Guidebook for Monitoring and Evaluating Ecosystem-based Adaptation Interventions

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Abbreviations

ADAPT	*Adaptive, Dynamic, Active, Participatory, Thorough*
ARCOS	*Albertine Rift Conservation Society*
BMU	*German Federal Ministry for the Environment, Nature Conservation and Nuclear Safety*
BMZ	*German Federal Ministry for Economic Cooperation and Development*
CARE	*Cooperative for Assistance and Relief Everywhere*
CBA	*Community-based Adaptation*
CBD	*Convention on Biological Diversity*
CCAFS	*Climate Change, Agriculture and Food Security*
CGIAR	*Consortium of International Agricultural Research Centers*
CI	*Conservation International*
CSC	*Community Score Card*
CSIR-SARI	*Council for Scientific and Industrial Research - Savanna Agricultural Research Institute, Ghana*
EbA	*Ecosystem-based Adaptation*
Eco-DRR	*Ecosystem-based Disaster Risk Reduction*
ES	*Ecosystem Service*
FAO	*Food and Agriculture Organization of the United Nations*
FEBA	*Friends of EbA*
FMNR	*Farmer-Managed Natural Regeneration*
GIZ	*Deutsche Gesellschaft für Internationale Zusammenarbeit*
ICARDA	*International Center for Agricultural Research in the Dry Areas*
ICRAF	*World Agroforestry*
IIED	*International Institute for Environment and Development*
IISD	*International Institute for Sustainable Development*
IKI	*International Climate Initiative*
INECC	*Instituto Nacional de Ecologia y Cambio Climático, Mexico*
INERA	*Institut de l'Environnement et de Recherché Agricole, Burkina Faso*
INRM	*Integrated Natural Resource Management*

Abbreviations

ISRA	*Institut Sénégalais de Recherche Agricole*
INRAN	*Institut National de Recherché Agricole du Niger*
IPCC	*Intergovernmental Panel on Climate Change*
ISPONRE	*Institute of Strategy and Policy on Natural Resources and Environment, Vietnam*
ITT	*Institute for Technology and Resource Management in the Tropics and Subtropics*
IUCN	*International Union for Conservation of Nature*
M&E	*Monitoring and Evaluation*
MEA	*Millennium Ecosystem Assessment*
MACC	*Monitoring Adaptation to Climate Change*
MONRE	*Ministry of Natural Resources and Environment, Vietnam*
NbS	*Nature-based Solutions*
ONWR	*Office of the National Water Resources*
PMERL	*Participatory Monitoring, Evaluation, Reflection and Learning for Community-based Adaptation*
RBC	*River Basin Committee*
RCT	*Randomized Control Trials*
SMART	*Specific, Measurable, Attainable, Relevant and Time-bound*
SMS	*Short Message Service*
TGCP	*Thai-German Climate Programme*
ToC	*Theory of Change*
TOCO	*Theory of Change Online*
UNDP	*United Nations Development Programme*
UNEP	*United Nations Environment Programme*
UNEP-WCMC	*UN Environment Programme World Conservation Monitoring Centre*
UNISDR/ UNDRR	*United Nations Office for Disaster Risk Reduction*
UAVs	*Unmanned Aerial Vehicles*
WRI	*World Resources Institute*
ZUG	*Zukunft – Umwelt – Gesellschaft gGmbH*

ABOUT this Guidebook

What does this Guidebook do?

The *Guidebook for Monitoring and Evaluating Ecosystem-based Adaptation Interventions* provides an overview of the process needed for designing and implementing effective monitoring and evaluation (M&E) for Ecosystem-based Adaptation (EbA). It breaks this process down into four key steps that will help you develop and operationalise an M&E system for EbA, as well as effectively use and communicate M&E results. The Guidebook is not a detailed manual for this M&E process – rather, it describes key considerations and components for each step and points to additional tools and methodologies that provide more specific instructions, when these exist.

This Guidebook will help you understand some of the intricacies and challenges associated with monitoring and evaluating EbA interventions. It aims to assist you in going beyond simply measuring the activities and outputs of an EbA intervention and moving towards evaluating the outcomes and impacts of those actions. This will enhance your understanding of whether EbA measures are having the desired effects and determine if any changes need to be made. With this information in hand, you will be able to effectively communicate with beneficiaries about progress, fulfil donor reporting requirements, contribute to the evidence base and best-practice knowledge on EbA, and feed into higher-level reporting and policy processes.

Who is it for?

This Guidebook is primarily aimed at practitioners and planners who design and implement EbA on the ground and who are interested in assessing and understanding the results of their interventions in relation to helping people adapt to climate change.

When should you use it?

Ideally, you should consult this Guidebook in the early stages of designing an EbA intervention, as it will help clarify the logic behind the measures, including their intended pathway of change. It will also allow you to put the M&E process in place prior to implementing activities so that you can collect baseline information and, from there onwards, track relevant parameters at appropriate intervals.

However, you can also use the Guidebook if you have already begun implementing an EbA intervention; in this case, it can assist you in making improvements to the original framework and M&E system of the intervention. If they are not yet in place, you can develop them following this Guidebook, integrate them into your existing project as is appropriate and/or use them to help you conduct mid-term reviews or evaluations at later stages.

How is it structured?

The Guidebook starts by providing information on important terms and concepts related to EbA and M&E, as well as on the complexities and challenges associated with monitoring and evaluating EbA and adaptation interventions more broadly. The remainder of the Guidebook describes the following four steps for developing an effective M&E system for EbA:

- Step 1: Developing a results framework
- Step 2: Defining indicators and setting a baseline
- Step 3: Operationalising the monitoring and evaluation system
- Step 4: Using and communicating the results

Throughout the different sections, the Guidebook refers to additional resources (e.g. tools, methodologies) that provide more detailed guidance, and uses examples from actual EbA interventions to illustrate how M&E has been applied on the ground.

BACKGROUND: key terms and concepts for understanding EbA and M&E

Defining and contextualising EbA

Box — 1 — *Why true and effective EbA needs to encompass all elements of the EbA definition:**

Leave out A (people), and you aren't helping anyone adapt. Leave out B (nature), and you aren't using the tools available for an ecosystem-based approach, so it's not EbA. Leave out C (adaptation strategy), and you are just repackaging your old work without considering climate change. EbA was never meant to be a stand-alone activity. It is only effective when combined with other measures that help people adapt to change.

