ECO.

DEEPER THINKING

ECOSYSTEM BASED ADAPTATION FOR RURAL RESILIENCE IN TANZANIA

A HANDBOOK

This publication has been prepared for the Vice President’s Office of Tanzania as part of work on EbA Trainings of Trainers under the project “Ecosystem-based Adaptation for Rural Resilience in Tanzania”

Published by: Vice President’s Office (VPO)

Authors: Dr. Lili Ilieva, Dr. Emma T. Liwenga, Dr. Catherine A.

Last edited: 10 May 2021

Status: Version 1

Partners

This publication has been developed in collaboration with the following organisations:

Institute of Resource Assessment (IRA)

P.O BOX 35097,
Dar es Salaam,
Tanzania
TEl. +255 22 2410144
Website: www.ira.udsm.ac.tz

Contents

Tables

Figures

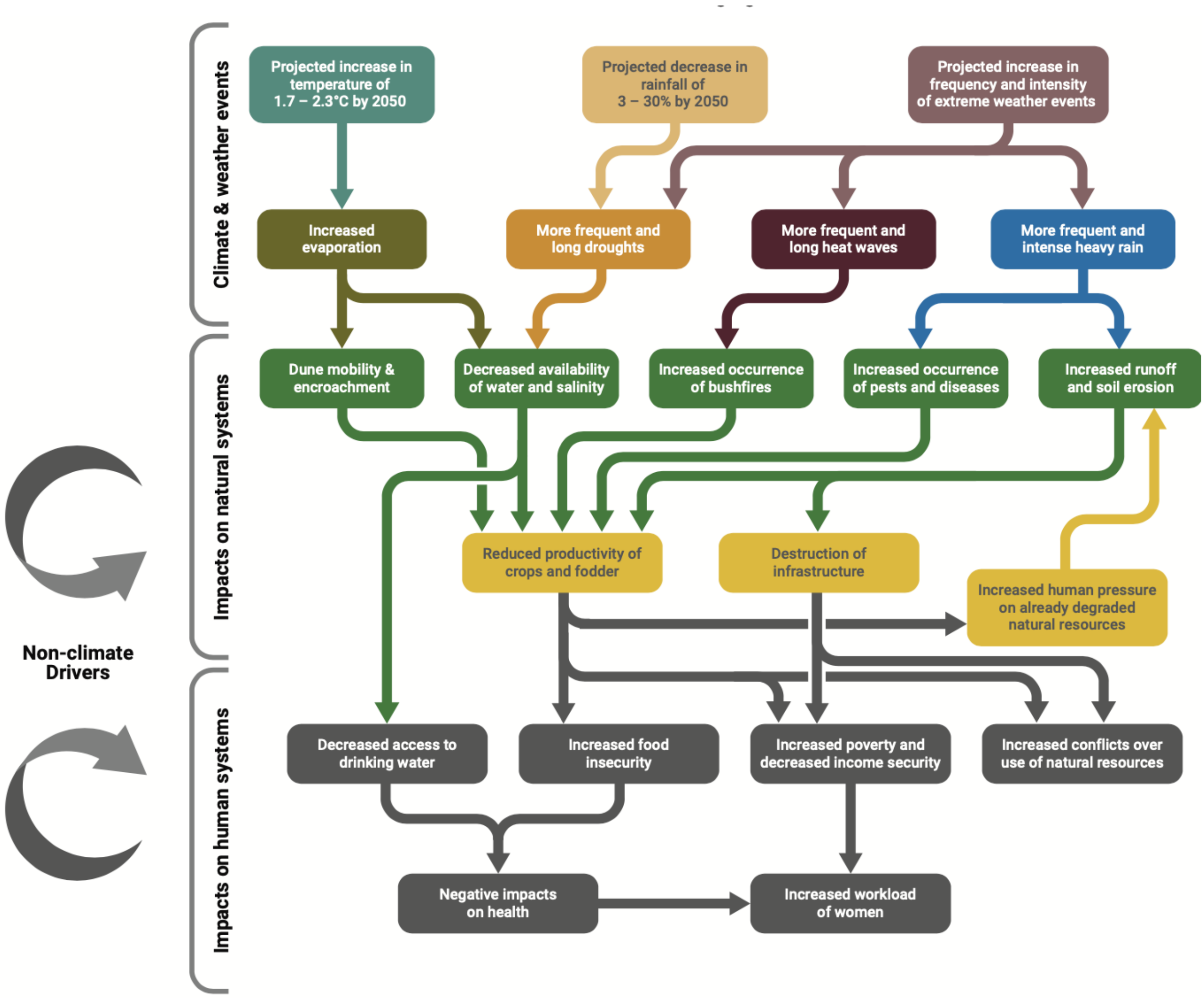

Figure 12. Mapping climate impact pathways helps to target EbA and other adaptation measures to address specific climate impacts and contribute to long-term resilience.36

Acronyms

ALiVE	Adaptation, Livelihoods and Ecosystem Planning
CbA	Community-based Adaptation
CBD	Convention on Biological Diversity
EbA	Ecosystem-based Adaptation
EbARR	Ecosystem-based Adaptation for Rural Resilience
IPCC	Intergovernmental Panel of Climate Change
GEF LDCF	Global Environment Fund – Least Developed Countries Fund
NbS	Nature-based Solutions
NRM	Natural Resource Management
TEEB	The Economics of Ecosystems and Biodiversity

1. Introduction to the EbA course

1.1. Background

Tanzania is the 30th most climate change-vulnerable country in the world, according to the University of Notre Dame's Global Adaptation Index (2017).[1] A large proportion of country's GDP is associated with climate sensitive activities, particularly agriculture. Historical climate trends for the country already indicate that temperatures are rising, and rainfall is becoming more erratic. The most prominent observed climate change trend has been a tendency towards lower rainfall during the main agricultural growing seasons. Annual rainfall in Tanzania has decreased at an average rate of 3.3% per decade from 1960-2006.[2] In addition, rainfall is becoming more variable, with both a higher likelihood of dry spells and a higher likelihood of intense rainfall events (often associated with flooding).

Climate change projections[3] show a likely increase in average temperature of 0.8 to 1.8°C by the 2040s, evenly distributed across Tanzania. By the 2090s, projected warming is in the range of 1.6 to 5.0°C across the whole country. The mean number of days with temperatures over 30°C is projected to increase from roughly 10 days per year now to 80 by the 2040s.[4] Rainfall projections are broadly consistent in indicating increases in annual rainfall. While the projected change in annual rainfall by the 2040s is very small, seasonal fluctuations are more prominent.

Climate change and variability, in combination with non-climate drivers such as deforestation, land degradation and forest encroachment, have altered ecosystem functions and agro-ecological systems thus affecting livelihoods across Tanzania. The country's food availability is greatly affected by low production and productivity due to factors that are linked to climate change, such as a high incidence of pests and diseases, and unreliable rainfall that leads to recurrent droughts or floods in some parts of the country. The agricultural sector alone has experienced impacts from climate change worth at least $200 million per year. Without adaptation measures, net economic costs could result in a decline of up to 2% of GDP/year by 2030.[5]

This is particularly true for poor people in developing countries, whose livelihoods are closely linked to existing natural resources. It is widely understood that there are various climatic and non-climatic stressors that affect both the livelihood and surrounding natural resources. Climate change is one of the major causes of changes and deterioration in ecosystem services and its impact will most likely increase in the future. However, functioning ecosystems can help people and the natural world adapt to climate change effects.

This training course is part of a modular training package on Ecosystem-based Adaptation (EbA) as part of the GEF LDCFII project "Ecosystem-Based Adaptation for Rural Resilience" in Tanzania

[1] ND-GAIN Index, 2017.Tanzania - https://gain.nd.edu/our-work/country-index/rankings/
[2] USAID, 2019. Tanzania: Climate Vulnerability Profile.
[3] Climate projections are from the CMIP5 - Coupled Model Intercomparison Project Phase 5. Baseline period 1950-2005, using the high greenhouse gas emission pathway known as RCP8.5.
[4] CDKN, 2017. Future Climate Projections for Tanzania.
[5] Global Climate Adaptation Partnership, 2011. The Economics of Climate Change in the United Republic of Tanzania.

(EbARR). The project aims to increase resilience to climate change in rural communities of Tanzania by strengthening ecosystem resilience and diversifying livelihoods.

1.2. Purpose

The aim of the publication is to enhance capacities among policy makers and practitioners on EbA and to support institutions in successfully taking action on promoting EbA. This course therefore provides an introduction to the theory and to the practical aspects of EbA. Participants will learn:

- to understand and be able to explain the basic concepts of climate change and climate change adaptation
- to understand the relevance of climate change as a topic for ecosystems and livelihoods
- to understand the role ecosystem services can play for climate change adaptation and understand the basic concept of EbA
- to apply the basic steps of designing and implementing EbA solutions (vulnerability analysis, identification of suitable EbA options/measures, monitoring and evaluation) and identify entry points for EbA
- how to approach the integration of EbA in your own work context.

1.3. Participants

The training package is primarily intended for professionals responsible for the planning and management of terrestrial and marine areas and their natural resources, not only from the environment sector, but also from other sectors (e.g. fisheries, coastal protection). It is particularly beneficial for participants working at the planning level and being actively involved in development and/or adaptation planning. Basic notions of climate change, adaptation and resilience are advantageous.

2. Overview of EbA modules

The training is structured in five modules, which describe key definitions and principles for EbA, the process for planning and implementation of EbA options and exercises. The modules include (Fig.5):

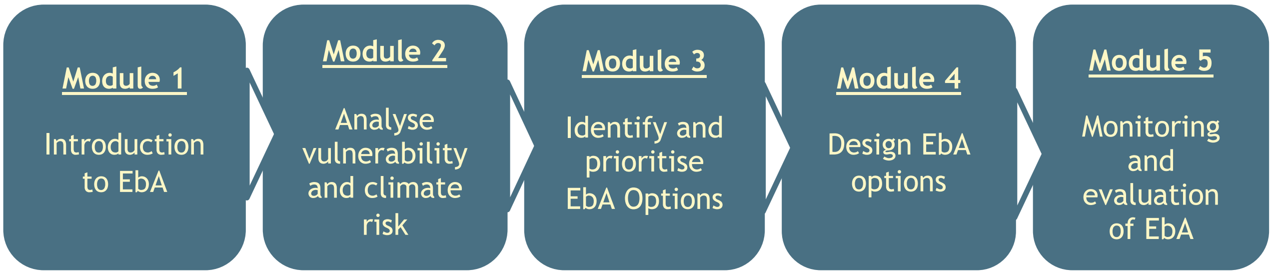

Figure 1. Structure of the EbA training course

Module 1. Introduction to Ecosystem-based Adaptation (EbA): This module describes the socio-ecological system and relevant processes at the project site, specifically in terms of the characteristics of the ecosystem, economic assets, population and infrastructure. It further provides guidance on the definition of the scope and problem to be addressed with the adaptation interventions.

Module 2. Analyse climate risk and vulnerability for ecosystems and livelihoods: This module addresses concepts related to climate risk and vulnerability and includes a step-wise approach to conducting assessments using the ALiVE tool (Adaptation, Livelihoods and Ecosystem Planning Tool) and other suitable methodologies. It is designed to guide the process of risk analysis against the effects of climate change. It presents a series of steps to perform the hazard analysis, exposure analysis, and vulnerability analysis (which includes analysing the sensitivity of ecosystems and the adaptive capacity of populations and ecosystems), as well as the identification of climate impacts.

Module 3. Identify and prioritise EbA options: This module presents the process for the identification of EbA options based on the previous steps. It considers specific characteristics of the ecosystems and the identified climate risks. This phase provides a series of considerations to identify the EbA measures with the potential to reduce risks to the effects of climate change. It also presents methodologies for prioritising EbA measures, such as Cost-Benefit Analysis and Multi-Criteria Analysis.

Module 4. Design EbA options: This phase describes the necessary considerations to design the selected EbA solutions, considering the stakeholder engagement, detailed activities, geographical scope and resources.

Module 5 Monitoring and Evaluation of EbA options: This module is designed to guide the monitoring of the progress of the implementation of the EbA options.

3. Technical notes for EbA modules

The proposed structure of the models is presented as a series of technical notes and exercises that can be used selectively according to the objectives, resources and data available.

Factsheet	The Factsheet consists of key definitions, steps required and examples for the planning and implementation process for EbA.
Exercise Sheet	The Exercise Sheet consists of guidelines and required steps for the exercises.

MODULE 1. Introduction to Ecosystem-based Adaptation (EbA)

SESSION 1A
FOUNDATIONS OF EBA: DEFINITIONS AND PRINCIPLES

SESSION 1B
MAINSTREAMING EBA IN DEVELOPMENT PLANNING

SESSION 1C
STEPWISE APPROACH TO DESIGN AND IMPLEMENTATION OF EBA

FACTSHEET - SESSION 1A
FOUNDATIONS OF EBA: DEFINITIONS AND PRINCIPLES

Learning objectives	- If necessary: (Re) learn the impacts of climate vulnerability and basic concepts of adaptation to climate change. - Understand the concept of ecosystem services and the rationale for the ecosystem approach to adaptation. - Gain a better understanding of the main characteristics of ecosystem services and their importance for development. - Obtain an overview of the fundamentals and main concepts related to EbA - Clarify terms and definitions and develop a common understanding.
Key definitions (Annex 1)	• Ecosystem services • Ecosystem-based Adaptation (EbA) • Nature-based Solutions (NbS) • Socio-ecological systems

WHAT IS A SOCIO-ECOLOGICAL SYSTEM?

A socio-ecological system (Figure 2) is defined as a linked system of people and nature. Households, villages, larger settlements, and districts are nested within an ecosystem, which are connected to other ecosystems within a watershed or landscape. Societies manage ecosystems to benefit from and/or influence the supply of ecosystem services. For example, they may log and replant trees for timber, or clear forest and plant crops for food and cash income. Ecosystem services may also be affected by climate change, such as increasing temperatures or decreasing rainfall, as well as other drivers of change, such as increasing demand from a growing population, or the effects of pollution. Determining the vulnerability of a socio-ecological system to changes in the supply of ecosystem services is thus an important component of determining its vulnerability to climate change.

