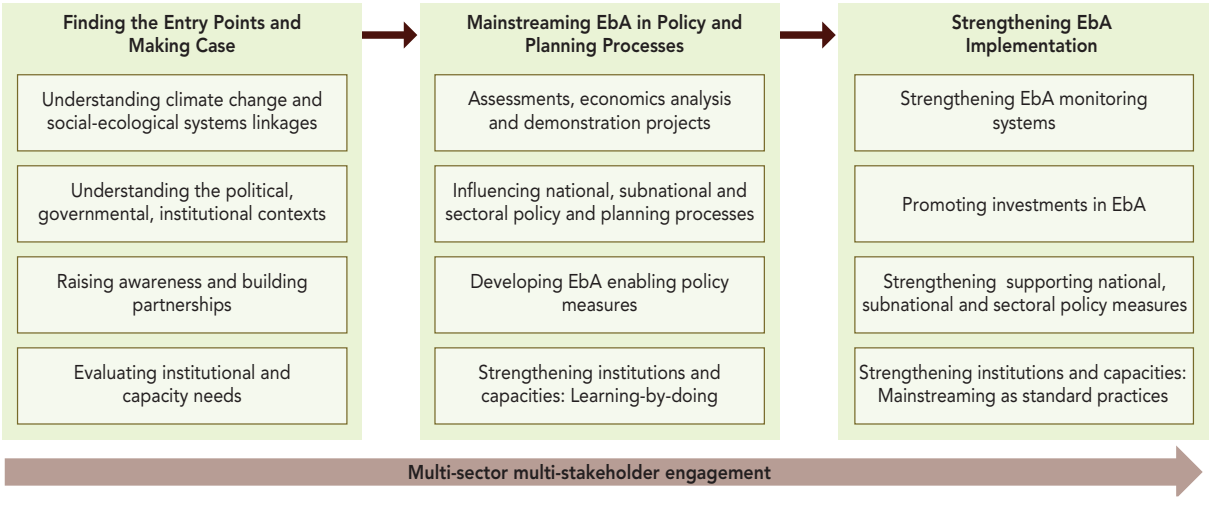
Capacity-building for EbA and Eco-DRR for different stakeholders at different levels is needed in order to support mainstreaming efforts. Awareness by national policymakers and decision makers, and technical skills to implement EbA and Eco-DRR approaches are limited in many countries. In addition, the turnover of focal points within government structures can make it difficult to ensure continuity of practice.

Opportunities for mainstreaming: Importance of policy integration at the national level
Global policy frameworks generally provide an enabling environment for national policies, and they can help reinforce each other. In some countries, a review of existing national policies and planning processes is useful to identify entry points for integrating Eco-DRR and EbA. For example, the Government of Japan is actively engaged in promoting Eco-DRR in various global policy processes, and has established the National Resilience Act (2013) and the National Spatial Development Plan (2015) which recognize the important role of ecosystems for disaster risk reduction and climate change adaptation.

A key challenge is for countries to translate global policy frameworks at the national level in an integrated and concerted manner, which would maximize available expertise, resources and tangible impacts on the ground.

Mainstreaming of Eco-DRR and EbA into national policies should learn from other mainstreaming processes, for example, gender mainstreaming.

Promoting sustainable ecosystems management can provide a bridge to national development policy priorities. Healthy, well-managed ecosystems provide multiple benefits to meet multiple priorities, including enhancing people's resilience to climate change and disasters, supporting biodiversity, and protecting food, water and livelihood security, especially of vulnerable populations.



Source: Adopted from UNDP-UNEP framework for mainstreaming adaptation into development planning.

Figure 12: Framework for mainstreaming EbA into development planning (WWF 2013).

14 Knowledge co-production is "the collaborative process of bringing a plurality of knowledge sources and types together to address a defined problem and build an integrated or systems-oriented understanding of that problem" (Armitage et al. 2011).

Learning from Samoa's experience, it is evident that customary laws and recognition of traditional knowledge can help build resilience of communities to climate change (Chong et al. 2014). Additionally, integration of EbA into NAPAs has been shown to work and is essential to delivering ecosystem-scale adaptation interventions on the ground and encouraging uptake of EbA into other sectoral policies including water, wetlands, environment and agriculture (UNEP, UNDP, and IUCN, 2014).

Opportunities for Mainstreaming: Innovative Tools
Various guidance tools are available for mainstreaming and could be adopted to a greater extent. An example from WWF's EbA Operational Framework developed for the Greater Mekong is shown below, as adapted from the UNDP-UNEP framework for mainstreaming adaptation into development planning.

6.3 SYNERGIES FOR EBA AND ECO-DRR AT NATIONAL LEVEL

EbA and Eco-DRR have many commonalities, and yet operate in different communities of practice, with EbA more commonly in the domain of environmental and development NGOs and academia, while DRR practice has more often been a focus of humanitarian organizations. Integrating policy and institutional contexts will require identification of policy and institutional entry points for promoting ecosystem-based principles, approaches and strategies; and development of partnerships that seek to achieve multiple priorities (Doswald and Estrella 2015).

The UNFCCC's Subsidiary Body for Scientific and Technical Advice highlighted the need for enhanced coordination among the Rio Conventions through involvement of national experts and sharing of relevant information (FCCC/SBSTA/2001/2). In the same vein, Parties to the CBD have reiterated the importance of activities to integrate biodiversity into relevant climate change activities and to ensure coherence in national implementation of both the United Nations Framework Convention on Climate Change and the Convention on Biological Diversity (CBD decisions VI/15, VII/15, X/33, XI/2, XI/15, and XII/20).

The linkages between climate change, biodiversity and ecosystem services are well established (e.g. SCBD 2009). Thus, there is much to gain from optimizing the opportunities provided by biodiversity and ecosystems to help people manage the impacts of climate change and contribute to mitigation.

Synergies can be realized at national level by linking national adaptation plans (NAPs) and NBSAPs, key planning tools for implementing the UNFCCC and the CBD. There is much overlap between the NAP and NBSAP processes, which both include stakeholder engagement, assessment of status and trends, knowledge management, and prioritization of actions. Promotion of synergies between the two processes will aid countries in meeting international obligations for climate change and biodiversity conservation, reduce vulnerability to climate change by building adaptive capacity and resilience, avoid duplication in actions to address threats of climate change and biodiversity, and ensure consistency in policy development and project implementation (SCBD 2014). Case Study 15 below provides an example of promoting synergies in implementation of the CBD and UNFCCC.

Measures to conserve coral reef biodiversity include the establishment of marine protected areas, and enforcement of the coral mining ban, which will help maintain the coastal protection properties of corals. These actions are also in line with the Aichi Target 10 and the priority actions for coral reefs set out in CBD decision XII/23.

Several other examples of synergies at national level are discussed below. In Mozambique, activities to mainstream adaptation into development frameworks involved activities across different ministries. The National Meteorological Services inventorized, digitized, and processed available climate data to assess vulnerabilities and impacts. The Centre for Sustainable Development of the Ministry of Environment produced an Ecological Zoning Map and Management Plan to be used for the management of the coastal zone of Guvuro. EbA and Eco-DRR approaches were incorporated into an overall adaptation plan: the Municipal Council of Xai Xai led the citizens of the city to construct and maintain soil erosion and sand stabilization walls landscaped with vetiver grass and shrubs. These enabled adaptation to erosion and destruction of properties induced by sea level rise (Nkem et al. 2011).

Case Study 15: Synergies in Swaziland for implementing EbA

Synergies in implementing the UNFCCC and CBD in terms of climate change adaptation are realized by the following measures:

- Swaziland's National Climate Change Policy aims to provide a national strategic framework for Swaziland to address the challenges and address benefits as well as opportunities presented by climate change. The Policy recognizes and promotes ecosystem-based adaptation.
- Swaziland's Sectoral Strategy explicitly calls for increased ecosystem-based approaches and protection-worthy areas into the NAP and climate change strategy. An associated target is: "By 2015, Swaziland's climate change response strategies (e.g. NAP) fully incorporate ecosystem-based resilience such as establishing carbon sinks and controlling invasive species." The indicators to assess progress are the budget allocation to ecosystem-based approaches to climate change adaptation, amount of carbon stored/captured by different ecosystems, and per cent reduction of total land area under alien plant invasion.
- Development of the Comprehensive Agriculture Sector Policy and the National Food Security Policy that promote sustainable land management practices which include conservation agriculture and community-based sustainable range management on rangeland and arable land. Cattle farmers are encouraged to prevent overgrazing by rotating their livestock, while arable farmers are legally required to plant contour strips in between their agricultural fields to reduce erosion, thus limiting further land degradation.

- excerpted from Swaziland's fifth national report

Cambodia's Climate Change Strategic Plan (CCCSP) 2014-2023 builds synergies with existing government policies to ensure cohesion between adaptation, greenhouse gas mitigation and low-carbon development strategies. The CCCSP covers strategic objectives related to EbA, such as reducing vulnerability of sectors and regions to climate change impacts, and ensuring climate resilience of critical ecosystems (Tonle Sap Lake, Mekong River, coastal ecosystems, highlands etc.), biodiversity, protected areas and cultural heritage sites. The CCSP also aims to strengthen institutions and coordination frameworks for national climate change responses, and to strengthen collaboration and active participation in regional and global climate change processes (Cambodia's fifth national report).

Less evident in the review of fifth national reports and NBSAPs are examples of countries that have clearly identified ecosystem-based approaches to adaptation for the benefit of people and communities as a common denominator in NAP and NBSAP processes. South Africa's NBSAP is linked to its Climate Change Response Strategy and National Action Programme Combating Land Degradation to Alleviate Rural Poverty, which include ecosystem-based approaches to drought through the landscape approach.

6.3.1 Challenges and Gaps

Participants at the UNFCCC technical workshop on EbA held in Tanzania in 2013 identified that poor coordination and alignment between sectors prevented the integration of ecosystem-based approaches for adaptation into sectoral policies. Participants mentioned the need to establish strong communication channels among the focal points of the three Rio Conventions in order to foster synergy (UNFCCC 2013).

Another challenge is the fact that policy, institutional and funding tracks are often separate; however, integration of EbA and Eco-DRR is more likely to be achievable at the project level (Doswald and Estrella 2015). The implementation of EbA/Eco-DRR projects may help to achieve better policy integration and contribute to biodiversity mainstreaming into other sectors.

At the global level, there is a need for closer alignment of funding for NBSAP and NAP processes so that common tasks can be carried out using shared resources – for example, biodiversity vulnerability assessments, which can aid identifying the vulnerability of ecosystems that provide adaptation services (SCBD 2014).

6.3.2 Lessons Learned

Many countries have prioritized the establishment or strengthening of collaboration between ministries and government agencies responsible for biodiversity and climate change as an important component of enhanced implementation. Examples of successful inter-agency collaboration drawn from national reports under the Rio Conventions include regular meetings among staff from different agencies; establishment of issue-based working groups; and assignment of shared responsibilities for overlapping issues (SCBD 2014). Strengthening links with the ministries and government agencies responsible for DRR and development planning could also assist in EbA and Eco-DRR implementation and planning.

Although most NBSAPs and NAPs have processes in place for stakeholder engagement, there is a need to increase the extent to which such processes are brought together. The timing of NBSAP revision and NAP development may present challenges with regard to common stakeholder engagement processes. NBSAP working groups and lists of stakeholders participating in relevant processes could be used to strengthen stakeholder engagement in addressing both biodiversity and climate-related concerns (SCBD 2014).

Participants at the CBD technical workshop on EbA and Eco-DRR noted that:

a) Conserving, restoring and sustainably managing ecosystems can deliver on a number of national and international development priorities and obligations, including enhancing people's resilience to climate change and disasters, supporting biodiversity, and protecting food, water and livelihood security, especially of vulnerable populations.

b) Cooperation among ecosystems/biodiversity, adaptation and disaster reduction communities results in a greater ability to design interventions that deliver multiple dividends.

c) Strong coordination between focal points for multilateral environmental agreements (MEAs) such as Ramsar, UNCCD, UNFCCC, and CBD can help to ensure synergies between MEAs are harnessed.

d) It is important to scale up knowledge-sharing at local, national, regional and global levels among different disciplines, and to continue to use knowledge-sharing platforms such as the Nairobi work programme under the UNFCCC.

e) Designing interventions for multiple benefits can be supported by creating space and incentives for collaboration and dialogue about trade-offs, establishing political commitment to integrated approaches, clarifying roles and responsibilities of various institutions, and encouraging financial support to integrated action through looking at the policies of donor partners.