**Adapted from Martin (2016).*

This section in brief

This section introduces the concept of EbA, both by highlighting the important aspects of its definition and by discussing the different ways in which changes to ecosystem management can address adaptation needs. It also explains the relation of EbA to other relevant approaches.

Ecosystem-based Adaptation (EbA) is an approach for reducing negative climate change impacts on people through working with and enhancing nature. EbA is officially defined by the Convention on Biological Diversity (CBD) as 'the use of biodiversity and ecosystem services [...] to help people to adapt to the adverse effects of climate change' which may include 'sustainable management, conservation and restoration of ecosystems, as part of an overall adaptation strategy that takes into account the multiple social, economic and cultural co-benefits for local communities' (CBD, 2009). This encompasses the following three core elements, which are essential to EbA (see Box 1):

A) To help people to adapt to climate change

B) by using biodiversity and ecosystem services

C) as part of an overall adaptation strategy.

EbA is therefore a people-centred approach that acknowledges the direct dependence of human well-being on ecosystems and the goods and services they provide (e.g. water and food supply, fuel and fibre provision, pest and disease regulation, water and nutrient cycling, climate regulation; MEA, 2005).

As the ability of ecosystems to supply these goods and services is being threatened by both climatic and non-climatic drivers of change, measures aimed at restoring and/or building on the different types of ecosystem services to help people adapt to climate change (Figure 1) can contribute to continued human well-being. The adaptation benefits of working with ecosystems (see example EbA measures in Box 2) can include:

- buffering communities from, or reducing the risk of, direct climate change impacts (e.g. flood or storm damage or heat stress);
- ensuring that ecosystem services on which communities depend (e.g. freshwater provision) persist and meet their needs despite climate change impacts;
- creating new livelihood options to replace those being threatened by climate change impacts (e.g. supplementing farmers' livelihoods with trade in non-timber forest products, or establishing payments for ecosystem services from downstream water users).

Box – 2 – ***Example EbA measures****

- *Maintenance and/or restoration/rehabilitation of mangroves and other coastal wetlands in order to reduce risks of flooding and erosion for coastal communities.*
- *Sustainable management of upland wetlands and floodplains in order to maintain favourable water flow regimes and water quality for downstream communities, despite changing rainfall patterns.*
- *Conservation and restoration of forests in order to stabilise mountain slopes and regulate water flows, protecting people and assets from flash flooding and landslides as rainfall levels and intensity increase.*
- *Establishment of diverse agroforestry systems, incorporating climate-resilient trees and ground crops for human and animal consumption, thus reducing crop damage caused by high temperatures or extreme rainfall events and providing flexible livelihoods and income options in order to manage increasing risks from climate change.*
- *Sustainable management of grasslands and rangelands in order to increase the adaptive capacity and resilience of pastoral communities against flood and drought.*
- *Establishment of marine protected areas in order to enhance the resilience of coastal ecosystems against climate impacts, increase fish productivity and provide opportunities for nature-based tourism, thus diversifying livelihoods and income to better manage risks.*
- *Use of indigenous plant species in order to strengthen and restore dune vegetation, thus preventing infiltration of sand into human settlements in desert environments subject to increasing levels of drought.*

**Adapted from IISD (2018).*

While EbA builds on the potential of ecosystems to provide adaptation (and other) services, it also acknowledges that ecosystem health alone cannot guarantee human well-being and resilience – especially in light of uncertainties around how ecosystems themselves will be affected and altered by climate change. Therefore, EbA should be implemented as an integrated element of a broader adaptation strategy to maximise the effectiveness of adaptation actions.

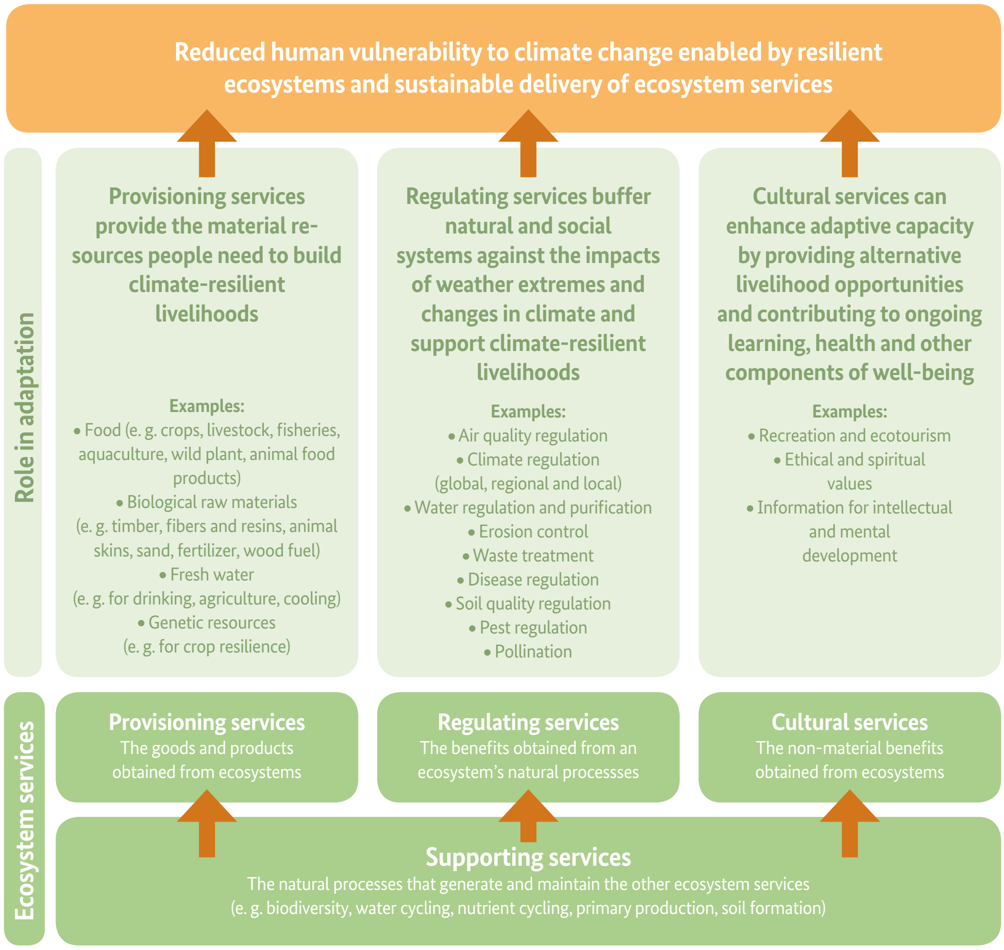

Figure — 1 — Ways in which ecosystem services can support adaptation (adapted from IISD, 2018)

This means that in each context, EbA should be considered as one option among engineered (e.g. sea walls, levees) and hybrid approaches (e.g. artificial reefs, green roofs), as well as social and institutional measures (e.g. capacity building, improving governance, influencing behaviour and/or markets).