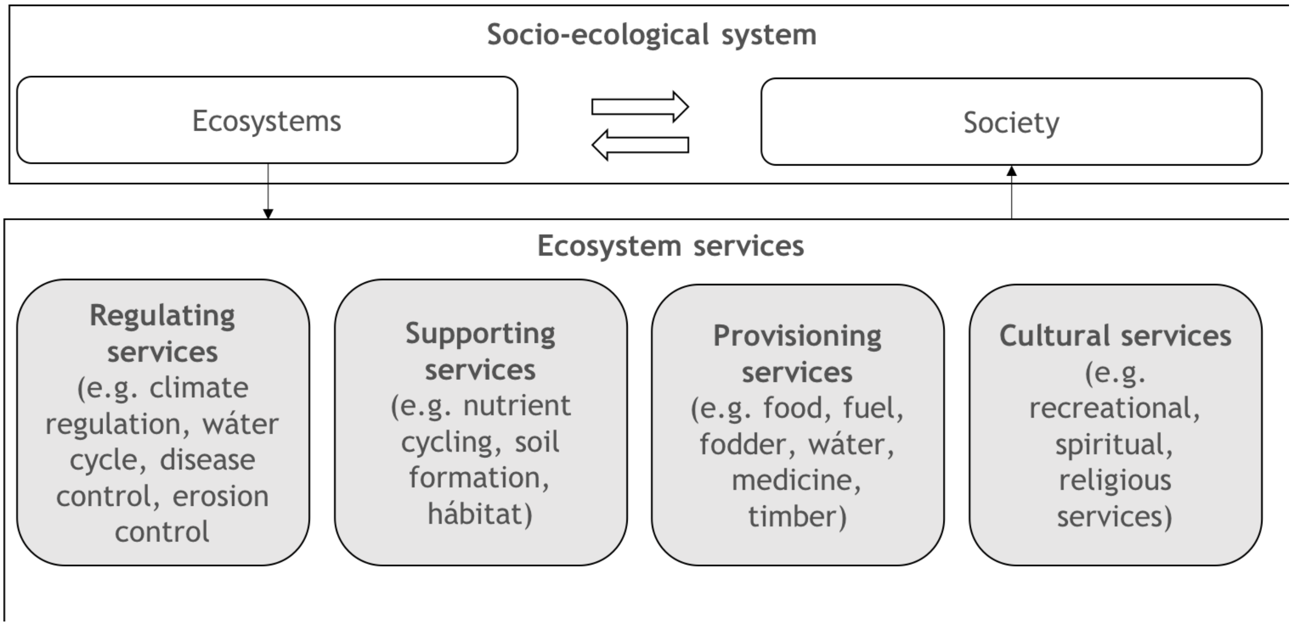

Figure 2. Conceptual representation of a socio-ecological system (Munroe et.al. 2015).

WHAT IS ADAPTATION TO CLIMATE CHANGE?

Climate change and variability is expected to have effects on sea level rise or variation in the water regime, shifts in seasons, increase frequency and magnitude of extreme events. All of these changes will produce impacts and opportunities in the society, the economy and the environment. Some of these changes include species migration or displacement of ecosystems, decrease in agricultural productivity, worsening of health conditions, flood or landslides, among others.

Managing those effects, anticipating impacts to minimize them or preparing to take advantage of the opportunities that may come with it, refers to **adaptation to climate change**. Climate adaptation involves developing a set of initiatives and measures aimed at reducing the vulnerability of socio-ecological systems to the potential impacts of climate change. It is essential that countries and communities adopt measures and practices to protect against probable damage and losses from climate change. Adaptation measures should focus on short- and long-term solutions, and consider socio-economic needs, ecosystem management components, disaster planning and management, among other aspects.

Adaptation to climate change is the process of adjustment to actual or expected climate and its effects. In human systems, adaptation seeks to moderate or avoid harm or exploit beneficial opportunities. In some natural systems, human intervention may facilitate adjustment to expected climate and its effects. (IPCC 2014)

It is of utmost importance to devote efforts and resources to understanding the effects of climate change that will allow for the design of effective adaptation strategies. Examples of adaptation measures for the agricultural sector to address impacts of prolonged droughts include:

- Promote efficient and sustainable water management in irrigated agriculture;
- Change planting schedules to minimize climate risks by modifying the sowing calendars under the new climatic conditions;
- Implement rainwater harvesting systems for irrigation and drinking via the construction of ponds and/or rood collecting systems.

Climate resilience is the capacity of social, economic and environmental systems to cope with a hazardous event or trend or disturbance, responding or reorganizing in ways that maintain their essential function, identity and structure, while also maintaining the capacity for adaptation, learning and transformation. (IPCC 2014)

WHY ARE ECOSYSTEMS AND THEIR SERVICES IMPORTANT FOR CLIMATE ADAPTATION?

The term "ecosystem" refers to a dynamic complex of plant, animal and micro-organism communities and their inert environment (air, water, soil) interacting as a functional unit.[6] An **ecosystem** comprises all living things (animals, plants, bacteria, fungi, etc.) called biotic factors, and the interactions between them (e.g., competition between organisms, predation, or symbiosis, among other possibilities). It also includes its non-living environment, (the climate, the soil, the sun, the atmosphere) called abiotic factors, the relationship of biotic factors to abiotic factors (e.g., the relationship of plants to the soil), and between abiotic factors (e.g., the relationship between soil temperature and soil moisture). There are many different types of ecosystems, for example, tropical forests, desert or savannah ecosystems, mountain and coastal ecosystems, with other very different characteristics. The well-being and development of human beings depend entirely on the planet's ecosystems.

All human beings depend on the benefits that ecosystems provide. The benefits that people receive from ecosystems are referred to as "ecosystem services". Ecosystem services are essential for human beings, and they work in a complicated and interconnected way that they cannot be replaced by technology. Ecosystem services can be divided into four main categories: 1) provisioning services, 2) regulating services, 3) cultural services 4) supporting services. Examples of ecosystem services are shown in Figure 3 below.

[6] CBD, 1997. Convention on Biological Diversity.

Categories of ecosystem services

Provisioning services	Food, fodder, building materials
Regulating services	Water quality, Hydrological regulation, climate regulation, storm protection
Cultural services	Recreational/aesthetic values, tourism, religious values
Supporting services	Soil formation, habitat provision

Figure 3. Examples of ecosystem services per category.

Understanding well the socio-ecological system allows us to have a better grasp of the range of ecosystem services that the system provides (e.g. raw material, biodiversity, water filtration) and their benefits and values (e.g. climate control, clean air and water, food security) (Figure 4).

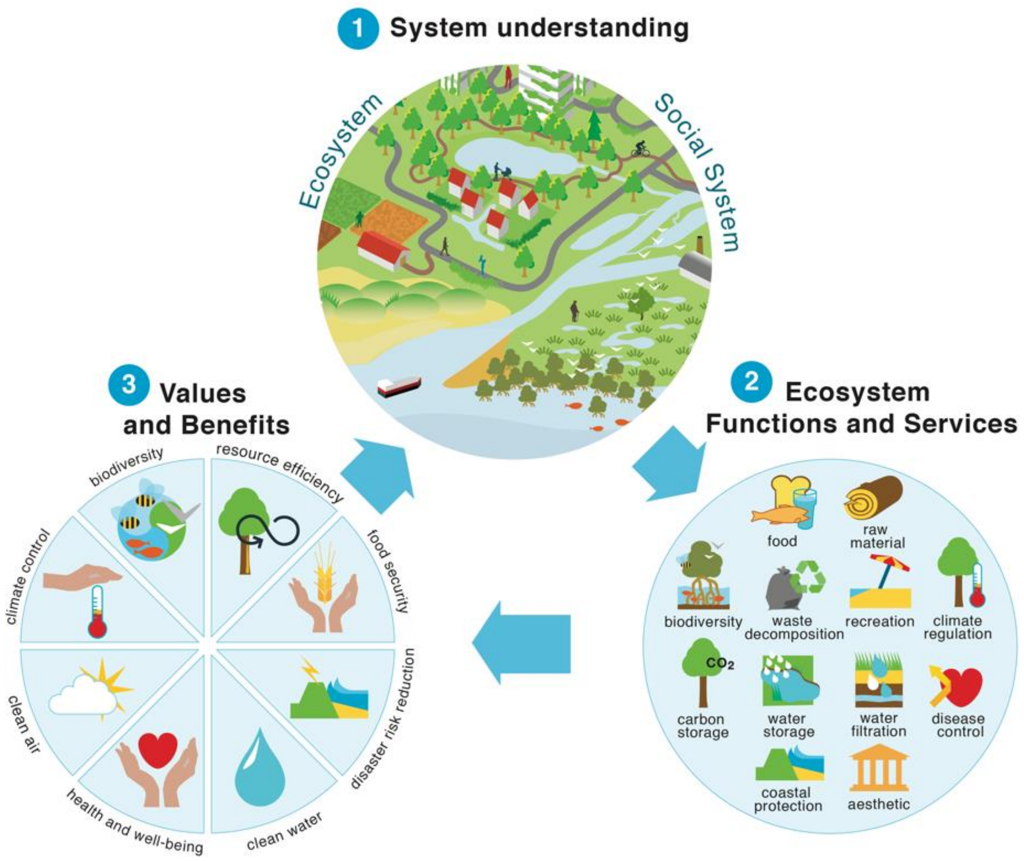

Figure 4. The benefits that ecosystems and their services provide to people.

WHAT IS ECOSYSTEM-BASED ADAPTATION?

Ecosystem-based Adaptation (EbA) is an approach that focuses on people, helping them to adapt through the goods and services provided by ecosystems and with the explicit objective of helping to reduce vulnerability of both population and ecosystems to climate variability and change. EbA places people at the centre and uses participatory and culturally appropriate methods to address challenges, but with an emphasis on natural solutions. The general objective of EbA is to help reduce vulnerability and increase adaptive capacity of ecosystems and in turn communities through the effective use and management of natural resources such as forests, wetlands and coastal ecosystems within a given area.

> **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 ecosystems and people in the face of the adverse effects of climate change." (CBD 2009)

The EbA approach is defined 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".[7] The EbA approach has been receiving increasing attention for its potential to reduce the vulnerability of both people and ecosystems to climate change impacts. Additionally, the approach provides multiple social and economic benefits such as clean water, food security, risk reduction and other services essential for livelihoods and human well-being.[8] The EbA approach considers that equity, gender, and the importance of local and traditional knowledge are critical constituents in effective adaptation efforts.

EXAMPLES OF EBA SOLUTIONS

EbA solutions include coastal habitat restoration, agroforestry, integrated water resource management, livelihood diversification, and sustainable forest management interventions that use nature to reduce vulnerability to climate change. Examples of EbA measures include:[9]

- Conservation, sustainable management and/or restoration of mangrove forests to reduce the impact of coastal flooding and erosion from storm surges linked to the changing frequency and intensity of storms;
- Sustainable management of upland wetlands, forests, and floodplains for the regulation of water flow and control of water quality;
- Conservation and restoration of forests to stabilise land slopes and regulate water flows;

[7] CBD. 2009. *Connecting Biodiversity and Climate Change Mitigation and Adaptation: Report of the Second Ad Hoc Technical Expert Group on Biodiversity and Climate Change*. CBD Technical Series No. 41. Secretariat of the Convention on Biological Diversity, Montreal, Canada.
[8] TEEB, 2010. The Economics of Environment and Biodiversity.
[9] UNFCCC, 2013. Ecosystem-based Adaptation. https://unfccc.int/sites/default/files/unep_leg_workshop.pdf

- Establishment of diverse agroforestry systems to cope with increased risk from changes in climate conditions;
- Management of ecosystems to complement, protect and extend the longevity of investments in hard infrastructure;
- Conservation of agrobiodiversity to provide essential gene pools and facilitate crop and livestock adaptation to climate change;
- Establishment and efficient management of systems to ensure the continued delivery of ecosystem services to support resilience to climate change, for example through protected areas, land use and agricultural systems.

HOW IS EBA DIFFERENT FROM OTHER ADAPTATION APPROACHES?

EbA draws on other climate change adaptation approaches, notably community-based adaptation (CBA), which takes a locally driven, participatory approach to reducing vulnerability to climate change. EbA and CBA share objectives and often use similar tools and strategies to engage stakeholders. Additionally, EbA builds on and is complementary to nature conservation and natural resource management (NRM) approaches. However, there are a few key differences between EbA and other approaches (Figure 5):

- **EbA places strong emphasis on the role of ecosystems in supporting adaptation** – it highlights the need to maintain ecosystem health for community adaptation efforts to be effective and sustainable.
- **EbA is a human-centric approach** – it purposely combines conservation and socioeconomic goals to sustain livelihoods and increase people's adaptive capacity to climate change.
- **EbA approaches directly address current and future climate risks -** it focuses on addressing adaptation needs right from the start.
- **EbA is grounded in the community development and local governance processes that underpin the above -** It recognises the importance of ensuring that vulnerable people have livelihood strategies that are sustainable and resilient now and into the future, drawing on decades of experience in livelihoods approaches.
- **EbA is part of an overall adaptation strategy -** it forms part of broader adaptation strategies and efforts toward sustainable development and effective governance of natural resources.

Adaptation focused on ecosystems	Community-based Adaptation	Ecosystem-based Adaptation
(i) The direct beneficiaries are ecosystems and species, who are being helped to adapt, but NOT directly people	(i) The direct beneficiaries are people who are being helped to adapt, but NOT through ecosystem management and conservation.	(i) The direct beneficiaries are the people who are being helped to adapt through ecosystem management and conservation.
(i) Outcome indicators focus on measurements on the state of ecosystems and species and NOT on the adaptation impact for people.	(i) Outcome indicators focus on measurements on the adaptation impact on people.	(ii) Outcome indicators focus on measurements on the state of ecosystem services and their adaptation impact on people.

Figure 5. Difference between adaptation based on ecosystems, CbA and EbA.

Case studies and literature indicate that ecosystem-based approaches can be flexible, cost-effective and broadly applicable approaches for reducing the impacts of climate change.[10] A critical aspect of the ecosystem-based approach is that it can be applied to diverse ecosystems and geographical scales – local, national, regional and global.[11] Thus, due to its multi-sectoral and multi-scale characteristics, it can integrate a variety of disciplines, stakeholders, and institutions, so that they can work at a range of governance levels and can influence decision-making.[12]

In order to be able to answer the question "Is the adaptation measure designed with the EbA approach or not?". The EbA measures should consider the following criteria: 1) Help people adapt to the adverse effects of climate change; 2) Uses biodiversity and ecosystem services sustainably; and 3) Forms part of a larger climate adaptation strategy (See Figure 6).[13]

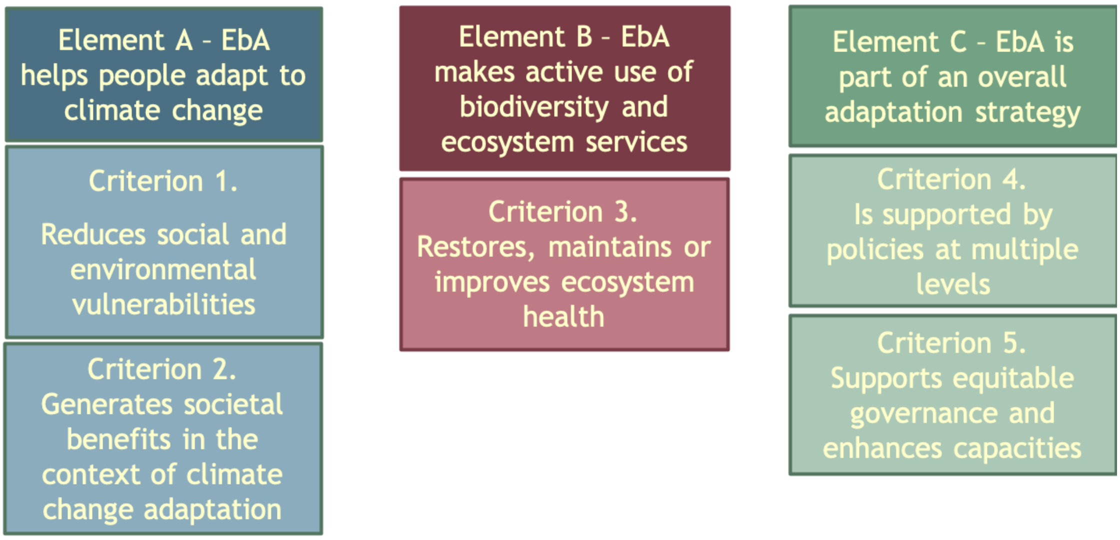

Figure 6. Criteria for EbA measures (FEBA, 2017).