6.3.3 Opportunities

There are several key entry points in the NAP process for consideration of ecosystems. Conservation International is currently working with partners on a tool that identifies these entry points and key considerations for capacity and information needs. The tool will provide support to enable consideration of ecosystems in adaptation planning using a step-by-step process that supplements the NAP technical guidelines and is focused on both the current phasing of their planning and local policy priorities (Conservation International 2015).

6.4 IMPLEMENTATION

Experiences from Fifth National Reports

All of the fifth national reports analysed indicated that EbA activities were being implemented, or were planned for implementation. Some caution was needed in interpreting what constitutes an EbA activity, as in many reports it was difficult to distinguish "business-as-usual" conservation with the goal of enabling ecosystems to adapt to climate change versus EbA activities which prioritize enabling people to adapt to climate change.

Activities in support of implementing the Strategic Plan for Biodiversity 2011-2020 were often not reported as EbA, even though they could be considered as EbA because i) it was clear that the outcomes of some activity (such as protected areas or restoration) was linked to enhancing resilience of ecosystems providing essential services that can reduce vulnerability of people to climate change; and ii) the project was linked to a funded programme where additional documentation was available to ascertain that the activities implemented were in support of EbA. A clear challenge identified for many LDCs is capacity to implement and report on biodiversity and climate change commitments.

EbA measures were explicitly integrated as targets into 26 of the 61 national reports to the CBD analysed, and were also integrated into 5 climate change strategies (including national adaptation programmes of action (NAPAs) under the UNFCCC).

The majority of the national reports (45 out 61 reports analysed) indicated that the EbA approaches implemented were focused primarily on building resilience of people and communities to impacts of climate change. The remaining countries reported activities that aim to help ecosystems cope with climate change, rather than emphasizing people and communities as the primary targets.

The types of EbA activities most often implemented, according to the typology developed, were capacity-building activities, protected areas, restoration, and crop diversification (see Figure 13). Information from all sources of information are included, for a total of approximately 500 activities classified.

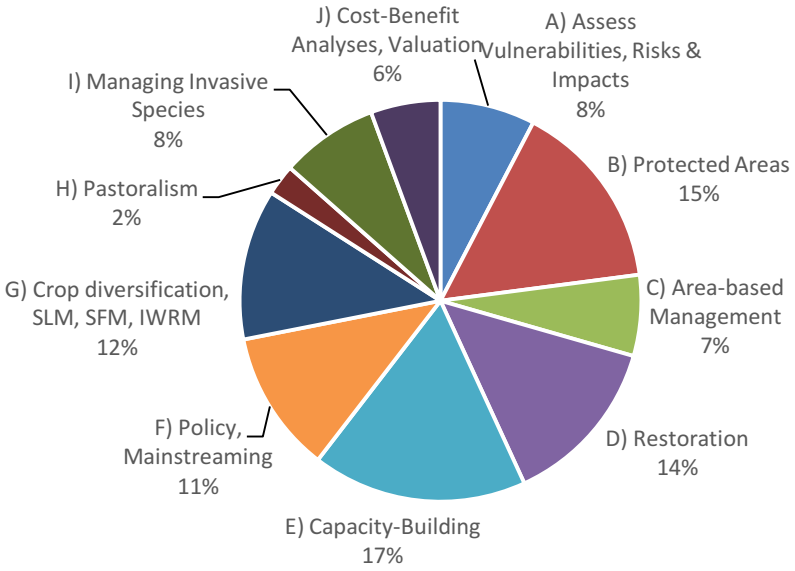


Figure 13: Types of EbA activities implemented or being implemented, as a percentage of total number of activities, as reported in fifth national reports and NBSAPs submitted by Parties to the CBD, submissions to the CBD, and case studies from project portfolios and a broader literature review. Approximately 500 activities were categorized.

Maintaining healthy, functioning wetlands plays a vital role in DRR measures. Mangroves and other coastal vegetation stabilize shorelines, reducing the impacts of storms. Lakes and marshes reduce peak flooding, and in arid regions wetlands provide relief from droughts. Contracting Parties to the Ramsar Convention commit to designate and effectively manage Wetlands of International Importance, or Ramsar Sites.

To determine which of the 2210 Ramsar sites have been identified as providing essential regulating services for DRR, the Ramsar Sites Information Service (RSIS)[15] was used, which allows filtering of information by region, wetland type, provision of ecosystem services, management status and other criteria.

Results showed that about half of the total number of Ramsar Sites provide hazard reduction ecosystem services, 15% maintain hydrological regimes, and 13% provide protection from erosion. This indicates that there are many designated wetlands that are recognized for their contribution to DRR. However, only about half of these sites have a management plan for sustainable use, indicating a need for governments to implement planning and management to ensure these sites continue to provide essential ecosystem services for adaptation and DRR.

6.4.1 Challenges and Gaps

The limitations of EbA and Eco-DRR must be recognized in addressing adaptation and disaster risk reduction. Ecosystems can only support adaptation if they maintain functionality under a changing climate. For example, investing in reforestation to protect watersheds will waste valuable resources if the trees or vegetation will not survive under future climate conditions. Management plans must be designed to accommodate unavoidable and irreversible change to maintain ecosystem functionality and service provision.

Several countries have cited lack of reliable funds as an impediment to implementation of adaptation measures, including EbA, and have also noted that short project cycle funding interrupts the continuity of adaptation work.

Additionally, lack of capacity, resulting from high staff turnover, was cited by several countries as a major impediment to maintaining institutional memory. Lack of staff capacity also prevents effective planning, implementation and monitoring of EbA and Eco-DRR activities and programmes.

6.4.2 Opportunities and Entry points

The review of fifth national reports and case studies from a wide variety of sources revealed several gaps and challenges in implementing EbA and Eco-DRR. However, several opportunities have emerged that can provide key entry points for further action, as outlined below.

Ecosystem-based Approaches to Mitigation
Reducing Emissions from Deforestation and Forest Degradation (REDD) is an effort to provide incentives through payment for results, for developing countries to reduce emissions from forested lands. "REDD+" goes beyond deforestation and forest degradation, and includes the role of conservation, sustainable management of forests and enhancement of forest carbon stocks. While a detailed discussion of REDD+ is beyond the scope of this report, it is important to note that while primarily envisioned as mitigation, REDD+ can offer adaptation and disaster risk reduction benefits if implemented wisely. For example, utilizing ecosystem-based approaches such as conserving forests to reduce greenhouse gas emissions can reduce the risks of soil erosion or landslides by stabilizing slopes.

The fact that coastal vegetation can sequester significant amounts of carbon is another argument for restoring and protecting them (if undisturbed, or else they are a source of greenhouse gases rather than a sink). There is increasing advocacy for coastal ecosystem initiatives, such as in mangroves, salt marshes and seagrasses. In Mexico, carbon stocks in mangroves have been quantified in three protected areas, in order to calculate carbon emissions and sequestration. It was demonstrated that the carbon stocks in the Sian Ka'an reserve store the equivalent of almost half of Mexico's emissions during 2009 (Adame et al. 2013).

REDD+ and coastal ecosystem initiatives, when carefully planned and implemented, can generate many co-benefits and complementarities (Munroe and Mant 2014).

15 Ramsar Sites Information Service: http://rsis.ramsar.org.

Achieving Climate Adaptation Through Innovative Debt Restructuring

The people and the economy of the Seychelles, with its low-lying island geography, are especially vulnerable to the impacts of climate change, which include severe storms, sea level rise, warmer ocean temperatures, and increasing ocean acidity which damages coral reefs and reduces their buffering capacity against storms. The Nature Conservancy mobilized a USD 30 million debt swap for the government of the Seychelles in exchange for a commitment to enhance marine conservation and support adaptation to climate change through improved management of coasts, coral reefs and mangroves. The agreement, announced at the margins of the twenty-first session of the Conference of the Parties to the UNFCCC in Paris in December 2015, is the first ever climate adaptation debt swap. The agreement will also establish a permanent endowment that generates sustainable financing for the Seychelles' marine conservation and climate adaptation activities.

Disaster Recovery - Building Back Better

The phrase "Build Back Better" (BBB) first emerged during the recovery effort after the Indian Ocean Tsunami in December 2004, when there was a clear need to improve current reconstruction and recovery practices and generate safer communities (Mannakkara and Wilkinson 2014). One of the four key priorities in the Sendai Framework for Disaster Risk Reduction is "enhancing disaster preparedness for effective response and to 'Build Back Better' in recovery, rehabilitation and reconstruction".

Building back better is defined as a way to utilize the reconstruction process to improve a community's physical, social, environmental and economic conditions to strengthen resilience to future natural disasters. Principles for building back better include:[16]

- Avoiding unnecessary damage to future recovery;
- Agencies are accountable to people they assist;
- People affected by disaster drive their own recovery;
- Recovery must promote fairness and equity;
- Recovery of local economy and livelihoods is a priority;
- Empowerment of local governments;
- Clarity and responsibility of multilateral agencies and NGOs;
- Recognizing diversity in reconstruction and recovery efforts;
- Drawing on social and economic resources from within communities affected;
- Account for future hazards and risks – assessment and decentralized DRR.

The principles of building back better provide key entry points to incorporate opportunities provided by nature to build back better. These opportunities must be made clear to the disaster risk management community.

An encouraging example of building back better is the Mangroves for the Future (MFF) initiative, a multiparty initiative led by IUCN and UNDP, aimed at promoting investment in coastal ecosystem conservation for sustainable development. The MFF grants facility offers small, medium and large grants to support initiatives that provide practical, hands-on demonstrations of effective coastal management in action. MFF builds on a history of coastal management interventions before and after the 2004 Indian Ocean tsunami. It initially focused on the countries that were worst affected by the tsunami and has expanded to include Bangladesh, Cambodia, Myanmar, Pakistan and Viet Nam.

16 Key propositions for building back better, p. 3, Fan et al. 2013 http://www.odi.org/sites/odi.org.uk/files/odi-assets/publications-opinion-files/8693.pdf.

Planting the appropriate vegetation is also part of building back better. There are ongoing research efforts aiming to identify species in certain regions that are more resistant to disasters, as demonstrated by the governments of Switzerland and Japan's research efforts to create effective multifunctional disaster protection forests. It is crucial to plan restoration efforts carefully, conducting systematic surveys to identify suitable sites where vegetation can thrive, planting the right species with proper timing (Durst 2015).

> Disasters have demonstrated that the recovery, rehabilitation and reconstruction phase, which needs to be prepared ahead of a disaster, is a critical opportunity to "Build Back Better", including through integrating disaster risk reduction into development measures, making nations and communities resilient to disasters.
>
> *—Sendai Framework for Disaster Risk Reduction 2015-2030*

Private Sector Engagement

Climate change will impact industries in different ways, particularly the sectors depending on coastal infrastructure or on reliable water supply – for example, ports, hydropower, agribusiness and water-intensive industries.

Proper regulation and incentives can help prepare industry for climate impacts. Partnerships with industry associations can also aid with identification of climate risks, impacts and adaptation strategies. Examples include the development of climate risk assessment tools for use by private sector investors and insurance companies, adoption of hydrometeorological and climate information services, and working with developers to improve land-use planning including EbA and Eco-DRR activities such as ecosystem restoration (GEF 2014).

The GEF's programming strategy on adaptation for the Least Developed Countries Fund and the Special Climate Change Fund promotes more partnerships with industry, with a special focus on the insurance industry. Areas of action for catalysing adaptation includes expanding insurance access for developing countries, supporting the introduction of innovative adaptation products and services, preparing the ground to allow insurers to directly invest in adaptation, and facilitating a formal space for engaging insurers to provide support for policy reform, land-use planning, capacity-building and technology transfer.

Several private sector activities that have been proposed for adaptation and DRR already consider the use of ecosystem-based approaches, including the promotion of sustainable land use planning. However, as work expands in this area, the opportunity to mainstream ecosystem-based approaches into private sector activities should not be missed.