The Friends of EbA (FEBA) Network[1] has developed a set of five criteria around the elements of the EbA definition to provide further clarity on the essential characteristics of what FEBA members consider 'good practice EbA' (FEBA, 2017; see Box 3). Accompanying that set of criteria is a quality assessment framework that proposes a tiered set of standards for each criterion according to which you can rate the quality of EbA initiatives. This framework, including its proposed example indicators, is particularly relevant to clearly defining the objectives of EbA interventions based on an understanding of what constitutes effective EbA. When developing an M&E system for EbA, this framework can help you identify outcome- and impact-oriented questions (see Steps 1 and 2 of this Guidebook).

[1] The FEBA Network is an informal network of over 50 organisations interested in promoting collaboration and knowledge-sharing on EbA (see https://www.iucn.org/theme/ecosystem-management/our-work/ecosystem-based-approaches-climate-change-adaptation/friends-eba-feba).

Situating EbA among related approaches

EbA has much in common with other approaches that combine aspects of biodiversity and ecosystem conservation, socio-economic development and broader climate change adaptation (Figure 2), such as community-based adaptation (CBA) or ecosystem-based disaster risk reduction (Eco-DRR[2]). Falling within the broader category of Nature-based Solutions (NbS), which includes all actions that work with and enhance nature to help address a variety of societal challenges (Cohen-Shachan et al., 2016), EbA both builds on and complements these other approaches.

However, although EbA combines traditional biodiversity and ecosystem conservation approaches with sustainable socio-economic development, it is not simply a continuation of "business-as-usual" in conservation or development practices. EbA is distinct from the former in its focus on helping people adapt to climate change and from the latter through its focus on reducing climate risks by drawing on nature (rather than by applying engineered measures). While in practice the different approaches may use similar techniques and achieve common goals, having clarity in definitions is important for several reasons. First, it will help you design and implement interventions (see Box 4) with clear objectives linked to climate change and the role of nature in helping people adapt. This will support you in considering appropriate timeframes and establishing an M&E system that can track change in relation to the chosen objectives over time.

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

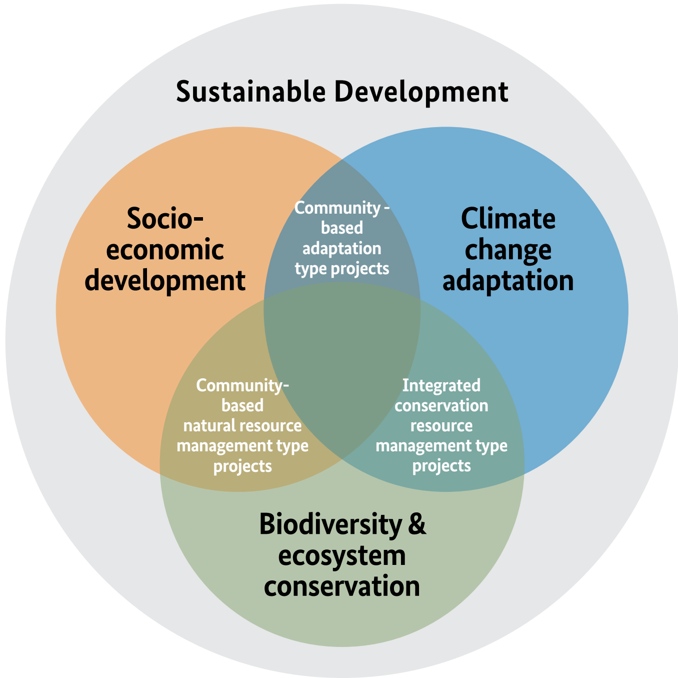

Figure — 2 — Interlinkages between EbA and other approaches contributing to sustainable development (adapted from Midgley et al. 2012)

Box — 3 — *EbA qualifying criteria in line with core elements of the CBD definition (FEBA, 2017)*

A) EbA helps people adapt to climate change:

- *Criterion 1. Reduces social and environmental vulnerabilities.*
- *Criterion 2. Generates societal benefits in the context of climate change adaptation.*

B) EbA makes active use of biodiversity and ecosystem services:

- *Criterion 3. Restores, maintains or improves ecosystem health.*

C) EbA is part of an overall adaptation strategy:

- *Criterion 4. Is supported by policies at multiple levels.*
- *Criterion 5. Supports equitable governance and enhances capacities.*

Box — 4 — What this Guidebook means by 'intervention'

In this Guidebook, the term 'intervention' is used to describe EbA actions implemented on the ground which are directed at achieving place-based adaptation outcomes (e.g. in a particular locality, watershed, or landscape). The major focus of such interventions will therefore be on managing, restoring and/or protecting ecosystems in order to help people adapt to identified climate risks.

An intervention can consist of multiple EbA measures (e.g. coral rehabilitation alongside mangrove restoration) and is likely to include a number of supporting/enabling activities such as capacity-building, livelihood diversification and efforts to improve governance or to mainstream EbA into relevant government plans and other sectoral policies. In the context of M&E, tracking aspects of these supporting/enabling activities can help provide a more comprehensive picture of the effectiveness of EbA measures.

Secondly, it enables clear communication with implementers of other approaches and with the beneficiaries of interventions about EbA and its role, facilitating coherence and collaboration among initiatives. Finally, it helps you identify how EbA can build on experiences from other approaches – the many convergences between EbA and approaches like CBA or integrated natural resource management (INRM) provide an opportunity for learning and sharing lessons, including best-practice principles and guidelines.

Additional useful resources

FEBA (2017): Making ecosystem-based adaptation effective. A framework for defining qualification criteria and quality standards

This resource is useful for understanding the essential characteristics and criteria that constitute EbA. It includes an assessment framework that proposes a tiered set of standards for each criterion according to which you can rate the quality of EbA initiatives.

UNEP (2019): Guide to ecosystem-based adaptation in projects and programmes

This series of seven briefing notes is a good "primer" on EbA, providing information on key concepts, issues and considerations to help design, plan and implement successful EbA initiatives. The notes highlight issues that need to be addressed and potential trade-offs and tensions that need to be resolved to enable EbA to form part of – and contribute to – the wider landscape of climate change adaptation in the context of sustainable development.