READING MATERIALS	
Key resources on ecosystems and ecosystem services	- Millennium Assessment Reports (MEA, 2005) - The Economy of Ecosystems and Biodiversity (TEEB, 2010) - Ecosystem approach (CBD, 2004)
Key resources on ecosystem-based adaptation	- Making Ecosystem-based Adaptation Effective: A Framework for Defining Qualification Criteria and Quality Standards (FEBA, 2017): - Convenient Solutions to an Inconvenient Truth: Ecosystem-based Approaches to Climate Change (World Bank, 2009):
Global and regional EbA knowledge platforms	- Community of Practice on EbA for Latin America - International Community of Practice on EbA

[10] Munang, 2013.
[11] Devisscher, T. 2010. Ecosystem-based Adaptation in Africa: Rationale, Pathways and Cost Estimates. Stockholm Environment Institute.
[12] Vignola et al., 2009. Ecosystem-based adaptation to climate change: What role for policy-makers, society and scientists?
[13] FEBA, 2017. Making Ecosystem-based Adaptation Effective: A Framework for Defining Qualification Criteria and Quality Standards.

FACTSHEET - SESSION 1B
MAINSTREAMING EBA IN DEVELOPMENT PLANNING

Learning objectives	- Better understand why mainstreaming of EbA is important and what is the process for mainstreaming in national planning. - Learn to identify entry points for mainstreaming EbA.
Key definitions (Annex 1)	- Mainstreaming - Entry points

WHY MAINSTREAMING EBA?

Mainstreaming EbA refers to the integration of ecosystem-based approaches into climate- and disaster-risk planning and decision-making processes at all levels.[14]

An EbA approach should be part of an overall adaptation strategy, alongside other forms of adaptation.[15] Therefore, EbA solutions should seek alignment with national, regional and local plans and policy measures for long-term sustainability and impacts (i.e. laws, regulations and enabling instruments and institutions).Where existing plans and strategies do not yet consider the role of ecosystems, it is crucial to work on getting such considerations incorporated or mainstreamed. Mainstreaming may start with integrating ecosystem considerations into adaptation and disaster risk reduction objectives, strategies, policies, measures or operations so that they become part of national and regional development policies, processes and budgets at all levels and stages.

WHAT ARE ENTRY POINTS FOR EBA MAINSTREAMING?

A key step in the mainstreaming process is the identification of entry points for integrating EbA into concrete policy and planning frameworks and decision-making processes. Entry points can be dynamic, depending on three key aspects:

- The awareness of stakeholders about an existing problem, challenge or risk;
- Available solutions, proposals, tools and knowledge;
- Political will to act, mandates and roles.

If all three aspects come together favourably, there is a "window of opportunity" for policy change. Particularly in the cases of disaster and states of emergency, there is generally higher interest and urgency for finding solutions. These are important opportunities to include EbA aspects into practice. Entry points may occur at all levels of government, and can imply different

---

[14] CBD, 2019. Voluntary Guidelines.

[15] CBD, 2009. Connecting biodiversity and climate change mitigation and adaptation: Report of the Second Ad Hoc Technical Expert Group on Biodiversity and Climate Change. (Technical Series No. 41). Montreal: Secretariat of the CBD. Retrieved from https://www.cbd.int/doc/ publications/cbd-ts-41-en.pdf

levels of governance, or collaboration with the private sector. In general, entry points for mainstreaming may be found in[16]:

a. The development or revision of policies and plans, e.g. development or sectoral plans, NDCs, NAPs, national biodiversity strategies and action plans, strategic environmental assessments, land-use plans;
b. Command and control instruments, e.g. climate change and environmental laws, standards, and environmental impact assessments, and disaster risk management;
c. Economic and fiscal instruments, e.g. investment programmes, funds, subsidies, taxes;
d. Educational and awareness-raising measures, e.g. environmental education, extension programmes, technical careers and university curricula;
e. Voluntary measures, e.g. environmental agreements with private landowners.

WHAT IS THE PROCESS FOR MAINSTREAMING EBA INTO NATIONAL PLANNING?

The best strategy for integrating EbA into national planning processes will depend on national context and circumstances, but the following process may serve as a guide (Figure 7)[17]:

A. Develop the evidence and build the capacity of decision-makers

Collect data that can inform assessments of climate risk, climate impact pathways and adaptation solutions. This should include information on social-ecological drivers and interdependencies. Present and discuss this data with government officials and other experts and jointly explore future climate risk and vulnerability (including climate impacts on ecosystems) in their respective sectors. If other climate change vulnerability assessments are underway, integrate ecosystem considerations and EbA into these. With an enhanced understanding of the latest available scientific information, government officials will be better positioned to design appropriate adaptation strategies to produce desired adaptation outcomes for their sectors.

B. Screen policies, plans, laws, and budgets to identify where harmonisation is needed

Review relevant policies, plans, laws, and budgets to identify misalignment with respect to meeting adaptation objectives. Strengthen the role of the budget as the integrator of climate change into sectoral plans. The screening of policies, plans and budgets involves analysing whether current practices contradict adaptation goals and whether they could lead to increased vulnerability to climate change in the future. Relevant policies and plans for integrating EbA include climate change adaptation related processes, such as NAPs and NDCs, as well as many sectoral policies (e.g. forestry, health, water).

C. Understand the regular policy, planning and budgeting cycles to identify entry points

Every policy, planning and budget development has a regular policy and planning cycle. Understanding the timeline for these cycles is key to initiate a process for integrating EbA. The policy formulation stage serves as a key entry point for the successful integration of EbA within the process cycles (e.g. through objective setting, developing scientific evidence and consultation with stakeholders for problem assessment and adaptation prioritisation). The review and revision

[16] CBD, 2019. Voluntary Guidelines.
[17] UNEP-WCMC/UN Environment, 2019. Integrating EbA into National Planning. Briefing Note 6.

of existing policies and plans is another key entry point. These stages are accompanied by budgetary approval and revision processes (inner orange cycle), which also need to be targeted by integration efforts. Interactions between the different policies / plans (blue arrows) and their respective cycles need to be factored into integration efforts. This includes considering synergies and conflicts between objectives, roles and responsibilities, and budget lines.

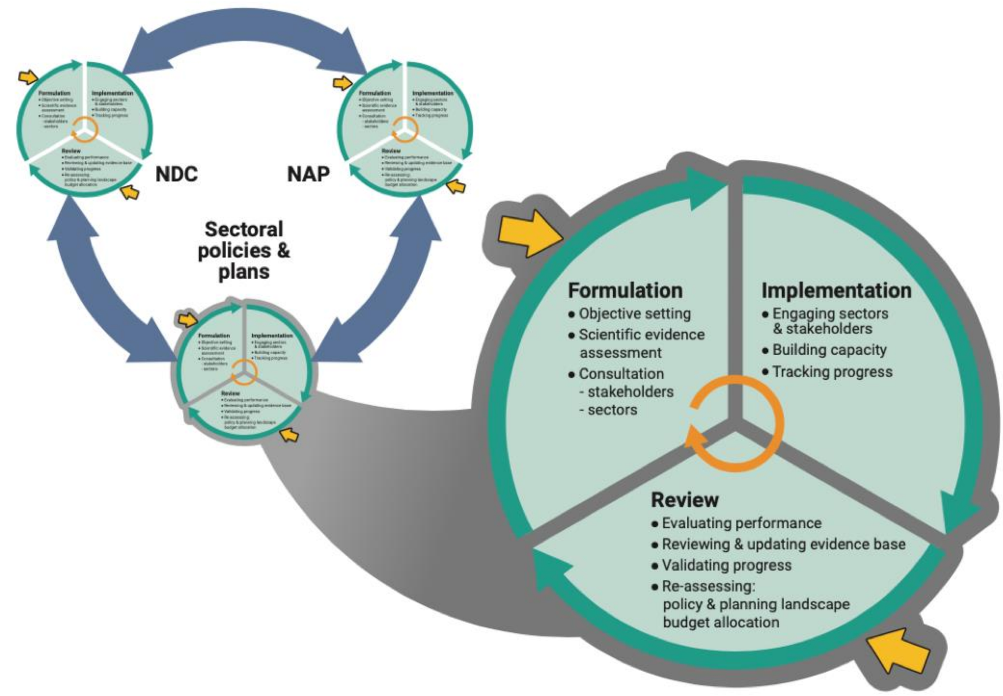

Figure 7. Framework for mainstreaming EbA in development planning. The small cycle, made up of multiple green circles connected by blue arrows, represents the above-described process B. The large green cycle represents process C. Yellow arrows are the entry points for EbA mainstreaming.[18]

[18] UNEP-WCMC/UN Environment, 2019. Integrating EbA into National Planning. Briefing Note 6.

Box 2. Opportunities for mainstreaming EbA into funding priorities

EbA contributes to multiple objectives, including development, disaster risk reduction, adaptation, mitigation, food and water security, and ensuring risk-informed investments. The cross-sectoral and transdisciplinary approaches, and the potential realization of multiple benefits, offer several opportunities to attract/enhance funding, such as:

- Encouraging new financial incentives for investments in sustainable ecosystem management that emphasize ecosystems as part of adaptation and disaster risk planning. Examples include developing incentive programmes for farmers to implement practices that contribute to maintaining resilient ecosystems, such as agroforestry and conservation tillage.
- Unlocking new investments for EbA through the climate-proofing of existing investment portfolios.
- Working with the private sector (including the insurance, tourism, agriculture and water sectors) to encourage and scale-up investments in EbA and identify public-private partnerships.
- Engaging government regulatory bodies to support and endorse private sector investments in natural infrastructure and EbA.
- Creating national-level incentive structures for EbA/Eco-DRR, especially for private landowners and companies.

Box 3. Integrating EbA in National Determined Contributions (NDCs) and National Adaptation Plans (NAPs)

Revision periods for national climate strategies allow for the integration of new evidence on EbA as it becomes available. Nationally Determined Contributions (NDCs), for example, are scheduled to undergo a stock-take of their implementation every five years, starting in 2018, and will be revised starting in 2020. This presents a window of opportunity to work with governments on incorporating EbA as a way of addressing climate vulnerability and highlighting the importance of climate risks to ecosystems themselves. Such windows of opportunity should also be identified across other relevant sectors in order to maximise opportunities for EbA integration. Policies and plans still under development, such as many National Adaptation Plans (NAPs), also represent strategic entry points. Alongside policy revisions, annual budgetary review processes should be targeted to ensure appropriate levels of funding are made available to support the implementation of policies and plans.

READING MATERIALS	
Key resources on mainstreaming EbA approach	Emerging lessons for mainstreaming Ecosystem-based Adaptation: Strategic entry points and processes (GIZ, 2019)
Case studies	Entry Points for Mainstreaming Ecosystem-based Adaptation - The Case of Peru (GIZ, 2018) Entry Points for Mainstreaming Ecosystem-based Adaptation The Case of South Africa (GIZ, 2018)

EXERCISE SHEET - SESSION 1B
MAINSTREAMING EBA IN DEVELOPMENT PROCESSES

EXERCISE 1: Entry points board (30 min)

Learning objectives	To assess participants' understanding of the mainstreaming process for EBA and encourage group discussion regarding the potential entry points.

INSTRUCTIONS

1. Separate the participants into groups (4-5 persons) and ask each group to choose one of the sector strategies from the entry points board.
2. Each group discusses for 30 min: What are the entry points, instruments and methods, and indicators to be considered for the mainstreaming of EbA in their chosen sector?
3. After the given time the trainer should ask participants to briefly present their results (2 min) and have a plenary discussion (5 min).

GUIDING QUESTIONS FOR GROUP DISCUSSION

- What national and subnational planning processes present opportunities for integrating EbA?
- Which sectors present opportunities for integrating EbA?
- What are the entry points for integrating EbA?
- Are there existing networks or working groups that bring together relevant actors where opportunities and barriers to EbA integration could be discussed?

FACTSHEET - 1C
STEPWISE APPROACH TO DESIGN AND IMPLEMENT EBA

WHAT IS THE PROCESS FOR THE DESIGN AND IMPLEMENTATION OF EBA SOLUTIONS?

Designing and implementing EbA solutions consists of a series of iterative steps (Figure 8). The process is intended to be flexible and adaptable to the needs of a project, programme or country, region, or landscape/seascape. The principles and safeguards for EbA and Eco-DRR are central to the planning and implementation process, and the overarching considerations are provided to improve effectiveness and efficiency. Steps are linked to a toolbox providing a non-exhaustive selection of further guidance and tools. Stakeholder engagement, mainstreaming, awareness-raising and capacity-building, and integrating the knowledge of indigenous peoples and local communities should be conducted throughout the process.

Step 1: Understand the context

This step focuses on understanding the livelihoods and ecosystems in the study area. It further explores the linkages between livelihoods and ecosystem services and the benefits they provide to people.

Step 2: Analyse climate vulnerabilities and risks to ecosystems and livelihoods

This step focuses on identifying observed and projected climate change in the study area. Specifically, it is needed to identify current and potential future climate hazards, document the impacts of climatic and non-climatic stressors on livelihoods and ecosystems, and identify vulnerable groups.

Step 3: Identify and prioritise EbA options

This step focuses on identifying adaptation solutions, such as EbA, to address the climate risks and reduce the vulnerability of livelihoods. Once the appropriate EbA solutions are identified, it is followed by prioritising the more effective and feasible EbA options for the study area. The prioritisation may use methods such as Cost-Benefit Analysis or Multi-Criteria Analysis.