Case Study 16: The Sustainable Insurance Initiative

The UNEP Finance Initiative Principles for Sustainable Insurance Initiative (PSI Initiative) was launched at the 2012 UN Conference on Sustainable Development. The principles serve as a global framework for the insurance industry to develop and expand the innovative risk management and insurance solutions needed to promote sustainable cities, food security and disaster-resilient communities.

The principles include: embedding environmental, social and governance issues into decision-making related to the insurance business; raising awareness and managing risk; working with governments, regulators and stakeholders to promote action on environmental, social and governance issues; and demonstrating accountability and transparency in disclosing progress in implementing the Principles (UNEP Finance Initiative 2014).

The PSI initiative evaluated the effectiveness of risk reduction measures, with plans to develop a global disaster map and mentor at-risk communities. In the review of risk reduction measures, several EbA and Eco-DRR approaches were demonstrated to be highly effective. For example, mangrove forests in Orissa, India, protected villages from a 1999 super cyclone, while there were higher numbers of deaths in unprotected villages. The role of wetlands in flood protection was also evaluated, and studies demonstrated that wetlands provide the same social benefits as permanent barriers, but with positive downstream environment impacts such as nitrogen and phosphorous control, and recreational benefits (UNEP Finance Initiative 2014).

The Global Mechanism of the UNCCD is establishing the Land Degradation Neutrality (LDN) Fund, to be launched in 2016. The Fund is designed to act as a coordination platform for blended finance, established as a public-private partnership (PPP)[17] among private institutional investors, international finance institutions and donors. It supports the transition to land degradation neutrality through land rehabilitation while generating revenues for investors from sustainable production on rehabilitated land. An example of an EbA and Eco-DRR activity aimed for is the restoration of natural and semi-natural ecosystems that provide valuable functions and benefits.

The increasing risk of disasters posed by climate change has also catalysed the insurance industry to action, given the costs of recovery from natural disasters to governments, communities, and businesses. In 2013, global economic losses due to natural disasters was estimated at USD 131 billion, of which 37 billion were insured (UNEP Finance Initiative 2014). Innovative ways to insure against losses are being developed, such as microinsurance which provides protection to low-income communities by insuring crops or assets. Catastrophe insurance pools can cover high-risk communities exposed to natural hazards.

Linkages between Climate Change, Biodiversity and Health

The World Health Assembly adopted a work plan on climate change and health in 2009. Climate change impacts on health have been well documented. For example, the number of reported weather-related natural disasters has more than tripled since the 1960s, resulting in over 60 000 deaths each year, mainly in developing countries (World Health Organization 2016). Rising sea levels and increasingly extreme weather events will destroy homes, medical facilities and other essential services. A lack of safe water, which can result from changing rainfall patterns, can compromise hygiene and increase the risk of diarrhoeal disease, which kills almost 600 000 children aged under 5 every year (World Health Organization 2016). Heat waves and heat island effects in cities also put the elderly and other vulnerable groups at risk.

Recent research has also established links between access to biodiversity and improved health and well-being, including a comprehensive summary of health effects of ecosystem services, nature and biodiversity (Sandifer et al. 2015), and a review of the state of knowledge on biodiversity and health, including the value of biodiversity and ecosystem approaches to increasing resilience and disaster risk reduction (WHO and SCBD 2015). These studies point to areas for further research, including addressing causation of health benefits and action mechanisms, and the need for multidisciplinary collaborations to enhance health and conservation. This can also provide impetus or an entry point for implementation of EbA and Eco-DRR measures to contribute to increasing resilience of communities in terms of health and well-being.

6.4.3 Lessons Learned

Participants at the CBD technical workshop on EbA and Eco-DRR identified the following set of challenges and lessons learned with regard to implementation of EbA and Eco-DRR:

a) Project implementation can be hampered by different understandings of concepts and different values regarding ecosystems and biodiversity. In achieving adaptation and DRR objectives, it is important to be tolerant and flexible with different terminologies, and to strive for maximum implementation on the ground, working towards global implementation of initiatives that contribute towards building resilience of as many local communities as possible.

b) There should be increased engagement between the scientific community and project executors in developing and implementing EbA and Eco-DRR activities, making use of available guidance to ensure optimal and appropriate use of ecosystems for adaptation and DRR. Experiences from the field have sometimes shown that inappropriate species or localities are used, even with available scientific guidance.

c) In implementing EbA and Eco-DRR activities, the quality of ecosystems used to reduce vulnerability to climate change impacts is not always considered. The appropriate use of biodiversity should be carefully

17 Public-private partnerships (PPPs) are a mechanism for government to procure and implement public infrastructure and/ or services using the resources and expertise of the private sector (World Bank).

considered. There have been examples of activities that use single or exotic species in implementation, with negative consequences for the ecosystems. On the other hand, EbA and Eco-DRR are sometimes applied in areas that maximize co-benefits for their conservation priorities and can miss significant opportunities, such as in urban areas or agricultural landscapes.

d) The most well-developed activities may be rejected by communities if they are not involved in project design from the beginning, even if they understand there will be some benefits from the project. Communities may also reject EbA even if they are involved in the process.

Guidelines on implementing EbA and Eco-DRR at the local and sectoral levels can aid in the increased use of ecosystem-based approaches and effective implementation.

6.5 MONITORING AND EVALUATION

Monitoring and evaluation (M&E) are key elements of adaptation strategies. Monitoring involves documenting changing conditions and enables planners and practitioners to improve adaptation efforts by adjusting processes and targets, and can be carried out during implementation throughout the lifetime of the adaptation action (UNFCCC 2011). Evaluation is a process for systematically and objectively determining the effectiveness of an adaptation action, ascertaining whether the objectives and targets have been achieved and whether this can be attributed to the adaptation measure taken (UNFCCC 2011). Together, monitoring and evaluation also improve implementation by applying lessons learned, and can also help to build the evidence base for EbA.

Activities involved in developing a monitoring and evaluation system include formulating indicators that measure changes in vulnerability and context. Various guidance is available on identification of suitable indicators, but a common goal for indicators is that they are, as much as possible, SMART - specific, measurable, achievable and attributable, relevant and realistic, time-bound, timely, trackable and targeted (WWF 2013).

UNEP's Partnership for Environment and Disaster Risk Reduction (PEDRR) included SMART indicators in their submission to CBD, which outlined several examples of DRR. One initiative addresses "Managing Environment and Disaster Risk in Afghanistan's Central Highlands (Koh-e Baba Mountain range)", a project implemented with UNEP and the European Commission. Evaluation is based on the following indicators:

a) Eco-DRR mainstreamed into development policies and plans;

b) New partnerships and collaborative initiatives on Eco-DRR;

c) Strengthened local / national capacities to implement Eco-DRR;

d) Field interventions on Eco-DRR demonstrate contribution to DRR in terms of hazard mitigation, exposure or vulnerability reduction or enhancing local resilience.

These indicators point to completion of activities that are assumed to reduce vulnerability or build resilience. However, as with many other EbA or Eco-DRR interventions, the early stages of the project do not enable full evaluation of its effectiveness.

In the fifth national reports, NBSAPs, and case studies reviewed, there were limited quantitative evaluations of success. Projects that were formally evaluated, such as the independent evaluations carried out for projects under funds administered by the Global Environment Facility, were more likely to quantify success.

Partly this may due to the fact that the majority of the activities described in case studies and fifth national reports have only been recently implemented, making it difficult to evaluate benefits quantitatively. Additionally, attributing success or failure to a single intervention like EbA or Eco-DRR that is implemented in complex systems is extremely difficult without controls with exactly the same characteristics as the system where the activity is implemented.

However, many initiatives have already demonstrated early benefits. The mountain EbA initiative implemented by UNDP, UNEP and IUCN and supported by the German Government has yielded some early benefits, with lessons learned to be fed into a framework for scaling up EbA in other areas.

Case Study 17: Adapting to climate change in mountain ecosystems in Uganda

Increasing temperature and rainfall are affecting the intensity and occurrences of hazards in Uganda's mountain areas, particularly floods and landslides. In turn, these hazards impact health, food security and the economic development potential of the people. Enhancing ecological services, such as catchment and natural resource management, could reduce such vulnerabilities and enhance livelihoods.

In Uganda, the mountain EbA programme has demonstrated that the implementation of soil and water conservation strategies like contour trenches has proven to be very effective. Immediate results include the reduction of impacts of soil erosion and floods. In only six months of implementation, combined with other good management practices on farms, there is already a clear and visible difference between those implementing climate resilient measures and those not, in terms of quantity and quality of crops and yields.

Uganda was chosen as one of three pilot sites for implementing the mountain EbA programme, for its representative social and environmental conditions, which will enable replication and upscaling in other areas. A framework for implementation will be developed based on the results from the pilot programmes in Peru, Uganda and Nepal.

— UNEP, UNDP and IUCN 2014

6.5.1 Challenges and Gaps

The limited hard evidence for EbA is likely due in part to lack of capacity to develop and implement monitoring and evaluation systems. A part of the challenge also stems from the time lag from implementation of some EbA activities to realizing their benefits – effectiveness of EbA measures are sometimes not seen until at least a decade after the intervention. The benefits may also manifest differently in different sectors of society.

Monitoring and evaluation frameworks were not often elaborated on in the national reports or submissions, but several countries identified lack of capacity as a key challenge, including insufficient technical capacity and finances leading to problems with periodic data collection and monitoring protocols (e.g., from Antigua and Barbuda's fifth national report).

Monitoring and evaluation challenges identified in the GEF-funded project, "Implementation of Pilot Adaptation Measures in coastal areas of Dominica, St. Lucia and St. Vincent and the Grenadines" included:

- Lack of clear links between the objectives, outputs and indicators;
- Indicators that were not measurable or were not relevant to EbA – for example, the number of nesting parrots in a Dominica National Park. Once the project was restructured, appropriate and measurable indicators were selected, enabling the results framework to be used as the instrument to evaluate on-the-ground progress;
- Monitoring and evaluation tools should have been incorporated in each activity, and appropriate instruments for measurement, registry and stocking of information should have been included. Their absence in several pilot activities (in some cases due to increased costs resulting from the purchase of such tools) has prevented a more accurate and detailed gathering of information.

Monitoring and evaluation were identified as a specific concern for the government of Palau in its fifth national report. However, this has been addressed by using community members' often extensive anecdotal knowledge of local environmental conditions, which is valuable in bridging some information gaps.

Improved monitoring and evaluation methods are needed, particularly methods with some level of standardization, if appropriate, which will enable comparisons between EbA approaches. Currently much evaluation is anecdotal, has not been peer-reviewed, and focuses mainly on success stories (Royal Society 2015).

6.5.2 Lessons Learned

Participants at the CBD technical workshop for EbA and Eco-DRR identified several challenges and lessons learned:

a) Beyond defining concepts, a key to leveraging the expertise from diverse communities (ecosystem, adaptation and disaster reduction) is to focus on the objectives that each community is trying to achieve and understanding the various indicators that each use. This is the basis for dialogue and finding common ground.

b) Monitoring and evaluation enable the review of policies and plans based on progress made and challenges encountered. It is important to consider both risk-informed decision-making and opportunity-informed decision–making, such as identifying watersheds or other ecosystems where there are opportunities for delivering measurable results in adaptation and disaster risk reduction.

6.5.3 Opportunities

Monitoring and evaluation is also necessary for adaptive management – needed in all adaptation processes given the uncertainty inherent in climate change projections – which enables a flexible approach in the face of uncertainty of future climate impacts. For example, deforestation pressures from agricultural expansion may change as suitability of areas for production changes (Munroe and Mant 2014). Adaptive management enables incorporation of relevant information as it becomes available (for example on emerging local changes due to climate change), and maintaining flexibility and diversity in approaches.

A variety of innovative tools for monitoring and evaluation have been developed and could be adopted to a greater extent. For example, the CBD and the Biodiversity Indicators Partnership have developed a series of factsheets and potential indicators to assist with national implementation of activities. As discussed above, several of the Aichi Targets have a bearing on EbA and Eco-DRR strategies to address adaptation to climate change and DRR. An example of indicators associated with Target 15 is shown below (Figure 14). Factsheets have been developed on proposed indicators for the Strategic Plan for Biodiversity 2011-2020 and potential sources of information.[18] Regional facilitators to assist in biodiversity indicators development are also available.