GIZ (2018): Solutions in focus: ecosystem-based adaptation from mountains to oceans

This publication illustrates a selection of applied EbA measures in a variety of regions and ecosystems 'from mountain to ocean' that can be found online at the 'PANORAMA – Solutions for a Healthy Planet' platform, offering a useful overview of what EbA can look like on the ground.

CBD (2018): Voluntary guidelines for the design and effective implementation of ecosystem-based approaches to climate change adaptation and disaster risk reduction and supplementary information

These guidelines are a good source for more in-depth information on EbA, how it relates to other approaches, such as Eco-DRR, and how to design and implement EbA. It also contains useful annexes on engaging in EbA with other sectors such as water, infrastructure or agriculture. This information can support co-ordination both on implementation and M&E with other relevant actors.

What is M&E and why is it important?

This section in brief

This section introduces key definitions related to monitoring and evaluation and explains why it is particularly important to monitor and evaluate EbA interventions.

M&E is an essential component of the successful management of any intervention. Monitoring is the process of systematically collecting and analysing data and information in order to detect signs of change in relation to a baseline. Evaluation is the process of examining the monitoring data collected in order to understand what difference an intervention has made and what lessons can be learned. Importantly, although evaluation is often seen as a way to measure the "success" of an intervention, its fundamental purpose is to analyse any type of change, be it positive or negative, intended or unintended.

There are many reasons why it is extremely important to monitor and evaluate EbA interventions (see also Box 5):

Understanding whether or not – and why – an intervention is achieving its objectives. M&E is vital for understanding whether, or to what extent, an EbA intervention is meeting or has met its objectives. Relevant information to collect can be related both to process (e.g.: is the implementation of activities and the delivery of outputs on track?) and, importantly, to results (e.g.: have activities reduced people's vulnerability to identified climate hazards?). In order to ensure that M&E can provide meaningful information about the results of an intervention (in this Guidebook and elsewhere often referred to as 'outcomes' and 'impacts'), those who design an M&E system must carefully consider which questions need to be answered and which indicators or data can realistically serve this purpose (see Steps 1 and 2 of this Guidebook). Furthermore, a well-designed M&E system should be able to provide information on how and why an intervention is achieving its objectives, as well as which of the detected changes have occurred due to the intervention itself as opposed to other, unrelated activities and developments in the area (i.e. it should allow attribution or at least contribution).

Informing adaptive management and addressing uncertainties. Although information on how well an intervention is performing is interesting in and of itself, one of the main reasons for gathering this information is that it may help you understand whether any adjustments to the

Box – 5 – *In a nutshell: what M&E can do for you*

'M&E helps practitioners gather and share information, enable adaptive management, track underlying assumptions, manage risks and uncertainties, meet transparency and reporting requirements, and, most of all, in the context of adaptation, learn which approaches and strategies best apply to which contexts and needs. M&E is a set of tools and methodologies with the potential to help demonstrate results and identify lessons learned and best practices for EbA approaches.' (Spearman and Dave, 2012)

*Box — 6 — **Maladaptation***

According to the Intergovernmental Panel on Climate Change (IPCC), maladaptation is 'an action that may lead to increased risk of adverse climate-related outcomes, increased vulnerability to climate change, or diminished welfare, now or in the future' (IPCC, 2014). Essentially, maladaptation is adaptation that results in unintended negative consequences.

Maladaptation may be caused by (Noble et al., 2014):

- *failure to anticipate future climates;*
- *forgoing longer-term benefits in favour of immediate adaptation actions;*
- *ignoring local relationships, traditions, traditional knowledge, or property rights;*
- *directly or indirectly favouring one group over others which may lead to conflict and possibly social breakdown.*

design and/or implementation of EbA measures are needed to improve their effectiveness. This adaptive management process (i.e. continuously reassessing the performance of an intervention when new information becomes available and changing management practices accordingly) is extremely important for EbA interventions given the many uncertainties associated with their design and implementation:

- scientific uncertainty about likely climate changes and impacts, including on ecosystems
- technical uncertainty about the effectiveness of measures to address identified vulnerabilities now and in the future
- socio-economic uncertainty about livelihood impacts and options, and whether capacities to adapt are sufficient
- political uncertainty about the implementation of necessary structural and institutional changes, both immediate and long-term
- social uncertainty about changes in values and needs over time.

M&E provides the foundation for adaptive management and thus for helping you to manage such uncertainties and risks. It also helps track whether assumptions you made about EbA measures at the start of an intervention were correct, and hence, importantly, detect and avoid risks of maladaptation (see Box 6).

Expanding the evidence base. In addition to supporting you in making well-informed decisions about the management of an EbA intervention, the information gathered through M&E at a site can be a valuable contribution to the wider evidence base on EbA. To date, the evidence on what works in EbA, where, when and why, is still scarce and dispersed – aside from a limited number of efforts to consolidate evidence (IIED, 2019), much of what we know about EbA effectiveness is anecdotal and not reliably replicable. By sharing M&E results and lessons learned with beneficiaries and relevant stakeholders in government, non-governmental organisations, the private sector and research institutions, you can contribute to building the scientific evidence base on "what works" in EbA across different contexts, thereby helping to improve future practice and maximise adaptation impacts. More solid evidence on EbA effectiveness will also help efforts to integrate and scale up EbA across different sectors, as well as inform the formulation of more robust, science-based adaptation policies and legislation.

Ensuring accountability and transparency. M&E is also an important tool for demonstrating that EbA interventions are carried out in an accountable and transparent manner – both to donors and to beneficiaries. In an era of increasingly limited funding, international donors, as well as national and local governments, want to ensure that resources are invested in the most effective adaptation options. Beneficiaries of an intervention will also want to know whether EbA measures are having the desired outcomes. In fact, M&E processes should have built-in mechanisms to ensure accountability and transparency, e.g. by including relevant stakeholders in M&E related decision-making and activities.

Facilitating participation and ownership. Not only is M&E important for demonstrating accountability to local beneficiaries and stakeholders, but it can also be an effective way to engage them in the EbA intervention and foster a sense of ownership. M&E can be designed to allow for local participation in data collection, interpretation and decisions about changes to management practices. Such participatory approaches also ensure that local perspectives and knowledge are reflected in M&E results. If M&E processes are well integrated into local institutions and stakeholder groups, participatory M&E can offer a way both to secure enough human resources to carry out M&E activities and to ensure their continuation over the long term, well beyond the funded duration of an intervention. Securing the long-term sustainability of M&E is crucial for EbA (and other adaptation) interventions, given the long time frames associated with managing and restoring ecosystems.