Step 4: Design EbA options

This step focuses on designing project activities to facilitate the implementation of selected EbA solutions. At this step it is required to identify necessary inputs; key actors and their responsibilities; opportunities, barriers, and specific project activities; and alignment with national and local planning processes.

Step 5: Identify key elements to evaluate EbA options

The focus of this step is to identify suitable indicators for the monitoring and evaluation of the selected EbA solutions. Based on the adaptation outcomes and EbA options, both short- and long-term indicators should be identified. This is followed by identifying the baseline for the EbA solutions and data collection methods.

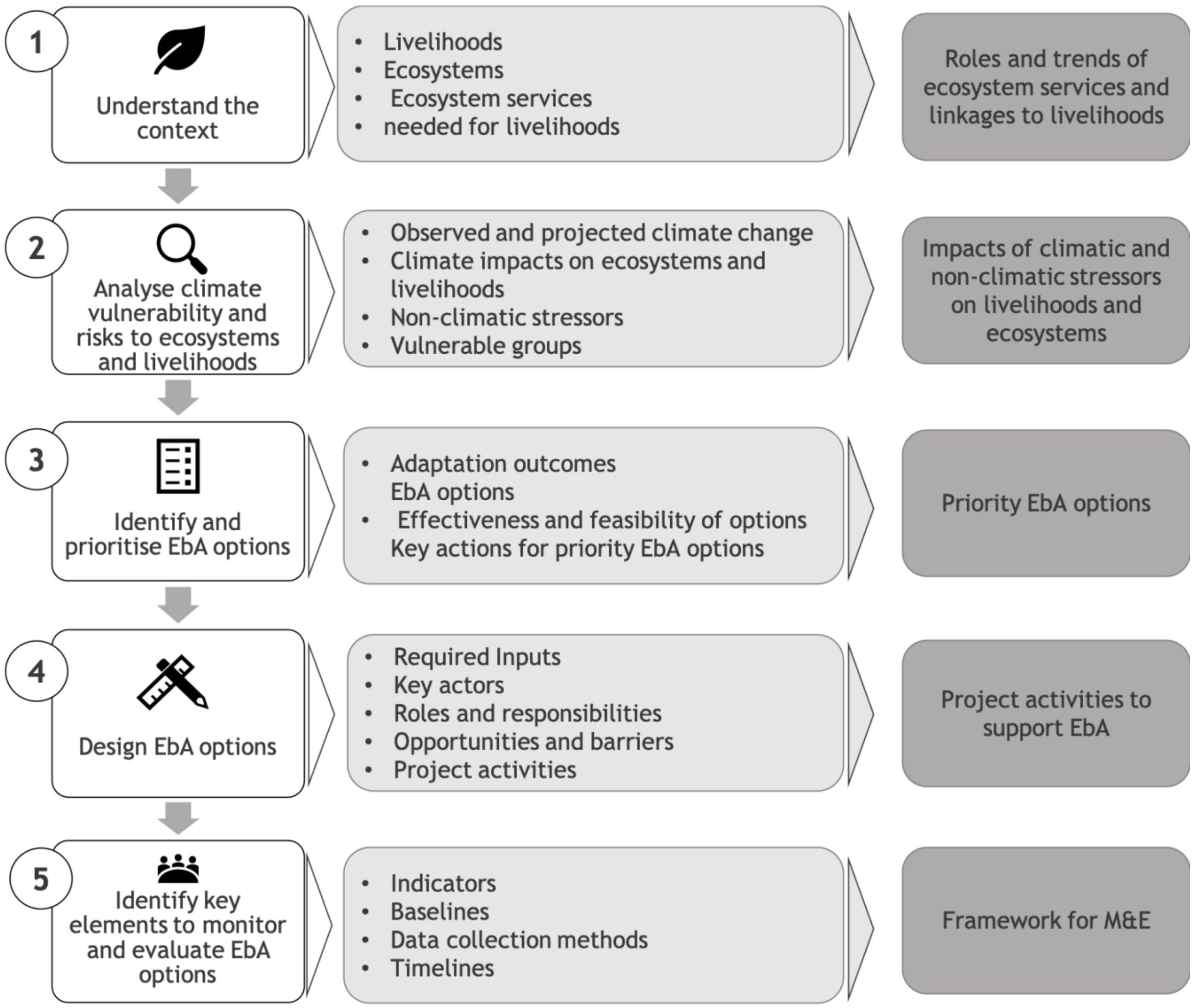

Figure 8. Stepwise approach for the design and implementation of EbA solutions. Adapted from ALivE framework.[19]

WHAT ARE THE KEY ASPECTS TO CONSIDER FOR THE PLANNING PROCESS?

The planning process should aim to ensure consideration of critical links between socio-ecological systems and climate change, especially in contexts where natural resource dependence is typically high, but where data and technical resources are often low. The following aspects should guide the planning process:

[19] IISD/UN-Environment/UNEP IEMP, 2018. ALivE -Adaptation, Livelihoods and Ecosystem Planning Tool - User Manual.

1	**Participation:** involvement of key stakeholders needs to be emphasized in the process including scientific, local community and government stakeholders, to ensure that a wide range of quantitative and qualitative data is sourced, and local perspectives and knowledge are integrated into the planning process.
2	**Short-term and long-term: It is essential to** consider both the effects of short-term climate variability and longer-term climate change. Therefore, a definition of the timeframe and the climate parameters is needed in the planning process for which the analyses will be carried out.
3	**Good governance** is an essential part of ensuring that adaptation policies are implemented effectively and equitably. It draws on a series of ethical imperatives, including fairness, lack of corruption, and transparency. Ensuring good governance is particularly important when a site is undergoing rapid changes that require wide-ranging and challenging responses.
4	**Scale:** Issues of scale are very important in the EbA approach. While the approach has been geared towards assessing the vulnerability of individual project areas, these cannot be viewed in isolation. All ecosystems are influenced in one way or another by surrounding areas and threats, particularly when thinking about climate change. Therefore, when undertaking an EbA approach, responses need to be designed around the scale of the intervention and linked to activities at different scales. Examples of appropriate scales include a landscape or watershed.
5	**Gender issues: P**eople within socio-ecological systems can experience different levels of vulnerability, which is often referred to as differential vulnerability. Women are often considered more vulnerable to climate change due to existing gender inequalities.

READING MATERIALS	
Key resources on planning for EbA	- Ecosystem – based Adaptation Handbook (IUCN, 2016)

MODULE 2

ANALYSIS OF CLIMATE VULNERABILITY AND RISKS TO ECOSYSTEMS AND LIVELIHOODS

FACTSHEET - 2
ANALYSIS OF CLIMATE VULNERABILITY AND RISKS

Objective	**Step 1** of the planning and implementation process for EbA solutions aims to gain an in-depth understanding of the socio-ecological context of the project area by exploring social, ecological and economic aspects. **Step 2** of the planning and implementation process for EbA solutions aims to introduce key definitions regarding climate adaptation and present approaches to vulnerability and climate risk assessments in socio- ecological systems.
Learning objectives	- Become familiar with definitions related to vulnerability and risk. - Acquire an overview of available methods and tools, as well as criteria for choosing methods appropriate to the context. - Learn from practical examples in the Tanzanian context. - Practice identifying vulnerabilities and risks (case work). - Assess the context for adaptation.
Key definitions (Annex 1)	• Climate variability • Vulnerability • Climate risks • Exposure

STEP 1 – UNDERSTAND THE SOCIO-ECOLOGICAL CONTEXT

Step 1 includes the following sub-steps (ALivE Tool):

- Describe the study area, project goals and objectives
- Describe the livelihood context in the study area
- Assess livelihood dependence on ecosystem services
- Describe the major ecosystems in the study area
- Identify ecosystems needed for livelihood activities
- Identify how ecosystems reduce impacts from natural hazards

WHAT IS THE SOCIO-ECOLOGICAL CONTEXT OF THE PROJECT SITE?

EbA solutions are community driven and therefore, it is essential to identify the livelihood groups in the project site and what the role of ecosystem services is in supporting their livelihoods and well-being. It is of particular importance to define which ecosystem services provide adaptation benefits to the livelihood groups. For each livelihood group, it is necessary to identify how each ecosystem service supports different aspects of their livelihoods and well-being.

For example, certain ecosystems can play a vital role in regulating hazards such as floods, mudslides and wind, and therefore changes to ecosystems can have impacts on assets and infrastructure such as crops, bridges, roads, houses, sewage systems, community buildings, and electricity transmission.[20] On slopes, the rates of absorption and discharge of rainwater can be significantly altered by the type of vegetation and soil cover. Where wetlands are present in valley bottoms and lowlands, the rates of water infiltration and discharge, and therefore regulation of flooding and water storage for times of drought, can also be greatly influenced by the vegetation structure of the wetlands. Categories of risk reduction potential for each ecosystem include[21]:

- **Flood protection**: Ecosystems such as wetlands, marshes, peat bogs, lakes, mangroves, swamp forests and coral reefs absorb and reduce water flow and provide space for water spillage.
- **Coastal protection**: Mangroves, coral reefs, sand dunes, coastal marshes and barrier islands, among other features, create physical barriers against tidal waves, storm surges and sea level rise, slowing down their intensity and providing space for tidal overspills.
- **Storm buffer/protection**: Healthy forests, shelter and shade trees, and shelterbelts can provide important protection for crops, structures and other assets from strong winds and storms.
- **Forest fire management/protection**: Wetlands, savannah, dry and temperate forests, and scrub can help maintain natural fire resistance.
- **Landslide prevention**: Forests and other vegetation on or beneath steep slopes, for example, can stabilise soils and act as buffers against earth movements.
- **Avalanche prevention**: Forests on steep slopes can act as buffers against avalanches.
- **Erosion protection**: Plant vegetation with deep roots—including native plants and woody perennials such as trees and shrubs—helps keep soil in place. Vegetation cover of grasslands and drylands can prevent soil erosion.
- **Drought protection**: Forests soak up excess water and are able to release it back into the water table. Wetlands retain excess water, return it to the water table during dry seasons and maintain soil moisture.

READING MATERIALS	
The Toolkit for Ecosystem Service Site-based	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

[20] Munroe, R., Hicks, C., Doswald, N., Bubb, P., Epple, C., Woroniecki, S., Bodin, B., Osti, M. (2015) 'Guidance on Integrating Ecosystem Considerations into Climate Change Vulnerability and Impact Assessments to Inform Ecosystem-based Adaptation', UNEP-WCMC, Cambridge, UK.

[21] IISD/UN-Environment/UNEP IEMP, 2018. ALivE -Adaptation, Livelihoods and Ecosystem Planning Tool – User Manual.

Assessment (TESSA)	from them currently, compared with those expected under alternative land-use. http://www.birdlife.org/datazone/info/estoolkit
Gender Analysis	Tool to help analyze gender roles, activities, assets, needs and available opportunities for men and women. E.g., CARE Rapid Gender Analysis Toolkit http://gender.care2share.wikispaces.net/CARE+Rapid+Gender+Analysis+Toolkit

STEP 2 – ANALYSE CLIMATE VULNERABILITY TO ECOSYSTEMS AND LIVELIHOODS

Objective: Step 2 of the planning and implementation process for EbA solutions aims to introduce the key definitions regarding climate adaptation and present approaches to vulnerability and climate risk assessment in socio-ecological systems.

Step 2 includes the following sub-steps (ALivE Tool):

- Document observed and projected climate change in the study area
- Assess impacts of climate change on ecosystems important for livelihoods
- Analyse impacts of climate change on ecosystems important for livelihoods
- Assess impacts of non-climatic stressors on ecosystems
- Analyse impacts of climatic and non-climatic stressors on livelihoods
- Identify social groups that are particularly vulnerable

WHAT IS CLIMATE RISK AND HOW DO WE ANALYSE IT?

Climate risk refers to the combination of the probability of an event and its negative consequences. Understanding risks considers three factors: exposure, the conditions of vulnerability that are present, and the magnitude and frequency of a hazard event.[22]

Risk analysis provides knowledge of the risk and its factors in order to inform the design of solutions. It is a methodology that allows for causal analysis of risk to identify the factors that generate it (hazards, exposure, vulnerability) as well as its effects on the socio-ecological system (Fig. 9).

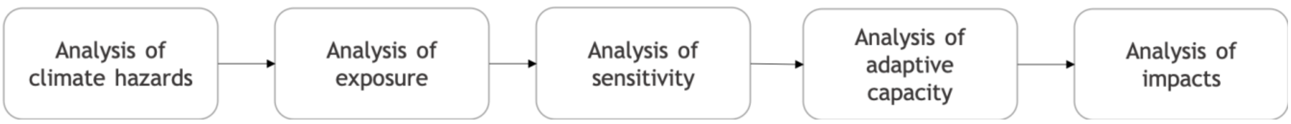

Figure 9. A stepwise approach to analysis of climate risks.

[22] IPCC, 2014. Summary for policymakers. In: Climate Change 2014: Impacts, Adaptation, and Vulnerability. Part A: Global and Sectoral Aspects. Contribution of Working Group II to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change

WHAT IS A CLIMATE HAZARD?

A climate hazard refers to 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.[23] Two elements are important for characterizing a hazard: 1) the probability of the event occurring in a specific location, which is a function of the physical characteristics of a territory, including climate, and 2) the potential to cause damage or alter socio-ecological functioning. Examples of climate hazards include, among others: **floods, landslides, drought,** etc.

WHAT IS CLIMATE VULNERABILITY OF ECOSYSTEMS AND LIVELIHOODS?

Vulnerability is the propensity or predisposition to be negatively affected by climate change. It comprises two key elements: **sensitivity**: the degree to which a system is affected, positively or negatively, by climate variability or change; and **capacity** (response and adaptation): the capacity of societies to prepare for and respond to present and future climate impacts (Fig. 10).

- **Sensitivity** may include the ecological or physical attributes of the system (the type of soil in agricultural fields, water retention capacity for flood control, building material for houses), as well as economic and cultural attributes (such as age or income structure). In the context of the EbA, it is recommended to consider how intact or deteriorated ecosystem services affect sensitivity.

- **Capacity** refers to the ability of societies and communities to prepare for and respond to future climate impacts. It does not refer to the capacity of ecosystems to respond to impacts, but to the social capacity to manage ecosystems. Capacity comprises two components:
    1. Capacity to respond: The capacity of people, institutions, organizations and systems to address, manage and overcome adverse conditions in the medium and short term, using skills, values, beliefs, resources and opportunities (e.g. early warning systems), and
    2. Adaptive capacity: The capacity of systems, institutions, humans and other agencies to adjust to potential harms, to take advantage of opportunities, or to respond to consequences (e.g. knowledge to introduce new farming methods).

  Lack of capacity can mean a significant increase in the vulnerability of the system and therefore its level of risk.