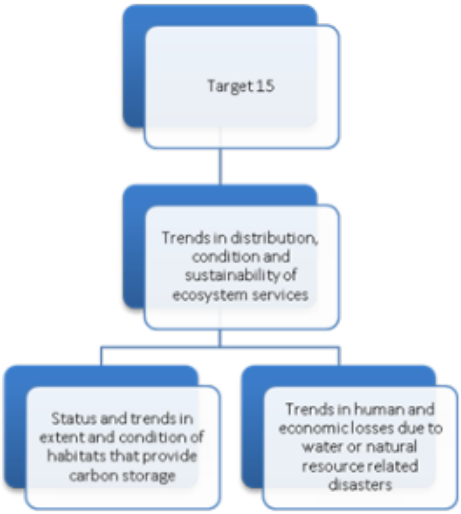


Figure 14: Examples of indicators related to the achievement of Aichi Target 15.

18 The Strategic Plan Indicators Factsheets are available via a searchable database at http://www.cbd.int/sp/indicators/. Regional facilitators can be contacted via http://www.bipnational.net/GetInvolved/FindaFacilitator.

7. CONTRIBUTION OF INDIGENOUS PEOPLES AND LOCAL COMMUNITIES TO ECOSYSTEM-BASED APPROACHES

Indigenous peoples and local communities (IPLCs) experience severe impacts of climate change in their territories due to their location in vulnerable habitats, including small islands, high altitude zones, desert margins and the circumpolar Arctic (Nakashima et al. 2012). Climate change response policies and strategies that do not take into consideration the particular needs and circumstances of IPLCs may prove to be inadequate, ill-adapted or inappropriate.

IPLCs have long managed variability, uncertainty and change through multigenerational histories of interaction with the environment (Nakashima et al. 2012). Traditional knowledge and coping strategies can thus form an important basis for climate change and disaster risk reduction responses.

> "Indigenous, local, and traditional knowledge systems and practices, including indigenous peoples' holistic view of community and environment, are a major resource for adapting to climate change, but these have not been used consistently in existing adaptation efforts. Integrating such forms of knowledge with existing practices increases the effectiveness of adaptation."
>
> *—IPCC Fifth Assessment Report (WGII Summary for Policymakers)*

Traditional and indigenous knowledge was included as a guiding principle for the Cancun Adaptation Framework under the UNFCCC. In CBD decision X/33, Parties and other Governments were invited to recognize the role of indigenous and local community conserved areas (ICCAs) in strengthening ecosystem connectivity and resilience and supporting biodiversity-based livelihoods in the face of climate change. Parties were also invited to consider traditional knowledge, including the full involvement of indigenous and local communities in planning and implementing effective climate-change mitigation and adaptation activities.

The IPCC Fifth Assessment Report (AR5) highlighted that integrating indigenous, local and traditional knowledge systems and practices with existing practices will increase the effectiveness of adaptation (IPCC 2014). This was reiterated by Parties to the CBD in decision XII/20.

The Sendai Framework for Disaster Risk Reduction 2015-2030 also emphasizes the contribution of traditional, indigenous and local knowledge in addressing key priorities laid out in the framework, including understanding disaster risk and strengthening disaster risk governance.

Key safeguards are rights enshrined in the United Nations Declaration on the Rights of Indigenous Peoples and human rights treaties, particularly the rights to self-determination and self-governance and to provide or withhold free, prior and informed consent for activities on their territories, lands and resources.

In 2007, the UN Declaration on the Rights of Indigenous Peoples recognized the rights of indigenous peoples to the territories and resources traditionally owned, occupied, used or acquired.

Such policies and conventions set out or acknowledge the rights of IPLCs, which must be respected and upheld in disaster risk reduction, prevention and preparedness activities, including full and effective participation of IPLCs in national planning processes and other decision-making processes that affect them.

Experiences extracted from fifth national reports, case studies and a broader literature review have demonstrated the value of participatory approaches to designing and implementing EbA and Eco-DRR and incorporating traditional knowledge into planning. The benefits include increased ownership of programmes/activities, enabling local innovation, ensuring equitable distribution of benefits, and maintaining project impact. Several examples are briefly described below.

The Government of Canada, as included in its fifth national report, is using traditional knowledge to guide national park management. Cooperative management allows Aboriginal traditional knowledge to inform aspects of park planning and operations, including the monitoring and restoration of park ecosystems which they depend on for food and fibre.

Case Study 18: Addressing food security - the use of traditional knowledge for adapting productive systems to climate change in Mexico

Changing temperature or precipitation patterns and climate extremes can threaten crop productivity. Risk of food shortages or famine can be mitigated by diversifying crops, land use or livelihood options, or implementing agroforestry or conservation agriculture. In the Central Region of the Sierra Madre Oriental in Mexico, families depend on corn crops to survive. However, this region has experienced increasingly frequent and intense weather events for the last 30 years including a rise in average temperature of 3 degrees in May in the last decade, and declines in rainfall. Communities have adapted through their accumulated traditional knowledge from their ancestors, which enables them to select seeds from their own diverse harvests, rather than sowing commercial seeds which have not been adaptable to different ecological conditions and climate change impacts

— Avalos et al. 2012, extracted from Mexico's submission to the CBD

For example, shellfish are an important part of the local economy and diet of the Coast Salish First Nations. Impacts of climate change may include reduced shellfish harvests due to climate-induced changes in water temperature or ocean circulation, harmful algal blooms or invasive species. As part of a collaborative clam monitoring and management project with the Coast Salish Nations, Parks Canada undertook a traditional knowledge study with Elders and key informants to gain more information regarding historic clam abundance levels and traditional management techniques. This study has enabled better understanding of contemporary shellfish data, and identification of potential techniques to improve restoration and management of clam populations in Gulf Islands National Park Reserve in British Columbia (Canada's fifth national report).

In a related example, clam gardens are a traditional form of shellfish management designed to ensure a reliable food source for the large populations of First Nations and Native Americans that inhabit the northwest coast of North America. The Clam Garden Network, an interdisciplinary, cross-sectoral network, has been formed to research and promote clam gardens for their significant cultural and ecological properties. It involves a community of First Nations iindigenous peoples, academics, researchers, and resource managers from coastal British Columbia, Washington State and Alaska.

The Government of Niue encourages traditional practices associated with hunting, fishing and agriculture, which incorporate long-term closures of forest or coastal areas to harvesting (*tapu*) or short-term bans in particular areas (*fono*). Use of t*apu* and *fono* is another example of maintaining traditional practices to enhance resilience of IPLCs to the impacts of climate change, which have particularly serious consequences for the inhabitants of Niue, as in other small island developing States. More permanent El Niño-like conditions as a result of climate change are predicted in Niue, which would result in increased fluctuations in fish numbers and distribution. Relative warming could reduce the strength of the water up-welling system in the central equatorial Pacific where Niue is located, which in turn may reduce fish productivity (Secretariat for the Pacific Community 2008).

While not specifically referred to as EbA, conservation practices such as *tapu* or *fono* are implemented to ensure sustainability of resources that Niueans depend on for food and traditional arts and crafts such as weaving, and may enhance the resilience of ecosystems to these impacts of climate change (Government of Niue's fifth national report). Other examples of closures similar to *tapu* or *fono* can be found in French Polynesia, Palau, and elsewhere.

Case Study 19 below outlines the importance of participatory approaches involving local communities in the planning, design, validation and implementation phases of EbA and Eco-DRR measures in the Peruvian Andean highlands.

Indigenous peoples' and community conserved territories and areas (ICCAs) involve collective decision-making about nature, and are closely related to peoples' livelihoods, culture and identity. ICCAs can be found around the world, span all types of ecosystems and cultures, have thousands of local names and are extremely diverse.

Case Study 19: Implementing low-regrets measures in the Peruvian Andes (Nor Yauyos-Cochas Landscape Reserve)

The Nor Yauyos-Cochas Landscape Reserve (NYCLR), located in the Peruvian Andean highlands, is one of 76 natural protected areas managed by Peru's National Service of Natural Areas. In this area, a number of EbA measures are being implemented, via a participatory methodology to select adaptation measures. EbA and Eco-DRR measures that are seen as "low-regrets" activities from the communities' perspective include:

- Sustainable water and grassland management, where upper micro-watersheds, wetlands, watercourses, and their associated vegetation (mainly grasslands) are managed to provide water storage, groundwater recharge and regulation services; and
- Community-based sustainable native grassland management to enhance pastoral livelihoods and increase resilience to extreme climatic events.

The process of consultation, diagnosis, and design of the measures lasted eight months. Project sites were selected based on environmental, social, ecological, political, and operational criteria. Field trips and workshops were carried out to identify vulnerabilities based on local perceptions, the local communities' needs and priorities, and ideas to address the vulnerabilities. Proposed activities were presented and validated by local stakeholders, reserve staff and project partners.

The participatory approaches used so far in the planning, design, validation and implementation phases have been key to delivering bottom-up activities that empower and enhance local community ownership.

A recommended action for incorporating climate change adaptation into protected areas systems is to follow a horizontal model of co-management, thus strengthening the governance of protected areas and enabling adaptation of the local communities and the ecosystems they depend on.

-—Global mountain EbA programme, funded by the German Government and implemented by UNEP, UNDP and IUC

They are built on collective ecological knowledge and capacities, including sustainable use of wild resources and maintenance of agrobiodiversity.

ICCAs are typically designed to maintain livelihood resources for times of stress, such as during severe climate events, war and natural disasters. Examples of ICCAs include:

- Sacred spaces such as the Chizire sacred forest, Zimbabwe; Khumbu of the Sherpa people (Mount Everest National Park); Indian Himalayas;
- Indigenous territories and cultural landscapes/seascapes, such as the Paruku Indigenous Protected Area, in Western Australia; and Traditional territory of ASATRIZY, Yapú, Vaupés, Colombia;
- Territories and migration routes of nomadic herders/mobile indigenous peoples, such as wetlands in Qashqai mobile peoples' territory, Iran;
- Sustainably managed wetlands, fishing grounds and water bodies (e.g., temporarily and/or permanently forbidden sites (*manjidura*), Bijagos biosphere reserve, Guinea-Bissau);
- Community-established, owned and managed areas in industrialized countries (Gajna floodplain commons, Croatia).

Indigenous, traditional and local knowledge systems – and forms of analysis and documentation such as community mapping – can play a significant role in identifying and monitoring climatic, weather and biodiversity changes and impending natural hazards, similar to early warning systems.

7.1 CHALLENGES AND GAPS

Challenges in integrating indigenous, local, and traditional knowledge into EbA and Eco-DRR practices, as identified by participants at the EbA and Eco-DRR workshop, include:

a) Integrating local knowledge and experience into national and regional policies and strategies;

b) Territorial and land ownership issues;

c) Ecosystem-based approaches for adaptation are often top-down and do not integrate lessons learned from community-based adaptation;

d) Guidelines on how to support the integration of gender considerations and local knowledge into adaptation actions have not been synthesized or integrated into the current principles of and/or guidelines for ecosystem-based approaches for adaptation (UNFCCC 2013);

e) Some IPLCs are experiencing climate change impacts on such a large scale that their traditional knowledge and traditional management strategies have become less reliable or not effective.

Under the UNFCCC Nairobi Work Programme, a workshop was held in Bonn, Germany, in April 2014, on the use of indigenous and traditional knowledge and practices for adaptation, and the application of gender-sensitive approaches and tools for understanding and assessing impacts, with a view to developing recommendations for practitioners. Participants at the workshop further identified challenges and needs related to:

- Limited resources, including finance, technology and capacity. While the indigenous and local communities vulnerable to impacts of climate change have rich knowledge in managing natural resources sustainably, they have minimal access to resources to address adverse climate impacts;
- Changes in local and indigenous communities themselves through the adoption of modern lifestyles, which can lead to the discontinuation of intergenerational learning and abandonment of local and traditional practices;
- The ability and willingness of national and local governments to engage with local and indigenous communities and to appreciate and respect the body of traditional knowledge and practices. The different roles and responsibilities of the various actors in the collaboration need to be made clear and recognized by all involved;
- The ability of time-bound adaptation projects and initiatives to recognize the relatively long time frame required to build relations, trust and a collaborative environment with local communities and holders of indigenous and traditional knowledge and practices;
- The need to ensure predictable and tangible benefits for, and empowerment of, communities resulting from collaboration. Otherwise local and indigenous communities face the risk of their knowledge and practices being extracted without proper compensation, which can then lead to collaboration fatigue.