For M&E to perform the above functions most effectively, you should integrate and carry out M&E throughout the lifetime of an EbA project cycle and beyond (Figure 3). This involves considering M&E from the early stages of conceptualising an EbA intervention to help clarify the intervention's underlying logic and pathway of change (see Step 1 of this Guidebook). You should also plan M&E activities alongside other project activities in order to make it easier to develop appropriate indicators and collect baseline data (see Step 2 of this Guidebook). Moreover, it is important that you gather data for M&E at the same time as implementing project activities to ensure that you compile an accurate picture of the changes that are occurring. This will help you make informed decisions about the way forward and communicate effectively with relevant stakeholders (see Steps 3 and 4 in this Guidebook).

Figure — 3 — Placement of M&E activities in relation to EbA project activities and stages of a typical adaptive management cycle, linking to the corresponding steps outlined in this Guidebook (adapted from Open Standards for Conservation)

Additional useful resources

Dickson et al. (2017): PRISM – toolkit for evaluating the outcomes and impacts of small/medium-sized conservation projects

The PRISM toolkit is a very comprehensive and in-depth source on M&E and includes sections on key concepts; designing and implementing an evaluation; in-depth guidance on a number of specific modules (i.e. awareness and attitudes, capacity development, livelihoods and governance, policy, species and habitat management); as well as over 60 practical, easy-to-use methods and supplementary guidance factsheets for collecting, analysing and interpreting evaluation data. While PRISM was developed to support small/medium-sized conservation projects, it is also an extremely valuable resource for EbA interventions and much of the information is applicable, and can be adapted to, the context of EbA.

GIZ (2013): Adaptation made to measure. A guidebook to the design and results-based monitoring of climate change adaptation projects

This guidebook has been designed for adaptation more broadly and describes five steps to designing adaptation projects and their results-based monitoring systems. It is accompanied by an Excel-based Monitoring Adaptation to Climate Change (MACC) tool, which is based on a theory of change approach and allows for defining up to 15 intended results with up to three indicators each.

Pringle (2011): AdaptME: Adaptation monitoring and evaluation

This toolkit was designed for adaptation more broadly and aims to help you to think through some of the factors that can make an evaluation of adaptation activities inherently challenging, as well as equip you to design a robust evaluation. It contains many useful 'further information' sections that provide links to additional M&E tools and resources.

CARE (2014): Participatory monitoring, evaluation, reflection and learning for community-based adaptation: PMERL

PMERL provides participatory strategies to help different groups and organisations affected by, or involved in, a community-based adaptation project, community action plan or similar to assess their effectiveness in achieving their objectives. In addition to providing valuable conceptual background information on participatory approaches, it outlines the process of designing and implementing a participatory M&E system and includes a number of practical annexes and examples.

GIZ & Fundación Alma (2018): Asesoría técnica para el diseño, planificación e implementación del sistema de monitoreo y evaluación de las medidas de adaptación basadas en ecosistemas planeadas por el programa AbE en Cartagena y Córdoba

A manual for a participatory monitoring and evaluation of EbA measures in two Colombian cities, Cartagena and Córdoba, is available in Spanish with many annexes for further inspiration.

Understanding the challenges of monitoring and evaluating EbA

This section in brief

This section provides an overview of the challenges associated with monitoring and evaluating EbA, both taking note of challenges related to monitoring any adaptation intervention and highlighting issues related specifically to EbA.

As outlined in the previous section, it is of great importance to monitor and evaluate EbA interventions. Doing so effectively, however, can require overcoming a number of challenges.

Some of these challenges are common to all adaptation interventions (Table 1), be they engineered or nature-based; others are unique to EbA, largely due to the complexities of working with nature and people in an interconnected way (i.e. considering the complex dynamics of a social-ecological system). M&E for EbA therefore also needs to take into account the following:

Changes in ecosystems are inherently complex, long-term and influenced by multiple drivers. Measuring the results of changes in the way ecosystems are managed can be more difficult than measuring the progress of a technical or institutional adaptation intervention. This is because ecosystems are complex systems that are affected by both climatic and non-climatic drivers that interact with each other, often over long periods of time, and involve natural fluctuations. Understanding the impacts of climate change and other stressors on ecosystems is important for adaptive management, as the effectiveness of EbA measures depends on the ecosystem's ability to provide adaptation benefits in the long term under changing conditions.

Difficulties in developing clearly defined causal pathways linking EbA interventions to intended social and ecological outcomes and impacts. The logic underlying EbA interventions, including their intended pathway of change, is often poorly articulated and oversimplified. Many interventions map out the links between planned activities and their immediate outcomes but offer little explanation of how these will lead to the intended impacts. Impacts are also often vaguely defined, e.g. 'increased social-ecological resilience.' Due to the many uncertainties with which EbA planning is confronted, it may also seem difficult or speculative to describe an exact causal pathway into the distant future. It is important to develop such a description as a working model, however, in order to be able to design an M&E system that can provide information on the results of an intervention.

Difficulties in identifying a consistent set of indicators that can be used to analyse causal effects within the context of complex social-ecological interactions. Closely linked to the lack of well-developed causal pathways for EbA interventions is a lack of consistent indicator sets that can be used for tracking social and ecological parameters and their interactions in a way that meaningfully demonstrates causal effects. Understanding the links between changes in social and environmental conditions is important because EbA measures, as opposed to engineered adaptation approaches, rely on, and are embedded in, social-ecological systems. At the same time, many important characteristics of ecosystems (such as soil quality, water retention capacity or livestock carrying capacity) are difficult or costly to measure directly, and more easily monitored proxy parameters may need to be identified. Although – given the context-dependence of EbA – indicator sets need to be specifically tailored to each EbA intervention, a repository of tried and tested indicators from which project teams could choose would facilitate the design of M&E systems.

Long time horizons required to observe social and environmental adaptation benefits. The time horizons needed for EbA measures to deliver demonstrable adaptation benefits can be even longer than for other adaptation measures. This is because processes such as ecological restoration may take decades before they reach the desired outcome (e.g. natural forest regeneration to stabilise slopes and reduce impacts of landslides). Therefore, M&E for EbA must extend beyond the typical duration of a funded project cycle of an intervention in order to be able to fully gauge effectiveness. This is a widely shared concern and innovative approaches are needed to secure funding and sustain M&E over the long term (see Box 7).