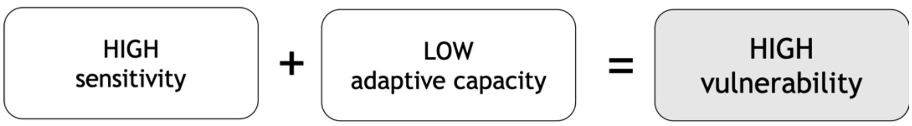

Figure 10. Components of climate vulnerability.

[23] IPCC, 2014. Summary for policymakers. In: Climate Change 2014: Impacts, Adaptation, and Vulnerability. Part A: Global and Sectoral Aspects. Contribution of Working Group II to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change

Box 4. Differential vulnerability – Gender aspects

People within socio-ecological systems can experience different levels of vulnerability, which is often referred to as differential vulnerability. For example, demographic factors (such as age, gender, education and place of residence), socio-economic factors (such as poverty), and other relevant factors (such as access to natural resources, food security and social networks) affect the components (i.e. exposure, sensitivity and adaptive capacity) and degree of vulnerability of individuals and groups. Unequal power relations between different groups in society may cause inequalities in the distribution of rights, roles, opportunities, power and access to and control over resources, leading to different degrees of vulnerability. Such inequalities increase many people's vulnerability to climate change impacts, while limiting their options for coping strategies and adaptation.

In an ecosystem services context, for example, gender differences in access to and use of ecosystem services, such as medicinal plants or clean water, can affect the extent to which women, girls, men, and boys are impacted by changes in the socio-ecological system caused by climate change. Relations within these groups can further affect vulnerabilities and should therefore also be considered.

WHAT ARE THE CLIMATE IMPACTS ON SOCIO-ECOLOGICAL SYSTEMS?

UNEP – WCMC/UN-Environment (2019) provides in their Briefing Notes an excellent description how climate change impacts socio-ecological systems. Figure 11 shows the interaction of climate and non-climate drivers. Climate change has numerous biophysical impacts, which can directly affect ecosystems (leading to ecosystem degradation) and people (causing loss of life, property and production). They can also trigger indirect impacts. Climate-induced ecosystem degradation affects the ecosystem's capacity to provide goods and services, reducing their available supply to people. As a result, on top of experiencing direct harm from climate change impacts, people can also suffer from shortages of vital ecosystem goods and services. The shortages can mean that the ongoing use and management of these goods and services may further reduce the capacity of the ecosystems to provide them, increasing people's vulnerability to climate change.

Simultaneously, non-climatic degradation processes, ultimately driven by population growth and lifestyle changes, as well as other political economy and governance factors, interact with those which are climate induced. On the one hand, increasing demand for land and other natural resources leads to unsustainable ecosystem management and use of goods and services, causing further ecosystem degradation. On the other hand, population growth and lifestyle changes lead to increasing and unmet demand for natural resources, which can increase poverty and reduce human wellbeing. This, in turn, affects people's demand for ecosystem goods and services, further driving unsustainable use and management of the ecosystem leading to negative feedback loops in a vicious cycle of degradation.

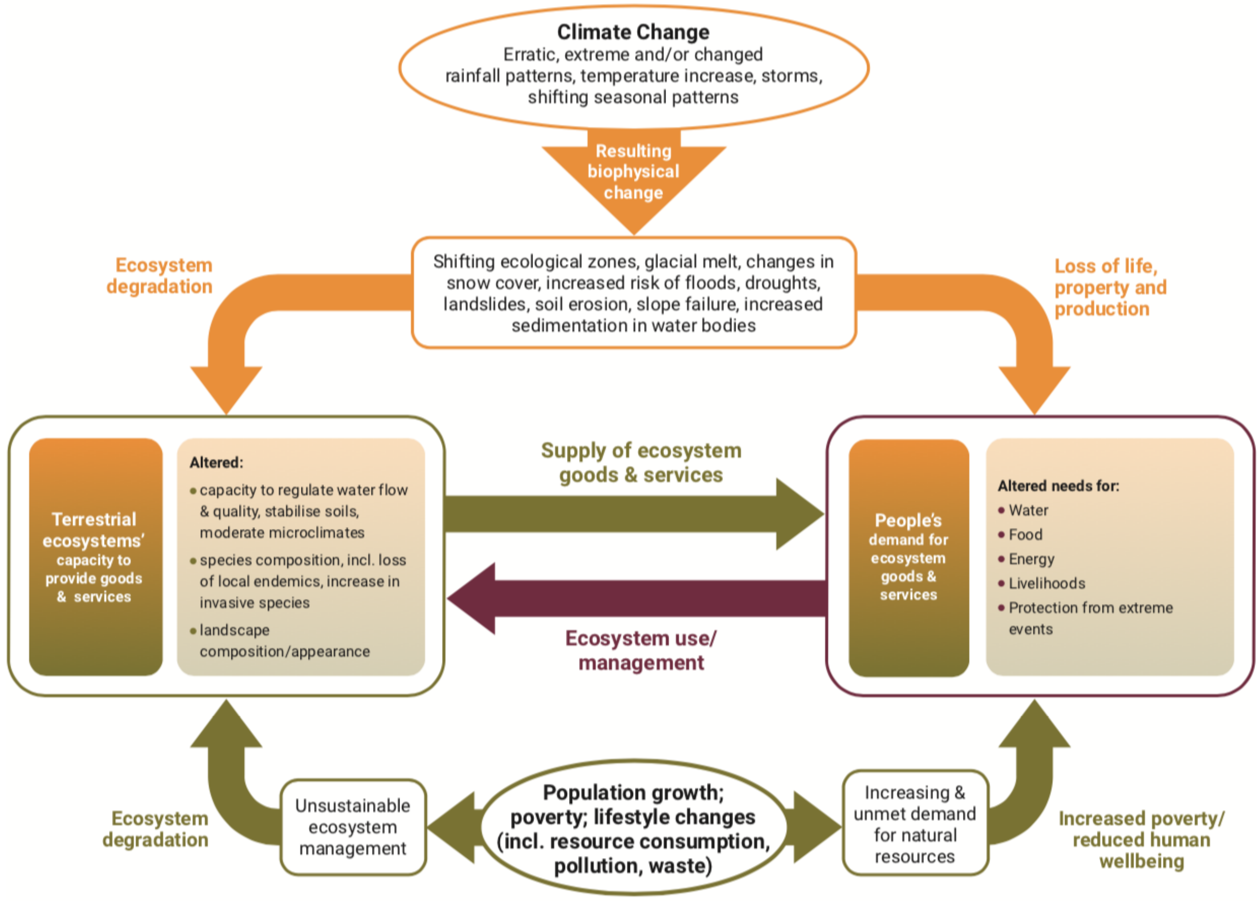

Figure 11. Interactions of climatic and non-climatic degradation processes in terrestrial ecosystems (UNEP – WCMC/UN-Environment, 2019).

WHAT IS A CLIMATE IMPACT PATHWAY?

A climate risk project that seeks to identify adaptation measures such as EbA solutions may start with the identification of climate change impact. The identification of impacts can be facilitated by the development of climate impact pathways (Fig. 12). An impact pathway is an analytical tool that helps to understand, systematise and prioritise the factors that drive risk for the socio-ecological systems in the project site. The structure of the impact pathway is consistent with the key components of climate risk explained above. The impact pathway has a similar structure: a climatic signal (such as a heavy rainfall event) can lead to a direct physical impact, causing a sequence of intermediate impacts (such as upstream erosion, which contributes to downstream flooding); which, due to the vulnerability of exposed elements of the socio-ecological system, ultimately leads to a risk (or multiple risks). The impact pathways are composed of risk components (hazard, exposure, vulnerability) and often include non-climatic factors, which contribute to the vulnerability of the socio-ecological system.

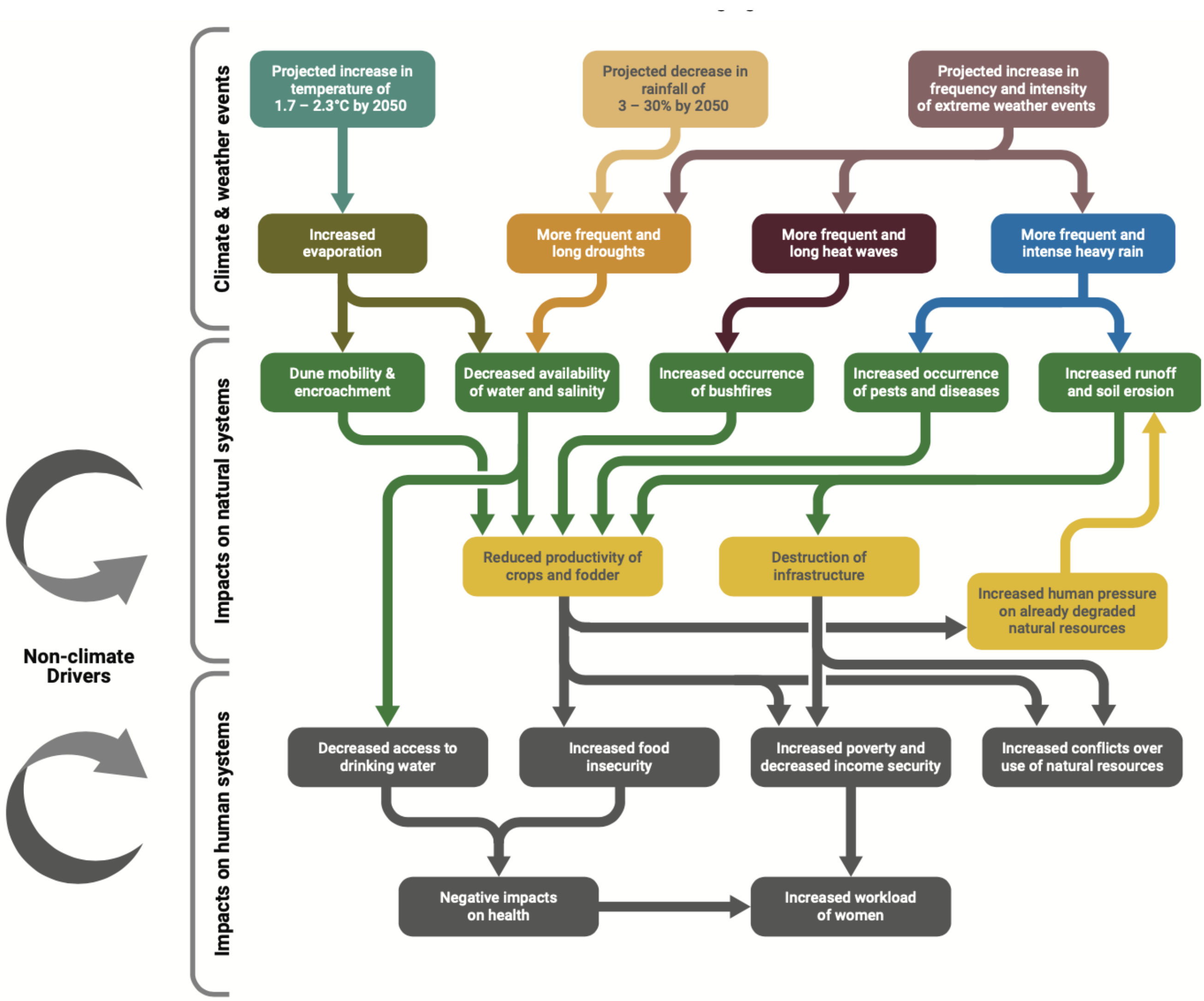

Figure 12. Mapping climate impact pathways helps to target EbA and other adaptation measures to address specific climate impacts and contribute to long-term resilience.[24]

READING MATERIALS	
Climate Risk Assessment for Ecosystem-based Adaptation – A guidebook for planners and practitioners. (GIZ/EURAC/UNU-EHS, 2018)	The risk supplement is a practical guidance on how to apply the Vulnerability Sourcebook's approach using the IPCC AR5 risk concept. The guidebook applies a standardized approach to climate risk assessments in the context of EbA-planning by following the modular sourcebook and risk supplement methodology and using an illustrative application example. https://www.adaptationcommunity.net/wp-content/uploads/2018/06/giz-eurac-unu-2018-en-guidebook-climate-risk-asessment-eba.pdf

[24] UNEP – WCMC/UN-Environment, 2019. Making EbA an effective part of balanced adaptation strategies: Introducing the UN Environment EbA briefing notes.

Operational Framework for EbA (WWF)	Step-by-step guidance for implementing EbA including a chapter (WWF) on the first step of conducting risk and vulnerability assessments http://awsassets.panda.org/downloads/wwf_wb_eba_project_2014_gms_ecosystem_based_adaptation_general_framework.pdf
Climate Vulnerability and Capacity Analysis Handbook (CARE)	Handbook assessing hazard impacts on each of the five categories of livelihood resources and provides a framework for community-based adaptation. https://careclimatechange.org/?option=com_content&view=article&id=25&Itemid=30

EXERCISE SHEET - 2
ANALYSIS OF CLIMATE VULNERABILITY AND RISKS

EXERCISE 2: Identify the context and assess climate vulnerability and risk (45min).

Learning objectives	• Get familiar with the case study • Consolidate basic concepts ecosystem and ecosystem services and their relevance as a topic for climate adaptation. • Learn how to identify factors contributing to risk in a system along an "impact chain" • Understand how to determine vulnerability, impact, risk and the need for action. • Understand that climate as well as non-climate stressors influence risk.

Exercise 2 seeks to put into practice the learned concepts and processes in Module 2 using a case study and the ALivE tool.

INSTRUCTIONS FOR CASE WORK

TASK 1 – UNDERSTAND THE SOCIO-ECOLOGICAL CONTEXT (30 Min)

Please see the ALivE tool (pages 21 – 27) and perform the following steps:

1. Describe the livelihood context in the study area
2. Assess livelihood dependence on ecosystem services
3. Describe the major ecosystems in the study area
4. Identify ecosystems needed for livelihood activities
5. Identify how ecosystems reduce impacts from natural hazards

TASK 2 – ASSESS CLIMATE VULNERABILITY AND RISK FOR ECOSYSTEMS AND LIVELIHOODS

Please see ALivE tool (pages 29 – 36) and perform the following steps:

1. Document observed and projected climate change in the study area
2. Assess impacts of climate change on ecosystems important for livelihoods
3. Analyse impacts of climate change on ecosystems important for livelihoods
4. Assess impacts of non-climatic stressors on ecosystems
5. Analyse impacts of climatic and non-climatic stressors on livelihoods
6. Identify social groups that are particularly vulnerable

MODULE 3

IDENTIFY AND PRIORITISE EBA OPTIONS

SESSION 3A
IDENTIFICATION OF EBA SOLUTIONS

SESSION 3B
PRIORITISATION OF EBA SOLUTIONS

FACTSHEET - SESSION 3A
IDENTIFICATION OF EBA OPTIONS

Objective	Step 3 aims to provide guidelines for the identification of possible EbA options to reduce exposure, decrease sensitivity and/or increase adaptive capacity. Once the EbA options are identified, this module provides guidelines on the selection of strategically relevant, effective and feasible EbA options.
Learning objectives	- Understand the nature of ecosystem-based adaptation measures. - Gain an overview of the different ecosystem-based adaptation measures and discuss their appropriateness. - Identify and design EbA measures relevant to national and local climate change and development strategies.
Key definitions	- Multi-criteria decision making - Cost-benefit analysis

STEP 3A: IDENTIFICATION OF EBA OPTIONS

Step 3A includes the following sub-steps (ALivE Tool):

- Identify adaptation outcomes for vulnerable livelihood strategies
- Identify EbA options for vulnerable livelihood strategies

Once the vulnerability of the ecosystems and livelihoods of the communities is assessed and the climate risks are known, it is important to identify EbA options that minimize or avoid them.