7.2 LESSONS LEARNED

National multi-stakeholder working groups have been effective in facilitating knowledge-sharing across sectors on the role of ecosystems in adaptation, and in coordinating policy reviews and inputs. Inclusion of policymakers and experts from both climate and biodiversity disciplines has helped enhance awareness of biodiversity-climate links, facilitate discussion between focal points of multilateral agreements, and promote a more holistic approach to policy development. Where possible, existing working groups and knowledge platforms should be used and enhanced to avoid redundancy and improve cost-effectiveness (BirdLife International's submission to CBD).

REDD+ has been briefly discussed above in Section 6, "Implementation" as a possible mechanism, with careful implementation, for integrating an ecosystem approach that meets both mitigation and adaptation needs. The development and implementation of legal, social, environmental and accountability safeguards is critical to the success of REDD+. While many frameworks governing REDD+ contain safeguards and policies to address the rights of IPLCs, there is often little oversight and accountability of these frameworks at the implementation stage (Nakashima et al. 2012). Indigenous worldviews must be integrated into social safeguards and approaches to ensure meaningful and equitable participation of IPLCs, and should be closely monitored through all phases of project development and implementation (Nakashima et al. 2012).

Lessons identified by participants at the CBD technical workshop on EbA and Eco-DRR included the following:

a) Traditional knowledge is an important part of ecosystem-based approaches, can complement science, and can bridge gaps in information. Indigenous, traditional and local knowledge systems – and forms of analysis and documentation such as community mapping – can play a significant role in identifying and monitoring climatic, weather and biodiversity changes and impending natural hazards, similar to early warning systems.

b) Effective EbA and Eco-DRR should consider the kind of support that communities need for adaptation and DRR (e.g. through needs assessments). Listening to the diverse and differentiated needs of indigenous peoples and local communities is necessary since interventions that do not consider needs, roles, aspirations, etc. can be detrimental to IPLC livelihoods and cultures. Also important is ensuring prior and informed consent and government and other institutional support, including resource mobilization, promoting community-led initiatives, and respecting local forms of governance.

c) Further awareness is needed about the importance of processes of consultation and community engagement throughout all steps of the project, including inception and planning. Involving communities creates ownership of processes that in turn can ensure the sustainability of the project in the long run.

d) It is important to understand the cosmovision[19] of IPLCs when undertaking EbA and Eco-DRR, in order to realize the contributions they can make. IPLCs may be vulnerable to climate change impacts but they are also important knowledge holders and rights holders.

e) Differences in terminologies related to EbA and Eco-DRR depend on different experiences and areas of work, but it is important that adaptation and DRR approaches integrate all three pillars – social, environmental and economic – in projects and strategies, and not regard them as separate issues.

7.3 OPPORTUNITIES

Several tools are available to facilitate the engagement of IPLCs in EbA and Eco-DRR, and these can be adopted to a greater extent. An example of a participatory tool and process for understanding vulnerability and ecosystem services is a toolkit for assessing ecosystem services (TESSA; see Annex 4), developed by BirdLife International. TESSA engages local communities in consultation, data collection, interpretation and verification. BirdLife International in Burundi worked with the Serukubeze community to assess their vulnerability and plan for adaptation using TESSA. The tool helped the community understand and communicate to decision makers their dependence upon ecosystems and the implications of different land use scenarios. Through this participatory process the community was empowered and mobilized to take collective and locally appropriate action to address their vulnerability (BirdLife International's submission to the CBD).

Participants at the UNFCCC Nairobi work programme workshop on the use of indigenous and traditional knowledge and practices for adaptation identified several opportunities in using indigenous and traditional knowledge,

19 Worldview that has evolved over time that integrates physical and spiritual aspects (adapted from the Indigenous Peoples' Restoration Network).

addressed through sharing of lessons learned, good practices and tools at various stages of the adaptation policy process. Figure 15 provides a useful summary of this process that can be applied in implementing EbA and Eco-DRR activities (UNFCCC 2014).

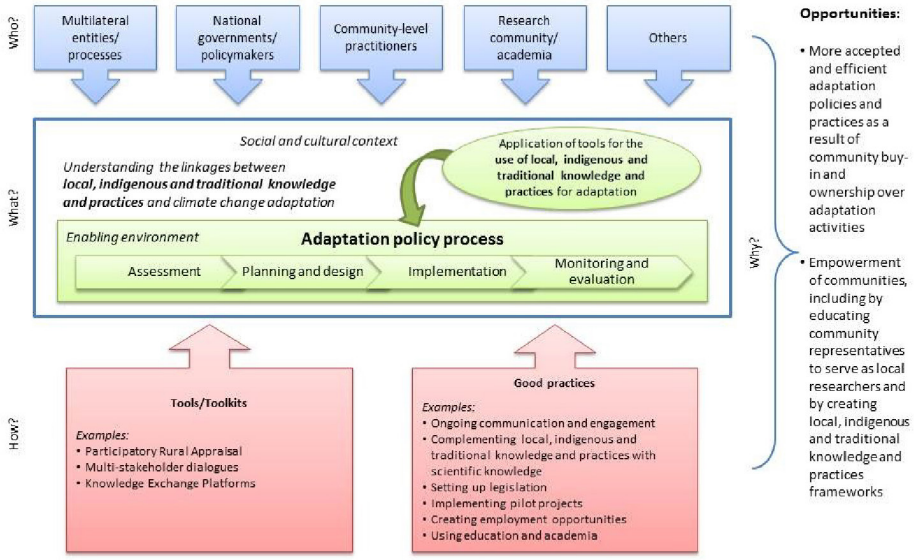


Figure 15: Opportunities in using indigenous and traditional knowledge and practices for adaptation through sharing of lessons learned, good practices and tools throughout the adaptation policy process (UNFCCC 2014).

8. GENDER MAINSTREAMING: THE ROLE OF GENDER IN ADAPTATION AND DRR

There is growing international dialogue about the different ways that climate change can affect men, women and children, and recognition that gender perspectives need to be incorporated into adaptation solutions. Some of the key issues that underpin gender inequalities relevant to climate change and disaster risk include lack of equal rights for women, and corresponding lack of access to resources, legal protection, decision-making and ownership over land and natural resources, and vulnerability to violence (Oxfam 2010).

When wood or water is scarce, women and children are most often venturing further out to look for these resources, leaving school and becoming exposed to potential violence. Women farmers are responsible for a significant portion of the world's food production, but they are often barred from agricultural decision-making and have less access to land and resources (UNDP 2010a).

Rural women in particular are responsible for half of the world's food production and produce between 60-80% of the food in most developing countries. In Africa, the share of women affected by climate-related crop changes could range from 48% in Burkina Faso to 73% in the Congo. Women are more likely than men to die during a disaster (UNDP 2010a).

Women and girls bring different perspectives and capabilities to the adaptation and disaster risk reduction effort. Adaptation and DRR policies and programmes can be strengthened if contributions from both women and men are incorporated. The inclusion of all segments of society – men, women, children, minorities and ethnic groups – are important at all stages of decision-making (IUCN 2014a).

Indicative Statistics on Gender, Disasters and Climate Change (UNDP 2010a)

- During the 1991 cyclone disasters in Bangladesh, 90% of the 14,000 fatalities were women (Ikeda, 1995)
- Women, boys and girls are more than 14 times more likely than men to die during a disaster (Peterson, 2007)
- The majority of victims in Hurricane Katrina were African-American women and their children, a group likely to be poor, lack health care and earn low wages (Gault et al, 2005; Williams et al, 2006)
- In Hurricane Mitch, men suffered higher mortality rates because they took more risks trying to save themselves and their families (Bradshaw, 2004)

In addition to the Cancun Agreements, CBD decisions, and UNCCD Advocacy Policy Framework on Gender, the role of women has also been highlighted in the Sendai Framework for Disaster Risk Reduction 2015-2030, which emphasizes that "women and their participation are critical to effectively managing disaster risk and designing, resourcing and implementing gender-sensitive disaster risk reduction policies, plans and programmes." It further calls for adequate capacity-building measures to be taken to empower women for preparedness, and to build their capacity to secure alternate means of livelihood in post-disaster situations (UNGA 2015).

Gender mainstreaming should be a significant aspect of the adaptation and disaster risk reduction planning and implementation process to ensure success and sustainability of policies, programmes and projects. Gender mainstreaming is a globally recognized strategy for making women's as well as men's concerns and experiences an integral dimension of the design, implementation, monitoring, and evaluation of policies and programmes in all political, economic, and societal spheres. Gender mainstreaming ensures that women and men benefit equally from processes of development, and that inequality is not perpetuated (Oxfam 2010).

Figure 16 illustrates the process of incorporating gender considerations into EbA and Eco-DRR, as developed through the Huairou Commission's Community Resilience Fund (CRF), a grassroots-run community fund focused on reducing vulnerability to climate and disaster risks and losses in poor rural and urban communities subject to tropical storms, flooding, landslides, drought, seismic activity, food insecurity and other threats. In the "resilience diamond" (Figure 16), women identify disaster and climate-related risks and vulnerabilities in the communities, then prioritize and put in place activities to protect lives, homes, assets, livelihoods, services and infrastructure.

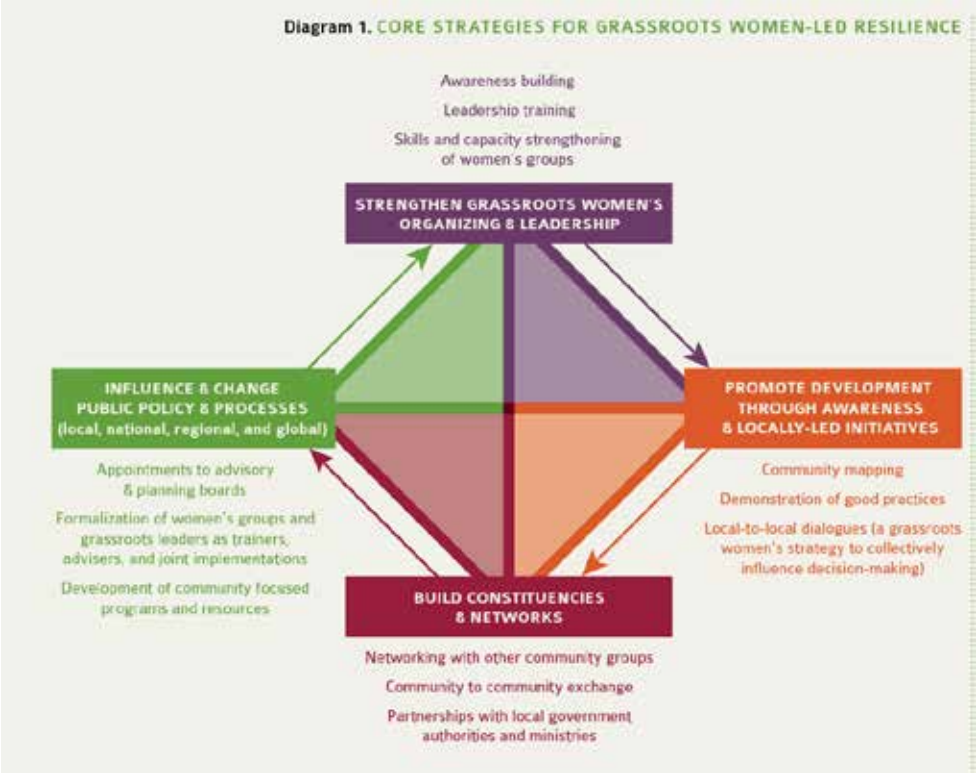


Figure 16: Resilience Diamond: core strategies for grassroots women's-led resiience (The Huairou Commission 2015)

The fifth national reports and case studies indicated encouraging progress on the recognition that involvement of women and all sectors of society is important in planning processes. There were, however, few concrete examples of action on gender mainstreaming, particularly for adaptation and disaster risk reduction planning.