Box — 7 — Strategies for sustaining M&E for EbA in the long term

As it can take a long time (up to several decades) for some of the adaptation benefits of EbA measures to be fully realised (e.g. slope stabilisation following natural forest regeneration), M&E activities need to continue beyond the typical duration of a funded project cycle to track longer-term outcomes and impacts. You can explore several options for ensuring the long-term sustainability of your M&E system for EbA, including:

- *using practically feasible, low-cost participatory M&E approaches and anchoring the responsibility for their continuation in local community groups and organisations (maximise interest and ownership in M&E by measuring parameters that are valuable to community well-being, goals and planning processes);*
- *partnering with national research institutions or universities (see Box 14), protected area officials, other organisations or projects that have long-standing research programmes;*
- *identifying overlap with government-run M&E at district, sub-national or national levels and integrating intervention-level M&E processes with them;*
- *applying for continued/second phase funding (this can be at a reduced rate to support M&E).*

Tracking multiple objectives and co-benefits. As opposed to most other adaptation interventions, EbA measures often aim simultaneously to address several climate hazards (e.g. restoring mangroves to reduce coastal erosion, saline intrusion and storm impacts) and to achieve a number of co-benefits (e.g. improving health, income, food security). This requires a more holistic M&E framework that can measure a broad range of parameters, as well as multi-disciplinary expertise for collecting and interpreting different types of data.

In light of the many uncertainties related to climate change impacts and the planning of EbA measures, **M&E must be seen as an essential, rather than an optional component of responsibly implementing an intervention.** Therefore, although the challenges associated with monitoring and evaluating EbA and other adaptation efforts may seem daunting, it is critical to find ways to address them. Indeed, being aware of the challenges is the first step towards finding solutions. With a clear understanding of the potential limitations, you can design an M&E system that accounts for them, and you can build in mechanisms to keep track of identified difficulties and address them should they arise. Given the importance of M&E, it is better to set up an M&E system that has some limitations and/or shortcomings, and to acknowledge and address these over time, rather than not engaging in any M&E activities at all. This Guidebook aims to equip you with knowledge and approaches that can assist you in doing so.

Table — 1 — M&E challenges common to all forms of adaptation (e.g. engineered, hybrid, nature-based)

M&E challenge	***Description***
Context-dependence of goals and absence of universal indicators for measuring performance	*Although climate change is global, adaptation takes place locally. Therefore, adaptation measures need to be tailored to the context of a particular area, taking into account the local social, ecological, political and economic situation. This context-dependence leads to a great diversity in adaptation measures, which in turn means that different indicators of performance will be meaningful in each context. Thus, it is difficult or impossible to develop and adopt a universal set of adaptation indicators.*
Tracking success against 'shifting baselines' and 'moving targets'	*Although global climate change trends have been well established, local level projections of climatic changes and their timing are far less certain. Adaptation interventions are therefore typically implemented in a context of uncertainty, which is compounded by the impacts of other factors such as socio-economic change. Having to measure progress when the underlying conditions that determine adaptation needs are themselves changing – often referred to as working with 'shifting baselines' – can compromise the usefulness of comparisons to a pre-intervention state. Similarly, targets that are set to guide activities at the beginning of an intervention might no longer be relevant at the end because the understanding of current and likely future climate-related hazards can change over time, entailing a need for adjusting the results framework.*
Long and variable time horizons associated with climate change	*Climate change is an ongoing, long-term process that will unfold over decades – far beyond the typical timeframe of traditional project-style interventions. Objectives of adaptation interventions are often defined for a time horizon of 30 to 50 years. This means that there will be time lags between activities and their immediate measurable results, and many of the intended outcomes. Most importantly, the impacts of an adaptation intervention can only be measured directly once climatic changes (such as a change in the severity of extreme events) have actually occurred, i.e. in most cases after the duration of the intervention itself.*
Complexity of influencing factors and attribution	*It can be difficult to untangle the various interconnected factors that influence the ecological and socio-economic changes that occur over the course of an adaptation intervention. A diversity of climatic and non-climatic environmental factors and anthropogenic influences can act in combination with each other to cause observed trends in a region. Determining causal links can therefore require measuring a broad range of parameters. This complexity not only makes it more difficult to measure all relevant changes, but also to attribute results to an intervention.*
Difficulty in defining a standard of comparison (the 'business-as-usual' scenario) and measuring avoided impacts	*To fully understand the effectiveness of an adaptation intervention, ideally, a counterfactual would need to be established to compare the observed situation in the project area against what would have happened in the absence of adaptation measures (thus establishing what potential impacts of climate change the intervention has helped to avoid). However, it is difficult to use real-life 'comparison sites' to create counterfactuals, as their overall ecological and socio-economic situation would need to be comparable to that of the intervention site over the full period during which monitoring takes place, and without changes occurring that are caused by external factors that only affect one of the sites.*

Table continues on the next page -->

Table — 1 — (continued) — M&E challenges common to all forms of adaptation (e.g. engineered, hybrid, nature-based)

M&E challenge	***Description***
Adaptation strategies typically span multiple scales and sectors	*Well-planned adaptation policies and strategies often reach out across diverse locations, sectors and population groups, and are linked to a range of other programmes and strategies. Although the results of adaptation actions will be observed at the local level, progress in adaptation is also examined at much higher levels and across portfolios. Comparing and aggregating results from different adaptation interventions can be challenging, however, due to the diversity of targeted sectors, differential availability of data, and the context-dependence of objectives and measures. The many ways in which 'vulnerability' or 'adaptive capacity' are interpreted and addressed by different actors are also not conducive to the development of a more unified M&E framework.*
No universal agreement on what constitutes 'successful' adaptation	*Adaptation is a process of continual adjustment that aims to enable socio-economic and/or environmental goals to be achieved despite a changing climate context. This process inevitably involves trade-offs, including between geographic areas (e.g. adaptation actions may increase water availability in one area at the expense of another); between different sectors and values (e.g. there may be a need to balance benefits for food security against goals on water quality or biodiversity); and between different timescales (e.g. actions that incur a societal cost in the short- to medium-term may lead to long-term benefits and vice versa). Perspectives on the vision towards which adaptation interventions should work (and the time horizons that should be considered) are thus bound to vary between different actors. There is no clear measure or benchmark to signal that an adaptation intervention is 'successful' – there is even debate about whether successful adaptation is an outcome, a process, or both (Villanueva, 2012). Not only does this mean that the task of adaptation will never be fully achieved, but also that agreement on adaptation goals should be the result of an inclusive discussion process that may need to be revisited from time to time.*

Additional useful resource

Bours et al. (2014a): Guidance note 1: twelve reasons why climate change adaptation M&E is challenging

This resource provides further details on why M&E can be particularly challenging in the context of climate change adaptation projects.