The identification of effective EbA measures needs to take into account ecosystem degradation processes that affect people's vulnerabilities to climatic changes. Although the EbA measures themselves will primarily address climatic drivers of change, their effectiveness will ultimately be impacted by other pressures on land- and sea-scapes. Past climate trends and future projections describing risks and impacts inform EbA measures in order for them to target the negative impacts arising from climate change.

To understand whether implementing the selected EbA measures is achieving these adaptation goals, monitoring and evaluation (M&E) are critical. Effective M&E requires indicators that are well matched to the objective of the EbA measure and provide appropriate information to track its immediate and intermediate outcomes and, eventually, its impacts (more information on M&E in Module 5).[25]

WHAT EBA SOLUTIONS CAN BE IMPLEMENTED IN MOUNTAIN ECOSYSTEMS?

Mountains are characterised by a complex topography, with strong gradients of temperature and microclimates across small areas. Mountain ecosystems are significant for forestry and agriculture,[26] and play a vital role in hydrological cycles.[27] They are also among the most vulnerable ecosystems to climate change impacts. Water provision, in particular, can be affected by changes in rainfall due to climate change. Increasing rainfall can also further destabilise slopes, causing erosion and landslides. EbA measures in mountains (Table 7) typically aim to address these risks by reducing the effects on local people from climate impacts related to slopes and hydrological regimes.

Table 1. Typical EbA solutions in mountain ecosystems, along with example outcome indicators that directly reflect the primary adaptation goal of each measure. [28]

Climate change impact targeted	EbA measure	Elements of outcome indicators
Flooding and sediment deposition resulting from extreme rainfall, rainfall variability and increasingly frequent and severe storms	**Riparian reforestation/rehabilitation along riverbanks** to slow run-off and capture sediment before it reaches the water course, thus limiting down-stream flood damage to property and livelihoods *e.g. planting indigenous and climate-resilient species, revegetating micro-catchments, and demarcating riparian buffer zones*	- Frequency and severity of floods - Sediment load - Measures of flood damage (infrastructure, households, crops)
Landslides and slope failure resulting from increasingly frequent and extreme rainfall	**Reforestation/forest restoration** to stabilise slopes and prevent landslides, mud flows and debris flows, thus limiting risks to life, property and livelihoods *e.g. planting indigenous, climate-resilient and multi-use species that benefit local communities (e.g. by providing NTFPs, shade and wind breaks)*	- Frequency and severity of landslides - Measures of damage from slope failure (loss of life, damage to property, impact on livelihoods)
Altered hydrology, river flow and water availability resulting from rising temperatures and	**Watershed restoration** to increase water storage capacity and reduce surface run- off, thus improving water availability and quality, and reducing flood risk	- Variation in river flow - Per capita dry season water availability

[25] UNEP – WCMC/UN-Environment, 2019. EbA in different ecosystems: placing measures in the context. Briefing note 3.
[26] Egan, P.A. and Price, M.F. (2017) *Mountain ecosystem services and climate change: a global overview of potential threats and strategies for adaptation*. Paris: UNESCO.
[27] Kohler, T., Wehrli, A. and Jurek, M. (2014) *Mountains and climate change: a global concern*. Sustainable Mountain Development Series. Bern: Centre for Development and Environment (CDE), Swiss Agency for Development and Cooperation (SDC) and Geographica Bernensia.
[28] UNEP – WCMC/UN-Environment, 2019. EbA in different ecosystems: placing measures in the context. Briefing note 3.

associated glacial melt, and changing amount, seasonality and variability of rainfall	*e.g. community-based watershed restoration, including the development of watershed management plans*	- Measures of water quality - Measures of flood damage (infrastructure, households, crops)

WHAT EBA SOLUTIONS CAN BE IMPLEMENTED IN DRYLAND ECOSYSTEMS?

Dryland refers to deserts, grasslands, scrublands and woodlands, which provide important ecosystem services including water regulation, carbon storage and provision of fibre, timber, bioenergy and food, staple crop production.[29] While high in cultural and ecological diversity, drylands are characterised by low productivity and low soil moisture content. For this reason, they are often overexploited and prone to land degradation and desertification, which affects local livelihoods.[30] Due to these characteristics, drylands are extremely vulnerable both to human driven disturbance and to climate change. Climate change impacts, including rising temperatures and reduced rainfall, exacerbate existing water shortages, soil erosion and desertification. As a result, dryland populations are extremely vulnerable, as they depend on rain-fed agriculture and cattle grazing for their livelihoods. EbA measures in drylands (Table 8) typically aim to address the impacts on ecosystem services of reduced and/or increasingly variable rainfall to secure livelihoods.

Table 2. Typical EbA solutions in dryland ecosystems, along with example outcome indicators that directly reflect the primary adaptation goal of each measure.[31]

Climate change impact targeted	EbA measure	Elements of outcome indicators
Drought, desertification and soil erosion resulting from increasing temperatures, reduced and more variable rainfall, and increasingly frequent and severe wind/ sandstorms	**Establishment of a multi-use desert 'Green Belt'** to increase water availability, improve soil quality, provide shade and wind breaks, thus improving food and income security *e.g. planting drought-tolerant species of trees, shrubs and crops whose roots can hold water in the soil*	- Extent of protective vegetation cover - Measures of wind/sandstorm impact - Measures of soil quality - Water availability (irrigation and household use) - Agricultural yields and income (home consumption and market)
	Climate-resilient grazing and livestock management to regenerate vegetation, increase forage quality and quantity,	- Quantity of forage for livestock

[29] Thomas, R., Stewart, N. and Schaaf, T. (2014) *Drylands: sustaining livelihoods and conserving ecosystem services*. Hamilton: UNU-INWEH.

[30] Spear, D., Baudoin, M-A., Hegga, S., Zaroug, M. Okeyo, A. and Haimbili, E. (2015) *Vulnerability and adaptation to climate change in the semi-arid regions of southern Africa*. Ottowa: CARIAA.

[31] UNEP – WCMC/UN-Environment, 2019. UNEP – WCMC/UN-Environment, 2019. EbA in different ecosystems: placing measures in the context. Briefing note 3.

	increase water availability, improve soil quality, and safeguard livestock, thus improving food and income security *e.g. increasing perennial species cover to enhance forage production, shifting livestock breeds or species, adjusting flock management and/or developing drought contingency plans*	- Water availability (irrigation, livestock and household use) - Measures of soil quality - Livestock survival rates - Measures of food and income generated from livestock
Increasingly frequent and severe wildfires resulting from increasing temperatures, reduced rainfall and seasonality	**Rehabilitation and restoration of rangelands** to repair ecological processes and enhance fire resistance, thus reducing damage, loss of life and livelihoods from wildfires *e.g. using indigenous drought-tolerant and/or fire-resistant grass, shrub and plant species, including species with multiple uses for local populations*	- Frequency and severity of wildfires - Extent of loss and damage caused by wildfires (life, infrastructure, livelihoods)

WHAT EBA SOLUTIONS CAN BE IMPLEMENTED IN WETLAND ECOSYSTEMS?

Wetlands include peatlands, estuaries, lakes and ponds, floodplains, mangroves and other coastal wetlands. Wetlands provide ecosystem services such as flood and coastal protection, water purification and supply, climate regulation (carbon sequestration and storage), provision of food and raw materials, and cultural services. However, increasing land use change has led to wetland degradation and loss of productivity, leaving local communities increasingly vulnerable. Rainfall variability, rising temperatures and more frequent extreme events cause significant changes to wetland hydrological cycles, thus reducing provisioning and regulating services to local communities. Wetland EbA measures (Table 9) include maintaining and restoring ecosystems to address hydrological impacts of changing rainfall regimes and ensuring the continued supply of ecosystem services to local communities.

Table 3. Typical EbA solutions in wetland ecosystems, along with example outcome indicators that directly reflect the primary adaptation goal of each measure.[32]

Climate change impact targeted	EbA measure	Elements of outcome indicators
Flooding and increased invasive species resulting from extreme rainfall, rising temperatures and increasingly frequent and severe storms	**Wetland rehabilitation** to reduce flood damage, enable groundwater recharge and improve water quality, and reduce pests affecting agriculture, thus improving food and income security *e.g. planting species that are climate-resilient, promote growth of other*	- Frequency and severity of floods - Measures of flood damage (infrastructure, households, crops) - Agricultural yields and income (home consumption and market)

[32] UNEP – WCMC/UN-Environment, 2019. UNEP – WCMC/UN-Environment, 2019. EbA in different ecosystems: placing measures in the context. Briefing note 3.

	species (e.g. through nitrogen fixation), have deep roots that bind soil, and meet multiple local needs (e.g. NTFP, fodder)	
	Wetland protection to encourage growth of spawning/nursery grounds and areas of high species diversity, and to allow vegetation regeneration for flood protection, thus improving water quality, reducing pests and improving food and income security *e.g. designating multiple-use zones and strict protection zones in areas of ecological significance*	- Measures of species abundance and diversity - Measures of water quality - Frequency and severity of floods - Measures of flood damage (infrastructure, households, crops) - Agricultural yields and income (home consumption and market)
Flooding, salt intrusion, and drought resulting from extreme and variable rainfall, rising temperatures, and increasingly frequent and severe storms	**Climate-resilient agriculture** to reduce impacts of floods, droughts and saline intrusion into groundwater and farmlands, thus improving food and income security *e.g. agroforestry and conservation agriculture near floodplains, using species that are salt tolerant and/or flood*	- Frequency and severity of floods - Measures of flood damage (infrastructure, households, crops) - Salinity levels in groundwater and farmlands - Agricultural yields and income (home consumption and market)

WHAT EBA SOLUTIONS CAN BE IMPLEMENTED IN COASTAL ECOSYSTEMS?

Coastal ecosystems include sand dunes, seagrass beds, coral reefs and mangroves. The ecosystem goods and services provided by coastal ecosystems are vitally important for fishing communities. Mangrove and reef-based fisheries, for example, provide food and livelihoods on which many coastal communities rely.[33] Mangroves also provide wood, fodder and medicine, and act as carbon sinks. Coral reefs, among other things, generate income from tourism. Coastal ecosystems also help reduce flooding, erosion and damage caused by storm surges. Coastal ecosystems are subject to impacts from high density human populations and associated development activities. Climate change also has significant impacts on coastal systems. Increasing ocean temperatures can lead to coral bleaching and reef degradation, and sea-level rise increases the incidence of coastal erosion and flooding, as do increasingly frequent and severe storm surges. Many coastal EbA measures therefore address the flooding and erosion impacts of climate change (Table 10) by restoring or enhancing ecosystem services that also support livelihoods.

Table 4. Typical EbA solutions in coastal ecosystems, along with example outcome indicators that directly reflect the primary adaptation goal of each measure.[34]

[33] UNEP – WCMC/UN-Environment, 2019. UNEP – WCMC/UN-Environment, 2019. EbA in different ecosystems: placing measures in the context. Briefing note 3.

[34] Idem.

Climate change impact targeted	EbA measure	Elements of outcome indicators
Sea level rise, flooding, coastal erosion and saline intrusion resulting from rising temperatures and increasingly frequent and severe storm surges	**Mangrove restoration/rehabilitation** to reduce wave energy, erosion and storm surge water levels, thus limiting coastal flooding, saline intrusion into groundwater and farmlands, and damage to property and livelihoods *e.g. establishing climate-resilient and pest-resistant nurseries and replanting* **Dune and beach stabilisation** to reduce coastal erosion and flooding, thus limiting damage to property and livelihoods *e.g. planting indigenous climate-resilient pioneer dune plants that biologically fix or reforest the dune ridge*	- Extent of coastal erosion - Frequency and severity of floods - Salinity levels in groundwater and farmlands - Agricultural yields and income (home consumption and market) - Measures of flood/storm damage (infrastructure, households, crops)
Increasing intensity of wave action, sea level rise, coastal erosion, changes in coastal fish abundance and diversity, resulting from rising temperatures, increasingly frequent and severe storm surges, ocean warming and acidification	**Coral reef rehabilitation** to attenuate wave intensity, and to increase habitat and nursery grounds for fish, thus reducing flooding, erosion and damage to property, and supporting fisheries and livelihoods *e.g. through restoring, rearing and transplanting coral reef fragments*	- Frequency and severity of floods - Extent of coastal erosion - Measures of fishing effort - Fish catch and income (home consumption and market)

READING MATERIALS	
EbA case studies from PANORAMA solutions platform	- Climate change Adaptation, Sustainably Aware (CASA) (Zanzibar), implemented by Sazani - Ecosystems-based coastal protection through floodplain restoration (Vietnam), implemented by GIZ - Functioning watersheds in the face of climate change (Mexico), implemented by FONNOR Mexico - Good Practices for Climate Change Adaptation (Mexico), implemented by Instituto Tecnológico de Chetumal (ITCH)
	- Ecosystems Restoration Opportunity Mapping for DRR and CCA (UNEP/GRID-Geneva and UNEP/PCDMB) New methodology and global interactive tool for mapping areas where ecosystems can reduce disaster risk, crossing human exposure to natural hazards with presence/absence of ecosystems, which enables the prioritization of areas where ecosystems should be protected and/or restored.

EXERCISE SHEET - 3A
IDENTIFICATION OF EBA OPTIONS

EXERCISE 1: Identify EbA options (35 min).

Objective	- Understand the different sets of adaptation options - their potential to reduce exposure, decrease sensitivity and increase adaptive capacity - Consolidate the basic concept of EbA and be aware of the potential role of ecosystem services for climate change adaptation. - Learn to distinguish between this potential role and the possible impact of climate change *on* ecosystems.

INSTRUCTIONS FOR CASE WORK

- Guide the participants through the key activities they need to perform under Step 3B by using the ALivE Tool Manual (pages 38 – 41).
- Each group works for 30 min with their case study, discusses and integrates their results in the ALivE tool.
- Encourage the Presenter of the group to write down the key outcomes from the discussion in their group.
- After the given time the trainer should ask the Presenters in each group to briefly present their results (2 min) and have a plenary discussion (5 min) of lessons learned.