The Gambia's fifth national report describes the National Policy for Advancement of Gambian Women which mainstreams women into the national development process, across all sectors and setting goals and strategies. The objectives include enhancing and developing the productive capacities of women with a view to "increasing their contribution to household welfare and food security, in particular reducing drudgery of rural women to enhance their quality of life, and increasing women's access to production resources and inputs and support services".

In the Gambia, the Women's Bureau is an important institution that advises the government and is responsible for conducting data collection, research, analysis and dissemination of information, monitoring of women's programmes, and backstopping to other institutions. While these measures do not yet explicitly mention the role of gender considerations in adaptation to climate change and disaster risk reduction, they provide an important basis or starting point.

Several experiences with integrating gender considerations into adaptation strategies were discussed at the UNFCCC Nairobi work programme workshop in Bonn, Germany (April 2014), on the use of indigenous and traditional knowledge and practices for adaptation, and on the application of gender-sensitive approaches and tools for understanding and assessing impacts.

For example, women were an important source of information for a vulnerability assessment tool used in Swaziland in relation to food security. The information was collected through household surveys, which served as a useful tool to collect gender-disaggregated vulnerability data (UNFCCC 2014).

Case Study 20: : Women adapting livelihood strategies in response to unpredictable rainfall in Uganda

In Caicaoan, a village in Karamoja in north-eastern Uganda, the climate is changing in unpredictable ways. For three years the rain came late, and when it came, very little rain fell. But then 2007 saw the worst flooding in 35 years. Harvests were destroyed and grain stores stood empty. With men spending weeks away from home tending cattle, women were left caring for families and struggling to find alternative sources of income. Collecting and selling firewood was one option, but firewood became more and more scarce, and women had to travel further and further to find it, and to places that were less safe.

Deforestation and lack of water are two of the many problems that the local women's group in Caicaoan decided to address. They successfully planted evergreen and mango trees to replace those cut down for fuel and charcoal, and this reduced soil erosion and helped women earn an income. They also built a borehole so that the seven-hour round trip they used to make to collect water was reduced to 30 minutes. The work of the women's group has given women an important leadership role in finding sustainable livelihoods solutions for the community.

— excerpted from "Sisters on the Planet", Oxfam 2007.

The different roles in society, and different knowledge of natural resources, of men and women were also an important consideration in mangrove rehabilitation activities in Timor-Leste. Because women were mainly responsible for collecting resources in coral reefs and mangroves while men were mainly responsible for fishing, women acquired more knowledge about mangroves. Women's involvement during participatory planning and monitoring and evaluation benefited the mangrove rehabilitation programme (UNFCCC 2014).

8.1 CHALLENGES AND GAPS

As with integrating traditional knowledge and participation of IPLCs, little information was found related to challenges and opportunities for gender mainstreaming into EbA and Eco-DRR activities in the review of reports and literature. Participants at the UNFCCC workshop and the CBD technical workshop provided several insights on challenges and opportunities.

Challenges identified were:

a) The limitations associated with social and cultural context and specificity of existing gender-sensitive approaches;

b) The lack of political will for gender-sensitive adaptation policies and plans;

c) Limited resources, including finance, technical and institutional capacities at all levels;

d) Misconception about gender equity and perception that gender is a women's issue only, when gender refers to both men and women;

e) Lack of comprehensive and consistent gender mainstreaming throughout the adaptation cycle;

f) Lack of understanding the benefits of gender-sensitive adaptation actions;

g) Lack of gender-sensitive approaches in monitoring and evaluation;

h) The need for enhanced decision-making power for women and initiatives that are targeted to reducing women's barriers to playing an active role in adaptation and disaster risk reduction processes.

8.2 LESSONS LEARNED

Participants at the CBD technical workshop on EbA and Eco-DRR identified several lessons learned regarding gender mainstreaming in EbA and Eco-DRR measures:

a) Different genders use and value ecosystems differently, which is an essential consideration for EbA and Eco-DRR activities, including assessing vulnerabilities and risks to climate change.

b) There is a need for capacity-building to understand gender issues for effective implementation of EbA and Eco-DRR initiatives, monitoring and evaluation of the impacts of gender mainstreaming, and associated resource mobilization for these activities.

c) Gender mainstreaming should be a significant aspect of adaptation and disaster risk reduction planning and implementation processes to ensure success and sustainability of policies, programmes and projects. Evaluating the impacts of gender mainstreaming is also important.

d) Even when gender has been mainstreamed into climate adaptation policy, implementation is still challenging.

e) Successful examples of gender mainstreaming can be seen from grassroots women's organizations in the Americas where women's groups are now training local governments on how to reduce disaster risk and build partnerships with local governments. These models have been successful and are now being considered as policy options including at the regional level.

f) Resource mobilization and funds allocation is needed for gender mainstreaming.

g) Beyond gender-sensitive approaches, gender-responsive initiatives that can have a transformative effect on adaptive and DRR capacity and approaches are also critical for real progress on gender mainstreaming.

h) Youth empowerment, regardless of gender, is also crucial as young people can be motivated in driving positive change but often do not have the means, knowledge or jurisdiction to act.

8.3 OPPORTUNITIES

Gender-sensitive approaches and tools have been promoted for understanding and assessing impacts, vulnerability and adaptation to climate change, and "methodologies and practices are applied to ensure that both men and women's concerns, aspirations, opportunities and capacities are taken into account in all climate change adaptation activities, including assessments, planning, implementation, monitoring and evaluation and technology development" (UNFCCC 2013). A gender-sensitive approach would allow women's traditional knowledge to be used as an effective adaptation tool. For example, women in Hawaii used their knowledge of planting pandanus trees for coastal protection (UNFCCC2013).

A number of factors underline the need for gender-sensitive approaches and tools for adaptation, mostly relating to the difference between men and women in terms of their social roles and cultural specificities leading to different impacts of and vulnerabilities to climate change (see Figure 17).

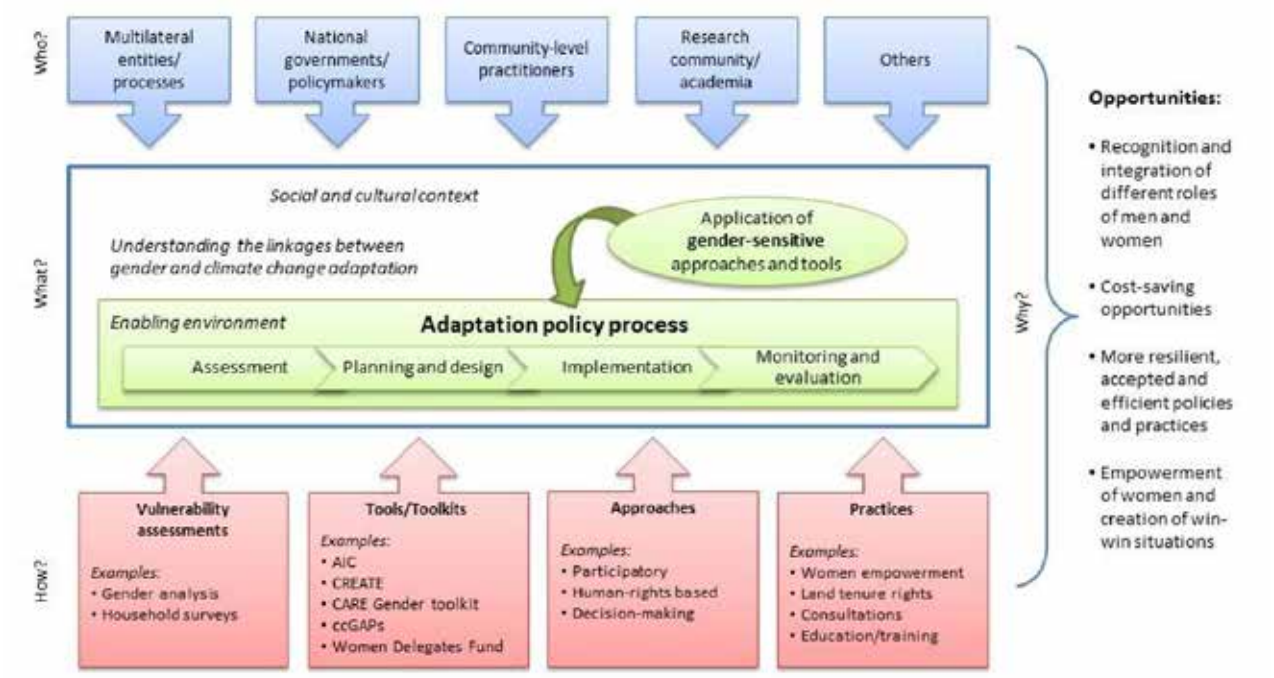


Figure 17: Opportunities related to the application of gender-sensitive approaches and tools for adaptation throughout the adaptation policy process. AIC = appreciate influence control, CREATE = Climate Resilience Evaluation for Adaptation through Empowerment, CARE = Cooperative for Assistance and Relief Everywhere, ccGAPs = climate change gender action plans (UNFCCC 2014).

9. GENERAL CONCLUSIONS

The compilation of activities from a wide variety of sources – submissions and fifth national reports to the Convention on Biological Diversity, national biodiversity strategies and action plans (NBSAPs), national adaptation programmes of action, and case studies from organization portfolios – demonstrated that a variety of ecosystem-based adaptation (EbA) measures are being implemented across the globe. This analysis is unique in that it enables the voices of countries to be heard in identifying challenges and early lessons learned in implementation. The compilation review also highlighted many EbA measures that, while not explicitly labelled as such, can be considered ecosystem-based disaster risk reduction(Eco-DRR) strategies.

Conserving, restoring and sustainably managing ecosystems can deliver on a number of national and international development priorities and obligations, including enhancing people's resilience to climate change and disasters, supporting biodiversity, mitigating climate change, and protecting food, water and livelihood security especially of vulnerable populations. Such actions can also help enhance the effectiveness of disaster risk reduction strategies.

EbA and Eco-DRR have been demonstrated in some cases to be cost-effective, low-regrets approaches to adaptation and disaster risk reduction. However, they also face challenges. The nascent stage of many activities and programmes make it difficult to quantify the full range of adaptation benefits achieved thus far. Lack of financial, technical and human resources can impede assessments of risks and vulnerabilities. New tools and methodologies for evaluating the costs and benefits of EbA and Eco-DRR activities, and assessing the full range of benefits, both monetary and non-monetary, will inform the process of planning and choosing various adaptation options.

An integrated and concerted approach to implementing global policy frameworks such as the CBD, UNFCCC, Sendai Framework for Disaster Risk Reduction 2015-2030, and Sustainable Development Goals can ensure efficient use of human and financial resources, deliver tangible impacts on the ground, optimize synergies, and reduce trade-offs.

EbA and Eco-DRR can be scaled up through effective mainstreaming into policy and practice. This needs to take place at multiple levels of policymaking, planning, programming, budgeting, and implementation. Embedding EbA and Eco-DRR in long-term visions, national development plans, and all relevant sectors and ministries can provide an enabling framework for, and direct funding towards, EbA and Eco-DRR implementation.

The unique set of physical, environmental, and socioeconomic conditions in each region or country means that the design of EbA and Eco-DRR activities should be context-specific, and should incorporate traditional and local knowledge as well as utilize the best available science. Planning and implementation should include full participation of indigenous peoples and local communities, women, men, children, and stakeholders, as emphasized in the Cancun Agreements, decisions under the Convention on Biological Diversity, the Sendai Framework, and the Sustainable Development Goals.

Recent experience shows the value of integrating ecosystem-based approaches as soon as possible into DRR frameworks to ensure their uptake and funding (FAO 2014). Several entry points have been identified for integrating and mainstreaming EbA and Eco-DRR into biodiversity, development, and disaster risk reduction considerations, and into other national planning processes such as NAPs and adaptation programmes and activities.

Climate change adaptation and disaster risk reduction are interdisciplinary and intersectoral processes. To address this intersection of disciplines and sectors, numerous cross-cutting tools have been developed to facilitate the implementation of EbA and Eco-DRR. Annex 4 provides a non-exhaustive list of such tools and resources for EbA and Eco-DRR, including for communicating EbA and Eco-DRR; frameworks for assessing vulnerabilities, risks and impacts; networks and fora; case studies and databases; and training opportunities.