FOUR STEPS

for designing and rolling out an M&E process for EbA

There is no one-size-fits-all approach for monitoring and evaluating EbA – each context will have its own particularities and requirements and the approach will need to be adjusted accordingly.

This section describes four broad steps that any project team of an EbA intervention can follow. These steps form the foundation for designing and implementing a robust M&E system:

- Step 1: Developing a results framework
- Step 2: Defining indicators and setting a baseline
- Step 3: Operationalising the monitoring and evaluation system
- Step 4: Using and communicating the results

This section also illustrates important points through examples of M&E application in on-the-ground EbA interventions and provides additional useful resources, including tools and methods that provide more detailed guidance for some of the tasks involved in each step.

STEP 1

Developing a results framework

This section in brief

This section discusses the need to set clear objectives and to map out the pathway for achieving them. It describes how results frameworks can assist you in doing so, briefly outlining the different types of results frameworks available, including the theory of change (ToC) approach, which this Guidebook recommends for EbA interventions. The section then expands on ToCs, including when and, broadly, how to use them, potential limitations, and what they can look like.

Setting objectives: what is the intervention trying to achieve?

As a first step to developing an M&E system for an EbA intervention, you need to establish clear objectives. Without knowing what the intervention aims to achieve, i.e. how it will help people adapt to climate change, you cannot measure progress. For EbA, objectives will generally relate to improving the state of an ecosystem (and its services) based on scientific evidence and local knowledge, reducing people's exposure and/or sensitivity to climate change hazards, and/or increasing their adaptive capacity. Considering different aspects of EbA effectiveness can further help you frame and formulate objectives for your intervention (see Box 8).

Importantly, objectives need to be realistic and well-defined, and the intended impact needs to be clearly articulated. They must respond to identified vulnerabilities and climate hazards while also taking into account other factors that can affect the intervention and its results. Objectives need to be defined in light of uncertainties about climate projections and about the impacts climate change may have on the ecosystems and services the intervention aims to protect, restore and/or manage. Ideally, you will have carried out a social-ecological vulnerability and impact assessment to which you can link the objectives of your intervention, thus ensuring they are based on a solid understanding of the issues that need to be addressed. Doing so will also ensure that the objectives are appropriate to the local context and that they reflect the needs of beneficiaries. Ideally, you should involve relevant local stakeholders and representatives in developing the objectives of the EbA intervention in order to capture their needs and aspirations, as well as strengthen their sense of ownership from the start.

Using a results framework to clarify the intervention's pathway for achieving change

To help you understand the steps needed for reaching the objectives of your EbA intervention, you should use a results framework: by mapping out an anticipated "causal pathway of

*Box — 8 — **What constitutes effective EbA?***

EbA effectiveness can be seen as having four pillars: human, ecosystemic, economic and institutional. A question-based guide for assessing EbA effectiveness has been devised, providing overarching questions for each pillar as well as nine more specific questions that can be used to assess the effectiveness of EbA interventions (Reid et al., 2017). These questions are also useful for guiding the design of EbA activities and M&E. The four overarching questions are:

1. Effectiveness for human societies

Does (or did) the initiative allow communities to maintain or improve their adaptive capacity or resilience and does (or did) it reduce their vulnerability in the face of climate change, while enhancing co-benefits that promote long-term well-being?

2. Effectiveness for the ecosystem

Does (or did) the initiative restore, maintain or enhance the capacity of ecosystems to produce adaptation services for local communities and allow ecosystems to withstand climate change impacts and other pressures?

3. Financial and economic effectiveness

Is the measure cost-effective and economically viable over the long term?

4. Policy and institutional issues

What social, institutional and political issues influence the implementation of the measure/activity and how might challenges best be overcome?

change" towards long-term outcomes and impacts, and determining how the intervention will contribute to, or enable, this pathway, you can clarify the underlying logic through which the intervention is to achieve its objectives. Such a results framework then forms the basis for designing and planning your EbA measures and M&E system.

There are several types of results frameworks. Common approaches include results chains or logical models (e.g. log frames) which describe how the intervention's actions are expected to lead to subsequent results. They tend to focus on outputs and outcomes that are anticipated within the framework of a specific project or programme and should be accompanied by measurable indicators. Results chains usually take the form of a flow diagram while log frames are also frequently presented in tabular form.

A Theory of Change (ToC) is another type of results framework. It also allows you to articulate how you think an intervention will bring about change, but it considers the larger context within which your intervention will operate, providing you with the "big picture", including issues that you cannot control. This systemic approach can reveal different factors (as well as different pathways, depending on the scope of the ToC) that can contribute to, or impede, the intended change, even if they are not related to your intervention. A ToC also identifies the long-term change (i.e. the impacts) you want the intervention to achieve – beyond the funded project cycle – and shows how the activities will contribute to getting there. Using the ToC approach, you ask how and why change will happen, which helps you to clarify why the measures that you are planning should be implemented. It helps articulate the individual, logical steps between project elements, clearly showing cause and effect between activities, outcomes and impacts (see Box 9).

A ToC also outlines risks and assumptions (see Box 10) relevant to achieving identified outcomes and impacts. It is usually presented as a flow diagram, accompanied by a narrative description and a set of indicators.

Box — 9 — Important terms in relation to ToC and M&E*

***activities:** What the intervention does to bring about change (e.g. conducting training workshops, surveys, education or outreach campaigns, cultivating new crops, planting trees).*

***outputs:** What is produced by the intervention's activities. Outputs are usually measured in terms of quantity and quality of delivery (e.g. the number of individuals trained, the number of seedlings planted and their survival rate, the number and types of reports produced from survey data).*

***outcomes:** The changes (biophysical and/or behavioural) brought about by the intervention's activities. Due to the long timeframes involved in EbA, it is helpful to distinguish between: immediate outcomes, which are shorter-term and show progress towards subsequent outcomes (e.g. increase in the number of individuals who undertake restoration activities and sustainable land-management practices) to longer-term outcomes, which represent the final change(s) that need to happen in order to achieve the adaptation impact (e.g. ecosystems maintain structure, function and extent over time and are able to resist or recover from perturbations caused by climate change – i.e. are resilient – and provide goods and services to people).*

***impacts:** The long-term, lasting changes brought about by the intervention's activities (e.g. community resilience being improved as demonstrated by their ability to use resources and ecosystem services in order to respond to, withstand and recover from climate shocks and longer-term climatic shifts).*

Different authors and organisations may use different terminology to describe the same ideas. For example, 'activities' may be referred to as 'actions', 'outcomes' might be called 'results' or 'intermediate results', and 'impacts' may be labelled as 'goals', 'aims' or 'ultimate outcomes'. It is not worth spending too much time focusing on the differences between the terms used in this Guidebook as opposed to other frameworks – what is important is that you understand what the terms described above represent, and that you are able to relate them to your own intervention.