FACTSHEET - 3B
PRIORITIZATION OF EBA OPTIONS

Step 3B includes the following sub-steps (ALivE Tool):

- Prioritise effective EbA options for vulnerable livelihood strategies
- Create a list of effective EbA options
- Change or add new EbA options
- Identify evaluation criteria to assess the feasibility of EbA options
- Evaluate feasibility of EbA options based on chosen criteria
- Create a list of feasible EbA options

HOW TO PRIORITISE EBA OPTIONS FOR ADAPTATION STRATEGIES?

The range of possible applications of EbA can be very broad, however only a few of the identified options will be considered for a project or program. Therefore, it is important to conduct a priority-setting exercise. To facilitate priority-setting there are two main methods widely used:

Multi-Criteria Analysis - the analysis is made on the basis of qualitative information that allows the classification of a range of EbA options according to pre-selected criteria. This analysis allows prioritisation to be performed with a limited amount of quantitative information. Selection criteria should be defined with the participation of all stakeholders participating in the planning process.

Cost-Benefit Analysis - the analysis is based on quantitative information to estimate and compare all the costs and benefits of an EbA option, and to provide information on which of the identified measures generate the greatest direct and indirect benefits associated with the reduction of climate risks. The benefits perceived by the population using ecosystem services will be related to the ecosystems where EbA will be implemented.

The two methodologies are differentiated by their complexity, type of analysis (qualitative or quantitative), and by the resources and inputs required to use them (Table 6).

Table 5. Comparison between Cost-benefit Analysis and Multi-criteria Analysis.

	Cost-Benefit Analysis	Multi-Criteria Analysis
Use	Useful when the adaptation intervention being considered is likely to involve significant capital and labor costs. Analyses of adaptation responses often involve a high degree of uncertainty in quantifying non-commercial goods and services, as well as in anticipating the direction and magnitude of climate change.	Applies to cases where a single-criterion approach (such as cost-benefit analysis) is not sufficient, especially when components cannot be assigned monetary values. The analysis allows decision-makers to include a full range of social, environmental, technical, economic and financial criteria.
Scope	It may be difficult to apply to sectors where the market does not apply a satisfactory measure of cost value.	All sectors
Key result	A monetary comparison of the costs and benefits of a proposed adaptation measure.	A single most preferred option, classified options, a short list of options for further evaluation or characterization of acceptable possibilities.
Required inputs	Quantitative values for all significant costs and benefits associated with the proposed response.	Evaluation criteria, as well as metrics relevant to those criteria.
Ease of use	Involves extensive research and economic analysis.	Depends on the particular tool to be used but is based on participatory and expert consultation.
Resource requirements (economic resources, time)	High	Medium
Strengths	- Produces rigorous and quantitative results that are easy to communicate. - Is independent of judgments and avoids conflicts.	- You can use both qualitative and quantitative information. - Supports broad stakeholder participation and assists decision-makers in making decisions to make compromises and avoid conflicts.
Limitations	- Cost-benefit analysis only assesses the efficiency of adaptation measures and no other problems, e.g. equity considerations related to the distribution of costs and benefits among stakeholders. - It requires all benefits to be measured and expressed in monetary terms. - There are costs and benefits that cannot be valued.	- The inclusion of climatic uncertainties remains relatively simplistic compared to other technically advanced methods. - The result may be influenced by personal interests.

WHAT CRITERIA TO USE TO ASSESS EBA OPTIONS WITH MULTI-CRITERIA ANALYSIS

EbA options can be assessed according to **effectiveness criteria**[35]:

- **Potential to reduce risks associated with current and future climate hazards and changes**: The EbA option directly addresses climate hazards, changes and uncertainty, taking into account both observations and projections of climate change. It is informed by both scientific information and traditional knowledge.
- **Potential to improve peoples' adaptive capacity to climate change**: The EbA option enables adaptation to climate change, for example by improving stability of access to climate-sensitive resources, creating new livelihood opportunities that spread risks, or improving systems for managing natural resources in ways that increase equity in access and control.
- **Potential to generate benefits for vulnerable social groups and enhance gender equality**: Implementation of this EbA option can ensure that vulnerable social groups can participate and benefit from the results. It addresses social and gender inequalities that present barriers to adaptation.
- **Potential to make sustainable use of biodiversity and ecosystem services to build resilience**: The EbA option harnesses ecosystem services to increase people's livelihood assets and their capacity to adapt to climate change in a way and at a rate that do not lead to the decline of the ecosystem's health.
- **Potential to build resilience of ecosystems to current and future climate hazards and changes**: The EbA option balances human adaptation with ecosystem resilience by supporting essential natural processes and the interconnections between different ecosystem services. Use of ecosystem services is at a rate that does not undermine the longer-term resilience of the ecosystem itself.

EbA options should also be assessed on the basis of **feasibility criteria**:

- **Affordability**
- **Technical feasibility**
- **Political feasibility**
- **Cost to maintain**
- **Ability to be monitored**
- **Flexibility**
- **Support for a large number of beneficiaries**
- **Culturally appropriateness**

[35] IISD/UN-Environment/UNEP IEMP, 2018. ALivE -Adaptation, Livelihoods and Ecosystem Planning Tool – User Manual

HOW TO MAKE AN ECONOMIC CASE FOR EBA OPTIONS IN THE PRIORITIZARION?

Climate change adaptation should be financially sustainable in all cases. It is often suggested that EbA can be more cost-effective, provide both the desired adaptation benefits and multiple co-benefits, and be more sustainable than engineered adaptation measures in the long term. However, there is a lack of 'hard' evidence of the physical effectiveness of EbA measures in responding to climate hazards and meeting adaptation goals or how EbA can generate wider co-benefits. Table 7 shows a framework that categorises benefits, costs and impacts arising from EbA implementation.

Table 6. Framework of EbA benefits, costs and impacts.[36]

BENEFITS	COSTS	IMPACTS
Primary adaptation benefits *i.e. the benefit of reducing climate change related risk, e.g. sustained agricultural productivity*	**Direct implementation expenses** *e.g. staff, equipment, transport, infrastructure, maintenance, etc.*	**Temporal impacts** *When do costs and benefits fall over time? e.g. rate at which habitat recovery restores ecosystem services, when intervention costs are incurred, interests of future generations, etc.*
Additional adaptation benefits *e.g. mitigation of storms and flood damages, year-round water supplies, sustained farmland productivity in the face of drought, maintenance of species habitat, etc.*	**Core institutional & enabling costs** *e.g. training, development of plans, laws, policies, incentives, etc.*	**Spatial impacts** *Where do costs and benefits fall spatially? e.g. gains and losses for upstream and downstream communities, costs and benefits to ecosystem providers and users, effects across borders, etc.*
Co-benefits *e.g. improved health, better food supplies, new and diversified income opportunities, disaster risk reduction, watershed protection, enhanced biodiversity, etc.*	**Opportunity costs** *e.g. foregone income and output due to land use restrictions, etc.* **Social & environmental losses** *e.g. negative impacts on women, downstream communities, etc.*	**Distributional impacts** *Where do costs and benefits fall demographically? e.g. changes in resource access or income opportunities between women and men, rich and poor, urban and rural, regions, sectors, communities, etc.*

[36] Emerton, L. (2017) Valuing the benefits, costs and impacts of ecosystem-based adaptation measures: a sourcebook of methods for decision-making. Bonn/Eschborn: GIZ.

READING MATERIALS	
Valuing the benefits, costs and impacts of ecosystem-based adaptation measures: a sourcebook of methods for decision-making (Emerton, L.,2017)	Resource to guide the design, delivery and use of EbA valuation studies to inform and influence decision-making, including 40 case studies on EbA-relevant valuations that have been implemented globally, over recent years. https://www.adaptationcommunity.net/wp-content/uploads/2017/12/EbA-Valuations-Sb_en_online.pdf
Supporting decision-making for effective adaptation (National Climate Change Adaptation Facility, Australia)	Policy brief exploring the support of decision-making for adaptation, through provision of frameworks, knowledge and criteria for performance evaluation and comparisons (Decision Support Tools) https://www.nccarf.edu.au/sites/default/files/attached_files_publ ications/DECISION_070313_A4.pdf
Cost and Benefits of Ecosystem Based Adaptation: The Case of the Philippines (IUCN)	Highlights case studies using 1) Cost-Benefit Analysis (CBA); 2) Cost-Effective Analysis; and 3) Multi-criteria Analysis for EbA decision-making https://www.iucn.org/sites/dev/files/content/documents/philip pines_cba_study_final_version.pdf
Making the economic case for Ecosystem-based Adaptation: Learning Brief (UNDP)	Description of application of cost-benefit analyses to EbA and lessons learned based on the Global Mountain EbA Programme in Nepal, Peru and Uganda

EXERCISE SHEET - SESSION 3B
PRIORITIZATION OF EBA OPTIONS

EXERCISE 2: Prioritise the identified EbA options (30 min)

Objective	- Understand the procedures of a multi-criteria analysis for adaptation. - Understand the impacts of choosing specific criteria. - Conduct a step-by-step narrowing down of adaptation options.

FACILITATION

Please see ALivE tool (pages 38 - 41) and perform the following steps:

1. Identify adaptation outcomes for vulnerable livelihood strategies
2. Identify EbA options for vulnerable livelihood strategies
3. Prioritise effective EbA options for vulnerable livelihood strategies
4. Create a list of effective EbA options

MODULE 4

DESIGN AND IMPLEMENT EBA OPTIONS

FACTSHEET - 4
DESIGN AND IMPLEMENTATION OF EBA OPTIONS

Objective	Step 4 of the design and implementation process for EbA aims to define the implementation strategy for the selected EbA solutions and a concrete work plan that includes policies and instruments, stakeholder participation, responsibilities and actions, and financial resources.
Learning objectives	- Reflect on the first steps towards the implementation of EbA measures. - Recognise opportunities and tools to support public investment for the implementation of the EbA. - Explore the elements and conditions for successful implementation

Step 4 includes the following sub-steps (ALivE Tool):

- Identify required inputs for prioritized EbA options
- Identify roles and responsibilities for priority EbA options
- Identify opportunities and barriers that influence the implementation of priority EbA options and key actions
- Identify project activities to support implementation of priority EbA options and key actions, taking into consideration required inputs, actors, responsibilities, opportunities and barriers

WHAT ARE THE KEY POINTS TO CONSIDER FOR THE DESIGN AND IMPLEMENTATION OF EBA OPTIONS?

Key points to consider for the design and implementation of EbA options:

Communicate activities to stakeholders

- ✓ Use local press and radio to publicize implementation
- ✓ Take pictures before and during activities
- ✓ Send letters to local authorities

Create a contact point for stakeholders

- ✓ Appoint a local liaison officer (ideally someone from the community)
- ✓ Provide a complete list of those involved in the implementation of the action plan

Identify responsibilities

- ✓ Develop a list of different responsibilities within the plan

Maintain the agreed schedule

- ✓ Create a workgroup with key stakeholders and prepare a roadmap to facilitate the monitoring of activities
- ✓ Identify targets and indicators to measure progress in implementing the measure
- ✓ Have regular face-to-face or telephone meetings between staff (and contractors, if any)

Provide training

- ✓ Conduct training courses for local actors
- ✓ Provide written didactic material where required

Relate the activity to the monitoring system and continuous improvement

- ✓ Measure the progress of the measure and assess vulnerability reduction
- ✓ Agree on a process for making changes to plans, if necessary

READING MATERIALS	
Implementing nature-based flood protection: Principles and implementation guidance (World Bank)	Guidelines including principles and implementation steps for ecosystem-based flood protection. http://documents.worldbank.org/curated/en/739421509427698706/Implementing-nature-based-flood-protection-principles-and-implementation-guidance
Restoring River Continuity: methods and challenges (Wetlands International - European Association and the Italian Center for River Restoration)	Webinars explaining methods and challenges of river restoration with a specific focus on improving river connectivity https://europe.wetlands.org/event/rivers/
Mainstreaming Climate-Smart Agriculture into a Broader Landscape Approach (FAO)	Guidance on understanding the different options that are available for planning, policies and investments and the practices that are suitable for making different agricultural sectors, landscapes and food systems more climate-smart http://www.fao.org/3/a-i3325e.pdf
Making Ecosystem-based Adaptation Effective: A Framework for Defining Qualification Criteria and Quality Standards (FEBA)	Practical assessment framework for designing, implementing and monitoring EbA measures by proposing a set of elements, qualification criteria and quality standards and example indicators. http://www.adaptationcommunity.net/download/ecosystem-based_adaptation/technical_paper/FEBA_EbA_Qualification_and_Quality_ Criteria_EN.pdf

EXERCISE SHEET - 4
DESIGN AND IMPLEMENTION OF EBA OPTIONS

EXERCISE 1: Design of the identified EbA options (20 min)

INSTRUCTIONS OF THE CASE WORK

Please see ALivE tool (pages 53-57) and perform the following steps:

1. Identify required inputs for priority EbA options
2. Identify roles and responsibilities for priority EbA options
3. Identify opportunities and barriers that influence the implementation of priority EbA options and key actions
4. Identify project activities to support implementation of priority EbA options and key actions, taking into consideration required inputs, actors, responsibilities, opportunities and barriers

MODULE 5

MONITORING AND EVALUTION OF EBA OPTIONS

FACTSHEET - 5
MONITORING AND EVALUATION OF EBA OPTIONS

Objective	Step 5 of the planning and implementation process for EbA solutions aims to identify the objective of the monitoring and evaluation system, and what approaches and tools exist. It further defines the elements of the monitoring and evaluation framework (results chain, indicators and data collection means).
Learning objectives	- Practice developing a results framework (case work). - Discuss specific needs and problems related to the EbA indicators. - Acquire an overview of appropriate indicators. - Practice developing indicators (case work).

Step 5 includes the following sub-steps (ALivE Tool):

- Identify long-term indicators to measure adaptation outcomes
- Identify short-term indicators to measure EbA options
- Describe the baseline situation for each adaptation outcome
- Data collection and methods - Monitoring
- Data collection and methods - Evaluation

WHY IS MONITORING AND EVALUATION IMPORTANT FOR EBA?