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ANNEX 1: EBA ACTIVITY CATEGORIES AND EXAMPLES OF RELATED ECO-DRR ACTIVITIES

Table 4: Categories of EbA activity, and examples of related Eco-DRR activities used in the framework for reviewing fifth national reports and other materials

EbA activity category	Brief description	Examples of Eco-DRR activities related to the EbA category
A	Assessing vulnerabilities, hazards, risks, impacts	Using scenarios to forecast potential climate change impacts to people and ecosystems
B	Establishing and effectively managing ecosystems to ensure the continued delivery of the services ecosystems provide that increase resilience to climate change, for example through protected areas	Protection of forests to regulate water flows, prevent erosion, or protect settlements from avalanches Managing ecosystems to complement, protect and extend longevity of investments in hard infrastructure
C	Other area-based management, e.g. marine spatial planning, integrated coastal zone management (ICZM)	Implementing marine spatial planning to protect coral reefs, in order to provide wave attenuation and protect coastlines from storm surges
D	Ecosystem restoration	Coastal defense through protection or restoration of mangroves, salt marshes, or coral reefs, to reduce impacts of coastal erosion Slope stabilization through planting indigenous grasses
E	Build adaptive capacity, capacity-building activities utilizing ecosystem approach	Training on marine and coastal resources conservation for communities
F	Work with practices that use appropriate species and technologies better adapted for climate change: conservation agriculture, agroforestry, evergreen agriculture, soil conservation	Improving water use efficiency Improvement to maintain ecosystem integrity and water security Crop diversification. to ensure food security and prevent food shortages and famine
G	Manage seasonal movements of people and livestock to better conserve ecosystem's services and biodiversity from climate impacts	National assessments of the health of pastoral lands to identify risks to livelihoods
H	Manage threats to biodiversity/resilience of ecosystems associated with climate change; e.g. managing spread of invasive alien species	Managing invasive alien species linked to land degradation and that threaten food security and water supplies
I	Economic analyses such as cost-benefit analysis, valuation of ecosystem services and natural capital	Valuation of the socioeconomic value of corals and associated ecosystems
J	Natural resource management (fisheries, forests)	Conservation and efficient use of forest biodiversity to safeguard livelihoods

ANNEX 2: AICHI BIODIVERSITY TARGETS AND THEIR RELATION TO EBA AND DRR

Table 5: Aichi Biodiversity Targets and their relation to EbA and disaster risk reduction, used in the framework for reviewing fifth national reports and other materials

Strategic goal	Aichi Biodiversity Target	Relation to EbA and DRR
B. Reduce direct pressures biodiversity and promote sustainable use	**Target 5:** By 2020, the rate of loss of all natural habitats, including forests, is at least halved and where feasible brought close to zero, and degradation and fragmentation is significantly reduced.	Forests and coastal vegetation can serve as a protective buffer from extreme events
	Target 7: By 2020 areas under agriculture, aquaculture and forestry are managed sustainably, ensuring conservation of biodiversity.	DRR is a core element of sustainability for forestry and agriculture; forests serve as a protective buffer from erosion and landslides
	Target 10: By 2015, the multiple anthropogenic pressures on coral reefs and other vulnerable ecosystems impacted by climate change or ocean acidification are minimized, so as to maintain their integrity and functioning.	Coral reefs can be effective in protecting against coastal hazards, such as by reducing wave energy
C: Improve the status of biodiversity by safeguarding ecosystems, species and genetic diversity	**Target 11:** By 2020, at least 17 per cent of terrestrial and inland water areas, and 10 per cent of coastal and marine areas, especially areas of particular importance for biodiversity and ecosystem services, are conserved through effectively and equitably managed, ecologically representative and well connected systems of protected areas and other effective area-based conservation measures, and integrated into the wider landscapes and seascapes.	Protection of ecosystems, which allows them to keep providing services that are important for adaptation and disaster risk reduction, even beyond the boundaries of the protected area
	Target 13: By 2020, the genetic diversity of cultivated plants and farmed and domesticated animals and of wild relatives, including other socio-economically as well as culturally valuable species, is maintained, and strategies have been developed and implemented for minimizing genetic erosion and safeguarding their genetic diversity.	Reduces risks of climate change affecting food security and livelihoods
D: Enhance the benefits to all from biodiversity and ecosystem services	**Target 14:** By 2020, ecosystems that provide essential services, including services related to water, and contribute to health, livelihoods and well-being, are restored and safeguarded, taking into account the needs of women, indigenous and local communities, and the poor and vulnerable.	Ensures provisioning of essential ecosystem services, including those underpinning DRR
	Target 15: By 2020, ecosystem resilience and the contribution of biodiversity to carbon stocks has been enhanced, through conservation and restoration, including restoration of at least 15 per cent of degraded ecosystems, thereby contributing to climate change mitigation and adaptation and to combating desertification.	Resilient ecosystems are a key component of DRR, e.g. restoration of coastal vegetated ecosystems contributes to mitigation, adaptation and disaster risk reduction through shoreline stabilization

ANNEX 3: OVERVIEW OF INTERNATIONAL POLICIES, STRATEGIES AND FRAMEWORKS RELATED TO EBA AND ECO-DRR

Table 6: International policies, strategies and frameworks on adaptation, and linkages to EbA and Eco-DRR

Agency/ convention	Programme, policy, strategy or framework	Description	Linkages to EbA and Eco-DRR
UNFCCC	Cancun Adaptation Framework (CAF) (2010)	Enhance action on adaptation, preparation of NAPs, invites parties to "build resilience of socioeconomic and ecological systems". CAF affirms that enhanced action on adaptation should account for vulnerable groups, communities and ecosystems, and should be based on the best available science and, as appropriate, traditional and indigenous knowledge, to integrate adaptation into policies.	Reference to vulnerable groups, communities and ecosystems as targets for adaption action, including those vulnerable to climate-related hazards
UNFCCC	Nairobi work programme on impacts, vulnerability and adaptation to climate change	Aims to assist all countries, in particular developing countries, including least developed countries (LDCs) and small island developing States (SIDS), to improve their understanding and assessment of the impacts of climate change and to make informed decisions on practical adaptation actions and measures. At COP 19, ecosystems were included as a focus of the NWP.	Mechanism to enhance knowledge on EbA and Eco-DRR
UNFCCC	National adaptation plans (NAPs)	The national adaptation plan (NAP) process was established under the Cancun Adaptation Framework. It enables Parties to formulate and implement national adaptation plans (NAPs) as a means of identifying medium- and long-term adaptation needs and developing and implementing strategies and programmes to address those needs.	Entry point for mainstreaming the ecosystem-approach, including EbA and Eco-DRR
UNFCCC	National adaptation programmes of action (NAPAs)	NAPAs provide a process for least developed countries to identify priority activities that respond to their urgent and immediate needs to adapt to climate change – those for which further delay would increase vulnerability and/or costs at a later stage.	Entry point for mainstreaming the ecosystem-approach, including EbA and Eco-DRR
CBD	Decision X/33	The Conference of the Parties called for implementation of ecosystem-based approaches for adaptation, including sustainable management, conservation and restoration of ecosystems	Explicit mention of EbA and adaptation approaches that can include Eco-DRR measures
CBD	Strategic Plan for Biodiversity 2011-2020	The mission of the Strategic Plan is to "take effective and urgent action to halt the loss of biodiversity in order to ensure that by 2020 ecosystems are resilient and continue to provide essential services, thereby securing the planet's variety of life, and contributing to human well-being, and poverty eradication." Five strategic goals underpin twenty Aichi Biodiversity Targets to be achieved by 2015 or 2020.	Target 14 aims for safeguarding and restoration of ecosystems providing essential services; Target 15 aims for ecosystem restoration, contributing to mitigation and adaptation
CMS	Resolution 11.26, "Programme of Work on Climate Change and Migratory Species"	References the impacts of climate change on migratory species, including the impact on habitats and on local communities dependent on the ecosystem services provided by these species	EbA measures to conserve or restore these ecosystems will help people adapt to climate change
Rio Conventions, Ramsar, other organizations, and national governments	The "Hyderabad Call for a Concerted Effort on Ecosystem Restoration" was launched at CBD COP11.	Call to make concerted and coordinated long-term efforts to mobilize resources and facilitate the implementation of ecosystem restoration activities on the ground for sustaining and Improving the health and well-being of humans and all other species with whom we share the planet.	Ecosystem restoration builds resilience to impacts of climate change, and is considered both an EbA and Eco-DRR activity

Table 7: International policies, strategies and frameworks on DRR, and linkages to EbA and Eco-DRR

Agency/ convention	Programme, policy, strategy or framework	Description	Linkages to EbA and Eco-DRR
ISDR	International Strategy for Disaster Reduction (ISDR)	A vision to enable all communities to become resilient to the effects of natural, technological and environmental hazards, reducing the compound risks they pose to social and economic vulnerabilities within modern societies, and to proceed from protection against hazards to the management of risk through the integration of risk prevention into sustainable development.	Sustainable development is linked to resilience of people and ecosystems, which can be addressed through EbA and Eco-DRR measures
intergovern-mental	Final Declaration of the High Level Meeting on National Drought Policy (2013)	Calls on all the governments around the world to develop and implement national drought policies, and notes the need to create synergies between drought relief measures and the preparedness, mitigation and adaptation actions for long-term resilience.	Drought risk is closely linked to ecosystem degradation, which can be mitigated via conservation and restoration
UNCCD	Advocacy Policy Framework on drought adopted by COP 11 (Windhoek) Decision 9/COP.11	Urges Parties to develop and implement national drought management policies, and invites the World Meteorological Organization, FAO and others to collaborate with the UNCCD towards assisting country Parties.	As above
UN General Assembly	Sustainable Development Goal 13: Take urgent action to combat climate change and its impacts	Strengthen resilience and adaptive capacity to climate-related hazards and natural disasters in all countries. Improve education, awareness-raising and human and institutional capacity on climate change mitigation, adaptation, impact reduction and early warning. Promote mechanisms for raising capacity for effective climate change-related planning and management in least developed countries and small island developing States, including focusing on women, youth and local and marginalized communities.	Explicit linkages of resilient socioecological systems to adaptation and DRR
UN General Assembly	Sustainable Development Goal 11: Make cities inclusive, safe, resilient and sustainable	By 2030, significantly reduce the number of deaths and the number of people affected and substantially decrease the direct economic losses relative to global gross domestic product caused by disasters, including water-related disasters, with a focus on protecting the poor and people in vulnerable situations. By 2020, substantially increase the number of cities and human settlements adopting and implementing integrated policies and plans towards inclusion, resource efficiency, mitigation and adaptation to climase change, resilience to disasters, and develop and implement, in line with the Sendai Framework for Disaster Risk Reduction 2015-2030, holistic disaster risk management at all levels.	Mention of policies on adaptation with holistic DRR, which can include EbA and Eco-DRR measures
CBD	Decision XII/20	The Conference of the Parties promoted EbA and Eco-DRR.	Explicitly mentions EbA and Eco-DRR
UN General Assembly	Sendai Framework for Disaster Risk Reduction 2015-2030	Outlines seven global targets to be achieved over the next 15 years, prioritizing "ecosystem-based approaches…to build resilience and reduce disaster risk". It was endorsed by the UN General Assembly following the 2015 Third UN World Conference on Disaster Risk Reduction.	Explicitly mentions ecosystem-based approaches, which applies to both EbA and Eco-DRR
Ramsar Convention	COP12 (Punta del Este) adopted Resolution XII.13 on Wetlands and DRR	Emphasizes "importance of conserving, restoring and wise use of wetlands for disaster risk reduction".	Conservation, restoration and wise use of wetlands encompass elements of EbA and Eco-DRR

ANNEX 4: TOOLS AND RESOURCES FOR EBA AND ECO-DRR

ASSESSMENT FRAMEWORKS

Assessing Ecosystem Services

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

Integrated Valuation of Environmental Services and Tradeoffs (InVEST)
InVEST is a suite of software models used to map and value the goods and services from nature that sustain and fulfil human life. This tool enables decision makers to assess quantified trade-offs associated with alternative management choices and to identify areas where investment in natural capital can enhance human development and conservation. http://www.naturalcapitalproject.org/InVEST.html