Monitoring and evaluation (M&E) is vital to understand the extent to which the project is making progress against the initial objectives and to identify uncertainties, gaps and barriers to progress in the short to longer-term. It should be carried out throughout the lifetime of an EbA project and beyond. It enables policy-makers, planners and practitioners to improve EbA actions by adjusting processes and targets to ensure that benefits are achieved over time. Monitoring and evaluation is important because it:

- **provides critical evidence** to support learning about 'what works' in EbA
- **promotes future investment** by demonstrating cost-effectiveness
- **motivates involvement** by stakeholders in a participatory monitoring

HOW TO STRUCTURE A MONITORING AND EVALUATION SYSTEM FOR EBA

EbA solutions aim to achieve long-term outcomes under changing climate hazards. The success of adaptation often depends on the context. There are a number of factors that should be considered when designing an effective M&E system for ecosystem-based adaptation[37]:

a) **Establish clear objectives as a first step to developing an M&E system**. These objectives may address issues such as improving ecosystem function or services, with the added aim of reducing vulnerability of populations to climate change as well as increasing their adaptive capacity.

b) **Consider the quality and characteristics of the planning context as input to a robust baseline.** i) How well have ecosystem services already been considered within the adaptation planning process? ii) What factors are at play that could possibly lead to mal-adaptation? and iii) how have they been addressed in existing efforts?

c) **Design M&E systems that include short, medium and long-term indicators, and operate at the most appropriate scale to assess project effectiveness and any changes in vulnerability**

d) **Ensure that the selected/developed indicator(s) address a specific driver of climate-relevant vulnerability** (sensitivity, adaptive capacity, or exposure) identified in the planning stages as being directly tied to ecosystems and/or ecosystems services.

e) **Remain realistic about the degree to which the M&E system can illustrate the interventions' contribution to adaptation and to longer-term development goals**. It is recommended to consider the local capacity as the key to monitoring short, medium and long-term effects of an EbA project/programme. Local communities need to be involved in the monitoring process to enhance efficiency as well as enhance local capacities and learning. Furthermore, M&E systems will need to be designed to cover an adequate time period and operate at the most appropriate scale to assess project/programme effectiveness.

HOW TO SELECT AND DEVELOP EBA INDICATORS?

In general, there are two types of indicators: *process-based* (measuring *input and output*) and *performance-based* (*measuring outcome and impact*) indicators. A description of process and performance-based indicators is provided in Table 9 below. Since EbA in a relatively new policy areas, process-based indicators are likely to be of greater importance in the short-term, whereas performance-based indicators will gain prominence in the longer-term.[38]

[37] IUCN, n.a. Ecosystem-based Adaptation Monitoring and Evaluation – Indicators. https://www.iucn.org/sites/dev/files/eba_me_indicators.pdf

[38] Meller *et al.*, 2012. Meller, L., van Teeffelen, A., van Minnen, J., Vermaat, J., Alkemade, R., Hellmann, F. and Cabeza, M. (2012). "***RESPONSES Project: A matrix of biodiversity indicators***". European responses to climate change: deep emissions reductions and mainstreaming of mitigation and adaptation.Grant Agreement number 244092, Deliverable D5.2. Pp. 20.

Table 7. Description of Process- and Performance-based indicators, including the potential advantages and disadvantages. [39]

Type of indicators	Description	Advantages	Disadvantages
Process-based **[Monitoring the development, implementation & progress]**	Process-based indicators seek to monitor the development and implementation of adaptation approaches. They measure an agreed course of action and track progress towards the desired outcome. They relate to input and output indicators. **Such indicators are needed to:** Inform and justify decisions; and assist decision-makers and other stakeholders to progress strategically and proactively through the adaptation process.	- Allows stakeholders & sectoral experts to choose the most appropriate adaptation action to meet an outcome. - Flexible approach: can adjust to new information as it becomes available. - Process-based indicators can often apply sufficiently at short time scales. - May support ongoing learning and capacity development.	- Defining a process does not guarantee successful adaptation. - It may be difficult to integrate adaptation targets with objectives in other policy areas (because they are different in nature). - Not necessarily sector-specific.
Performance-based **[Evaluating effectiveness]**	Performance-based indicators measure the effectiveness of adaptation policies, activities, projects and programmes. They relate to outcome and impact indicators.	May be possible to link adaptation objectives with objectives in other policy areas. Likely to be sector-specific.	- Defining an outcome does not guarantee successful adaptation. - Risk of being overly prescriptive of adaptation options (specifying sub-optimal options). - The utility of many outcome indicators is limited by the long timeframe within which M&E must measure adaptation outcomes.

In the process of identifying and selecting EbA-relevant indicators there are key criteria to be considered[40]:

- **Select indicators that reflect the resilience of all components of the human-environment system and their inter-linkages**;

[39] IUCN, n.a. Ecosystem-based Adaptation Monitoring and Evaluation – Indicators. https://www.iucn.org/sites/dev/files/eba_me_indicators.pdf
[40] Idem.

- **Select common broad indicators that may be identically measured/monitored** within a given region and between regions;
- **Include indicators that reflect ecosystem health** (i.e. indicators analysing the condition and status of aspects of biodiversity);
- **Include indicators that can measure ecosystem services delivered to vulnerable populations** (i.e. indicators quantifying the benefits that humans derive from ecosystems and their services);
- **Incorporate tools to quantitatively or qualitatively assess vulnerability and resilience of the local human communities after the implementation of EbA initiatives**;
- **Selected indicators should allow reporting at different scales** (national, regional and international) and across different jurisdictions;
- **A pre-requisite for ecosystem-based indicators is that they relate to spatially referenced data and/or policies for a particular region or ecosystem**;
- **Indicators and targets need to be set within a framework that considers changes over time**[41]

Table 8. Example of EbA-related indicators.[42]

Topic/Area	Indicator example[43]
Monitoring/evaluating changes in adaptive capacities and ecosystem resilience	**Measuring any improvement in water use efficiency to maintain ecosystem integrity**, i.e.: - amount of surface water extracted for irrigation in project sites; - number of monitored wells increasing groundwater efficiency in project sites
	Measuring improvement in land-use practices and climate change resilience. i.e.: - total hectares of riparian and wetland habitat restored with native vegetation within project sites; - total number of hectares with ecosystem-based approaches
	Assess ecosystem services and natural assets maintained or improved under climate change and variability-induced stress (outcome based). e.g.: - ***Measure changes in hectares*** (i.e. hectares improved through soil & water conservation methods such as reduced deforestation, improved integrity of ecosystems, reduced erosion and degradation, improved water retention, etc.). - ***Technical studies*** by government or specialized agencies, satellite maps, and before-and-after photographic evidence to estimate the area of improved land. - ***Measure through changes in species population numbers*** (dynamics, structure, etc.)

[41] Travers, A., Elrick, C., Kay, R. and Vestergaard, O. (2012). "***Ecosystem-based Adaptation Guidance: Moving from Principles to Practice***". United Nations Environment Programme (UNEP)- Decision Support Framework. Pp. 97.

[42] IUCN, n.a. Ecosystem-based Adaptation Monitoring and Evaluation – Indicators. https://www.iucn.org/sites/dev/files/eba_me_indicators.pdf

[43] UNFCCC, 2013. "***Report on the technical workshop on ecosystem-based approaches for adaptation to climate change***". Thirty-eighth session, Bonn, June 2013. Item 3 of the provisional agenda: Nairobi Work Programme on Impacts, Vulnerability and Adaptation to Climate Change. Bonn, Germany: UNFCCC. Pp. 18. Available at: http://unfccc.int/resource/docs/2013/sbsta/eng/02.pdf

READING MATERIALS	
Monitoring and evaluating ecosystem-based adaptation (EbA) – A guidebook (GIZ)	Step-by-step practical guidance on the development and implementation of an M&E system for EbA on multiple scales. The guidebook enables EbA projects operating at a local and community level to connect with EbA policies and programmes generated at regional and national levels and demonstrates the benefits of EbA and how effective M&E can strengthen the case for its inclusion in strategies for responding to the impacts of climate change. https://www.adaptationcommunity.net/publications/
AdaptMe: Adaptation Monitoring and Evaluation Toolkit (European Climate Adaptation Platform)	Enables users to think through some of the factors that can make an evaluation of adaptation activities inherently challenging, and guide the design of a robust evaluation http://www.ukcip.org.uk/wp-content/PDFs/UKCIP-AdaptME.pdf
Summary of tools for monitoring and evaluating adaptation activities (DEA and SANBI)	Provides practical guidance for making use of Indicators of Resilience in Socio-ecological Production Landscapes and Seascapes in the field, for engaging local communities in adaptive management of the landscapes and seascapes in which they live http://collections.unu.edu/eserv/UNU:5435/Toolkit_for_the_Indicators_of_R esilience.pdf
Making Ecosystem-based Adaptation Effective: A Framework for Defining Qualification Criteria and Quality Standards (FEBA)	Practical assessment framework for designing, implementing and monitoring EbA measures by proposing a set of elements, qualification criteria and quality standards and example indicators. http://www.adaptationcommunity.net/download/ecosystem-based_adaptation/technical_paper/FEBA_EbA_Qualification_and_Quality_ Criteria_EN.pdf
Integrating ecosystems in resilience practice: Criteria for Ecosystem-Smart Disaster Risk Reduction and Climate Change Adaptation (Wetlands International)	Introduces a set of criteria and steps to develop an 'ecosystem-smart' approach in the design, implementation and evaluation of risk reduction programmes, and guidance on the required capacities, partnerships, institutional set-up and planning needs https://www.wetlands.org/publications/integrating-ecosystems-in-resilience-practice-criteria-for-ecosystem-smart-disaster-risk-reduction- and-climate-change-adaptation/

EXERCISE SHEET - 5
MONITORING AND EVALUATION OF EBA OPTIONS

EXERCISE 1: Monitoring and evaluation of EbA options (20 min)

INSTRUCTIONS FOR CASE WORK

Please see ALivE tool (pages 59 - 64) and perform the following steps:

1. Identify long-term indicators to measure adaptation outcomes
2. Identify short-term indicators to measure EbA options
3. Describe the baseline situation for each adaptation outcome
4. Data collection and methods – Monitoring
5. Data collection and methods – Evaluation

Annex 1 - DEFINITIONS

Adaptive capacity	The combination of the strengths, attributes, and resources available to an individual, community, society, or organization that can be used to prepare for and undertake actions to reduce adverse impacts, moderate harm, or exploit beneficial opportunities (IPCC) Builds the capacity of people to adapt to climate change impacts through maintaining and enhancing their asset/capital sets, addressing entitlements, encouraging innovation, giving greater access to information, establishing flexible governance/decision-making, related to biodiversity and ecosystem services (IUCN)
Climate change	A change in the state of the climate that can be identified (e.g., by using statistical tests) by changes in the mean and/or the variability of its properties and that persists for an extended period, typically decades or longer. Climate change may be due to natural internal processes or external forcings, or to persistent anthropogenic changes in the composition of the atmosphere or in land use (IPCC)
Climate change adaptation	The process of adjustment to actual or expected climate and its effects. In human systems, adaptation seeks to moderate harm or exploit beneficial opportunities. In natural systems, human intervention may facilitate adjustment to expected climate and its effects (IPCC AR5)
Climate extreme	The occurrence of a value of a weather or climate variable above (or below) a threshold value near the upper (or lower) ends of the range of observed values of the variable. For simplicity, both extreme weather events and extreme climate events are referred to collectively as "climate extremes." (IPCC)
Climate-smart agriculture	CSA contributes to the achievement of sustainable development goals. It integrates the three dimensions of sustainable development (economic, social and environmental) by jointly addressing food security and climate challenges. It is composed of three main pillars: 1) sustainably increasing agricultural productivity and incomes; 2) adapting and building resilience to climate change; 3) reducing and/or removing greenhouse gases emissions, where possible (FAO)
Desertification	Defined as land degradation in drylands, leading to a condition of significantly reduced fertility and water holding capacity. Desertification is a reversible condition of the earth's surface, as opposed to aridity, which is a climatic condition (UNCCD)
Disaster risk	The likelihood over a specified time period of severe alterations in the normal functioning of a community or a society due to hazardous physical events interacting with vulnerable social conditions, leading to widespread adverse human, material, economic, or environmental effects that require immediate emergency response to satisfy

	critical human needs and that may require external support for recover (IPCC)
Disaster Risk reduction	Denotes both a policy goal or objective, and the strategic and instrumental measures employed for anticipating future disaster risk; reducing existing exposure, hazard, or vulnerability; and improving resilience (IPCC) The concept and practice of reducing disaster risks through systematic efforts to analyse and manage the causal factors of disasters, including through reduced exposure to hazards, lessened vulnerability of people and property, wise management of land and the environment, and improved preparedness for adverse events (UNISDR 2009, p. 10-11)
Ecosystem-based Adaptation	Incorporates biodiversity and ecosystem services into an overall adaptation strategy to help people to adapt to the adverse effects of climate change (CBD) Uses biodiversity and ecosystem services as part of an overall adaptation strategy to help people and communities adapt to the negative effects of climate change at local, national, regional and global levels (UNEP) Any initiative that reduces human vulnerabilities and enhances adaptive capacity in the context of existing or projected climate variability and changes through sustainable management, conservation and restoration of ecosystems. (IUCN)
Ecosystem services	The benefits people obtain from ecosystems, which have been classified by the Millennium Ecosystem Assessment as: *Provisioning* services, such as supply of food, fibre, timber and water; *regulating* services, such as carbon sequestration, climate regulation, water regulation and filtration, and pest control; *cultural* services, such as recreational experiences, education and spiritual enrichment and *supporting* services, such as seed dispersal and soil formation; (Millennium Ecosystem Assessment 2005)
Exposure	The presence of people; livelihoods; species or ecosystems, environmental services and resources; infrastructure; or economic, social, or cultural assets in places that could be adversely affected (IPCC)
Hazard	The potential occurrence of a natural or human-induced physical event that may cause loss of life, injury, or other health impacts, as well as damage and loss to property, infrastructure, livelihoods, service provision, and environmental resources (IPCC)
Impacts	Impacts generally refer to effects on lives, livelihoods, health, ecosystems, economies, societies, cultures, services, and infrastructure due to the interaction of climate changes or hazardous climate events occurring within a specific time period and the vulnerability of an exposed society or system. Impacts are also referred to as *consequences* and *outcomes*. The impacts of climate change on geophysical systems, including floods, droughts, and sea level rise, are a subset of impacts called physical impacts. (IPCC 2014)
Nature-based Solution	Actions to protect, sustainably manage and restore natural or modified ecosystems, which address societal challenges (e.g. climate change, food and water security or natural disasters)

	effectively and adaptively, while simultaneously providing human well-being and biodiversity benefits. (IUCN)
Risk	The combination of the probability of an event and its negative consequences (UNISDR). Risk is commonly expressed as a function of exposure, the conditions of vulnerability that are present, and the magnitude and frequency of a hazard event (Sudmeier-Rieux 2013).
Socio-ecological system	A coupled system of humans and nature that constitutes a complex adaptive system with ecological and social components that interact dynamically through various feedbacks (Stockholm Resilience Centre)
Vulnerability	The propensity or predisposition to be adversely affected. Vulnerability encompasses a variety of concepts including sensitivity or susceptibility to harm and lack of capacity to cope and adapt (IPCC AR5) The characteristics and circumstances of a community, system or asset that make it susceptible to the damaging effects of a hazard (UNISDR)