Exploring Nature-Based Solutions: The role of green infrastructure in mitigating the impacts of weather- and climate change-related natural hazards
This report proposes a simple, practical methodology for screening (rather than assessing) ecosystem services in areas where green infrastructure may contribute to reducing current (or future) weather- and climate-related natural hazards. The hazards addressed include landslides, avalanches, floods, soil erosion, storm surges and carbon stabilization by ecosystems. Several case studies at the European level outline the screening process and also summarize recent estimates of the economic value of green infrastructure. http://www.eea.europa.eu/publications/exploring-nature-based-solutions-2014

Assessing Risks

CRiSTAL - Community-based Risk Screening Tool – Adaptation and Livelihoods
CRiSTAL is a tool developed by the International Institute for Sustainable Development, Stockholm Environment Institute and the International Union for the Conservation of Nature to help project planners and managers integrate climate change adaptation and risk reduction into community-level projects. https://www.iisd.org/cristaltool/

Climate Vulnerability and Capacity Analysis Handbook
Developed by CARE, the handbook assesses hazard impacts on each of the five categories of livelihood resources and provides a framework for community-based adaptation. http://www.careclimatechange.org/index.php?option=com_content&view=article&id=25&Itemid=30

CEDRA - Climate change and Environmental Degradation Risk and Adaptation assessment
Analyses risks posed by climate change and environmental degradation and supports NGOs in understanding communities' experiences of environmental change (Tearfund). http://tilz.tearfund.org/en/themes/environment_and_climate/cedra/

Risk and Vulnerability Assessment Methodology Development Project (RiVAMP) in Jamaica
This training manual was developed by UNEP to provide instruction on how to implement a methodology that helps to quantify the role of ecosystems in DRR and climate change adaptation, based on a pilot project implemented in Jamaica from 2009-2010. http://www.grid.unep.ch/products/3_Reports/RiVAMP_Training_2012.pdf

Integrated Strategic Environmental Assessment in Sri Lanka
UNEP and UNDP collaborated together to modify the existing strategic environmental assessment used for sustainable development planning. The new version, the Integrated Strategic Environmental Assessment, includes more disaster sensitivities into the analysis framework of SEAs. This tool was tested in Sri Lanka's Northern Province, which helped to map out the distribution of space and resources available for development with minimum environment and disaster constraints. This tool can enable other countries to promote integrated area development that is both sustainable and disaster-resilient. http://www.unep.org/disastersandconflicts/Introduction/DisasterRiskReduction/Capacitydevelopmentandtechnicalassistance/ISEAinSriLanka/tabid/105928/Default.aspx

Scenario Planning for Climate Change Adaptation: A Guidance for Resource Managers
A step-by-step guide to using scenarios to plan for climate change adaptation. The intended audience includes natural resource managers, planners, scientists and other stakeholders working at a local or regional scale to develop resource management approaches that take future possible climate change impacts and other important uncertainties into account. http://scc.ca.gov/files/2013/04/Scenario-Planning.pdf

OTHER PLANNING AND IMPLEMENTATION TOOLS

Climate-Smart Agriculture (CSA) Sourcebook
The sourcebook, developed by FAO, elaborates the concept of CSA and demonstrate its potential, as well as limitations. It aims to help decision makers at a number of levels (including political administrators and natural resource managers) to understand the different options that are available for planning, policies and investments and the practices that are suitable for making different agricultural sectors, landscapes and food systems more climate-smart. http://www.fao.org/3/a-i3325e.pdf

Traditional Knowledge and Climate Science Toolkit
This toolkit provides access to articles, videos and various other resources that will assist indigenous peoples, local communities, policymakers and other stakeholders in accessing research on climate change adaptation and mitigation. The toolkit is an initiative of the United Nations University's Traditional Knowledge Initiative (UNU-TKI). It is available in English, French, Spanish, Russian and Portuguese.

Gender, Climate Change and Community-Based Adaptation
Guidebook for designing and implementing gender-sensitive community-based adaptation programmes and projects. http://www.undp.org/content/dam/aplaws/publication/en/publications/environment-energy/www-ee-library/climate-change/gender-climate-change-and-community-based-adaptation-guidebook-/Gender%20Climate%20Change%20and%20Community%20Based%20Adaptation%20(2).pdf

Exploring nature-based solutions: The role of green infrastructure in mitigating the impacts of weather- and climate change-related natural hazards
Published by the European Environment Agency in September 2015, this report focuses on certain types of extreme events and natural hazards at the European scale that will likely increase due to climate change, such as landslides, avalanches, floods and storm surges. In addition, the report also touches upon the green infrastructure and ecosystem services contributing to global climate regulation. The analysis is carried out using spatially explicit data centred on the physical capacity of ecosystems to deliver services that can mitigate natural hazard risks. http://www.eea.europa.eu/publications/exploring-nature-based-solutions-2014

RESOURCES ON VALUATION OF EBA AND ECO-DRR ACTIVITIES

Brown et al. 2014. Evaluating Ecosystem-based Adaptation for Disaster Risk Reduction in Fiji. http://www.landcareresearch.co.nz/__data/assets/pdf_file/0004/77341/Fiji_disaster_risk_reduction.pdf

Buncle et al. 2013. Cost-Benefit Analysis for Natural Resource Management in the Pacific. http://www.undp-alm.org/sites/default/files/downloads/cost-benefit_analysis_for_natural_resource_management_in_the_pacific-a_guide.pdf

Bynoe et al. 2014. The use of Benefit-Cost Analysis to Assess Adaptation and Mitigation Interventions in the Caribbean: Case Studies. http://dms.caribbeanclimate.bz/M-Files/openfile.aspx?objtype=0&docid=6062

Frontier Economics. 2013. The Economics of Climate Resilience: Appraising flood management initiatives – a case study. Report prepared for DEFRA and the Devolved Administrations. http://randd.defra.gov.uk/Default.aspx?Module=More&Location=None&ProjectID=18016

NETWORKS AND FORUMS

- **WIN - World Indigenous Network**: a network that brings together indigenous peoples and local communities (IPLCs), land and sea managers. WIN has published a case study compendium detailing best practices learned from 20 IPLCs.
- **NBSAP Forum**: The NBSAP Forum was established in 2012 by UNDP, UNEP and the CBD Secretariat to provide a platform for connecting practitioners and those working on developing and updating NBSAPs.
- **BES-Net (Biodiversity and Ecosystem Services Network)**: a web portal which aims to provide an interactive capacity-building tool for scientists, policymakers and local-scale implementers in support of the Intergovernmental Science-Policy Platform for Biodiversity and Ecosystem Services (IPBES).
- **CDKN - Climate and Development Knowledge Network:** The Climate and Development Knowledge Network supports decision makers in designing and delivering climate compatible development by combining research, advisory services and knowledge management in support of locally owned and managed policy processes, working in partnership with decision makers in the public, private and non-governmental sectors nationally, regionally and globally. http://cdkn.org/
- **ReliefWeb:** provides disaster and crisis updates and analysis to humanitarians, so they can make informed decisions and plan effective assistance. ReliefWeb is a specialized digital service of the United Nations Office for the Coordination of Humanitarian Affairs (OCHA). http://reliefweb.int/
- **The Global Alliance for Climate-Smart Agriculture (GACSA):** a voluntary alliance of partners, dedicated to addressing the challenges facing food security and agriculture under a changing climate, and scaling up the climate-smart agriculture approach. Action groups promote knowledge-sharing, investment and enabling environments for integration of CSA across policy, strategies and planning. http://www.fao.org/gacsa/about/en/

CASE STUDIES AND DATABASES

- **CBD Climate Change Adaptation Database:** The database provides web-based guidance on the integration of biodiversity within adaptation planning. It gathers information tools and case studies from a number of relevant partners. https://adaptation.cbd.int
- **UNFCCC EbA database:** This database on ecosystem-based approaches to adaptation intends to provide supplemental information to FCCC/SBSTA/2011/INF.8, that was mandated by the SBSTA at its thirty-

fourth session in the context of the Nairobi work programme. unfccc.int/adaptation/nairobi_work_programme/knowledge_resources_and_publications/items/6227.php

- **The Integrated Drought Management Programme (IDMP)**: led by the World Meteorological Organization and Global Water Partnership, it provides policy and management guidance by sharing scientific information, knowledge and best practices for IDM, including an extensive library of resources. http://www.droughtmanagement.info/find/library/
- **The Panorama Initiative**: a IUCN-led effort to collate case studies that showcase how protected areas provide solutions to some of the world's key challenges, including climate change. The online platform allows practitioners to share their stories and to learn about how others have tackled problems drawing on protected area solutions across the globe. www.panorama.solutions
- **Case Study Sourcebook on Eco-DRR (2014)**: *The Ecosystem-based Disaster Risk Reduction: case study and exercise source book,* PEDRR, CNRD, 2014. Developed as a supplementary teaching and training resource for PEDRR's master's course on Eco-DRR, this source book analyses seven case studies to stimulate discussions on why investing in ecosystems management can be an effective measure to reduce disasters risks. http://postconflict.unep.ch/publications/DRR_CASE_STUDIES_&_EXERCISES.pdf

TRAINING

National training
In order to develop national capacities to address environmental sustainability, support livelihoods and cope with climate change, PEDRR has developed national trainings geared for policymakers, programme managers, and practitioners. It seeks to facilitate a multisectoral approach to disaster risk reduction and disaster risk management, working across different sectors related to natural resources management, disaster management, climate change, urban planning, etc. The overall aim of the national training is to promote institutional change towards integrating ecosystem-based disaster risk reduction into development planning at national and sub-national levels. http://pedrr.org/activities/national-training/

The Green Recovery and Reconstruction Toolkit (GRRT)
The GRRT is a training programme designed to increase awareness and knowledge of environmentally sustainable disaster response approaches. The GRRT is made of ten modules which are designed to be delivered in a one-day training workshop. Each GRRT module package includes a trainer's guide; training materials for a workshop; PowerPoint slides; a technical content paper that provides background information for the training; and additional resources for further study. The GRRT is a partnership between the American Red Cross and the World Wildlife Fund (WWF), and involved experts from the International Federation of the Red Cross and Red Crescent Societies, Oxfam, World Vision, RedR, United Nations Environment Programme, International Union for Conservation of Nature, CARE, Danish Refugee Council, U.S. Agency for International Development, Save the Children, Sphere, and Tearfund among others. http://green-recovery.org/

Graduate Course on Disasters, Environment and Risk Reduction
In collaboration with the Center for Natural Resources and Development (CNRD), a global university network, PEDRR developed a master's course related to understanding disaster risk reduction and resilience, ecosystems management tools for disaster risk reduction, climate change and ecosystem-based adaptation as well as ecological engineering. The main guiding philosophy of this course is "learning by doing", combining theory with practice, whether through examples and case study analysis, learning games, field trips, student presentations, role play exercises, individual research, group assignments and other interactive teaching methods. http://pedrr.org/activities/graduate-course/

MOOC on Disasters and Ecosystems: Resilience in a Changing Climate
In order to make knowledge on Eco-DRR more accessible, UNEP together with the CNRD network and the Global Universities Partnership on Environment for Sustainability (GUPES) developed a Massive Open Online Course (MOOC) on Disasters and Ecosystems, based on the master's course. Course materials are based on videos, case studies, quizzes and optional assignments. It is split into two tracks: the leadership track which provides an introduction to Eco-DRR, and the expert track which provides a deeper understanding of the topic. The MOOC has over 11,500 students enrolled from 183 countries, and is being hosted through the Iversity platform. https://iversity.org/en/courses/disasters-and-ecosystems-resilience-in-a-changing-climate

WWF Adapt
WWF Adapt provides a wide range of learning tools that help conservation, development and humanitarian professionals better understand climate change adaptation, resilience-building and multi-hazard disaster risk reduction and their relationships to the natural environment. http://wwfadapt.org/

Regional Training Manual on Disaster Risk Reduction for Coastal Zone Managers
This training manual was prepared by the Asian Disaster Preparedness Center (ADPC) in collaboration with UNEP and it aims to build capacity of government officials, NGOs, academia and other entities to include DRR into coastal zone management. This training helps coastal zone managers to improve local resilience as well as emphasizing the role of ecosystems to reduce disasters. http://www.unep.org/disastersandconflicts/portals/155/disastersandconflicts/docs/drr_training/AIDCO_Regional_Training_Manual.pdf