**Adapted from Dickson et al. (2017).*

To generate a solid foundation for a ToC, including information on the wider context, you should develop the ToC in a structured and participatory way with your project team and relevant stakeholders. Doing so will not only help ensure that the ToC is as complete as possible, (group discussions are invaluable to contributing different insight, testing ideas and considering a wide spectrum of risks and assumptions) but it will also help you conceptualise and articulate the changes needed to meet the intervention's long-term goals.

Using a ToC will enable you to base your actions on a systematic, long-term logic, ensure that your monitoring efforts are rigorous and to scale, and help you map out long-term projected outcomes and impacts even when they cannot be attributed solely or unequivocally to the intervention.

Box — 10 — What are 'assumptions' in a ToC?*

Assumptions explain the conditions that need to be met so that the connections between different components of the pathway of change work out as planned. They represent a set of expectations about mechanisms and circumstances that guide decisions – and ideally should be supported by scientific research, best practice experiences or expert knowledge.

They describe both the relationship between activities and the long-term changes that occur in the different stages of the change process, and the expectations about how and why proposed activities will bring them about. Listing the assumptions substantiates the claim that all of the important preconditions for success have been identified.

Assumptions are used to justify the choice of planned activities intended to bring about the outcomes shown in the path, and to highlight external factors (e.g. socio-economic or political developments) that affect the landscape in a negative or positive way, thus hindering or promoting the achievement of the long-term goal(s). Assumptions should tell the story about how and why planners expect change to occur as depicted in a ToC.

**Adapted from CI (2013).*

Why you should use a Theory of Change approach for monitoring and evaluating EbA

A consensus is emerging among M&E experts that the ToC approach is one of the most robust results frameworks to be used in the context of adaptation because it is particularly well-suited for the design, monitoring and evaluation of complex, multifaceted and long-term interventions (Bours 2014b, 2014c; McKinnon and Hole, 2015). The ToC approach is inherently iterative and flexible and encourages you to periodically reflect on – and respond to – changes in the social, political and natural environment. This is crucial for M&E of adaptation programmes, which need to account for dynamic and emerging conditions.

This Guidebook also recommends using a ToC approach because it can:

- help you illustrate the relationship between different intermediate goals of your intervention and the overall project success; (*This is key to EbA interventions, as they typically encompass both social and ecological goals that interact – and in some instances conflict – with each other.)*
- guide your project team, ideally in partnership with relevant local stakeholders, in mapping out and discussing the mechanisms that underpin each step in the causal pathway; (*This is particularly important in EbA interventions, where causality is often inferred rather than confirmed by evidence.)*
- allow you to clearly identify assumptions and levels of uncertainty related to project management decisions; (*This is important given the evidence gaps that make EbA planning difficult.)*
- enable you to identify both short-term indicators (focused on key outputs or immediate outcomes) for reporting on progress during the project's lifespan, and longer-term indicators; (*This is key to tracking the core ecological and social outcomes and impacts linked to the intervention's goal.)*
- highlight differences in the ways in which costs and benefits are distributed over time; (*This is key to managing expectations, given the long periods of time it can take for EbA measures to yield the intended results.)*
- build consensus around a common vision of what the intervention expects to achieve. (*This is critical in the multi-sectoral, multi-disciplinary projects involving diverse stakeholder groups that are typical for EbA.)*

When to use a Theory of Change approach

Ideally, you should develop a ToC together with your project team and key local stakeholders in the early stages of designing an EbA intervention to ensure that a clear logic underlies the measures. If you were not able to develop a ToC when planning the intervention, you can still do so at a later stage. The ToC will then provide a useful framework for an interim review, adaptive management, re-design or evaluation of progress and impact.

A ToC can serve multiple purposes at different stages of the project management cycle, including:

- for strategic planning (to guide the setting of goals and selection of EbA measures);
- for validation of existing project plans (to check alignment of stated goals with proposed activities);
- as a communication tool (to explain intervention priorities and management decisions);
- for evaluation (to assess progress of EbA measures towards their long-term goals).

How to use a Theory of Change approach

While there is no standardised method for developing a ToC, there are some general elements that you should integrate into your ToC process:

1. **Identify the intended impact, ensuring it is clearly defined.** Begin with defining a clear, specific statement that describes the ultimate, long-term goal of the intervention, i.e. its impact. This impact statement can be far-reaching and ambitious, but it must be specific and should contain sufficient details to be tangible, meaningful and measurable. Importantly, the impact statement should be clear about the climate hazards to which the intervention aims to respond. Vague statements such as 'community resilience to climate change' will make measurement difficult. A better alternative might be: 'vibrant, healthy rural communities with sustainable and diversified livelihood practices and a species-rich environment that are resilient to flooding, soil erosion and landslides.'

2. **Develop a pathway of change by systematically working backwards from the impact, laying out all the necessary steps along the causal pathway and grounding them as concretely as possible in an evidence base.** Starting with the impact, design the pathway of change via 'backward mapping' or 'back casting.' This means systematically working backwards, step-by-step, from the impact to the longer-term, then immediate outcomes, until you reach the activities that need to be implemented in the present.

   One of the advantages of working backwards in time is that it will prevent you from getting stuck in your plan based on limitations in the present (e.g. not being able to imagine certain solutions in the future because of current capacity gaps). So, for each step, you ask:

'what needs to be in place before this can happen? What are the preconditions for successful outcomes at this step?'

Be sure to dedicate enough time to making the longer-term outcomes and their causal links to earlier steps as strong as possible. There can be a tendency to focus on the "big ideas", or visions, and the first steps (i.e. activities), while leaving the intermediate ones too vague – but these are just as crucial and will give you an indication of the effectiveness of EbA measures before the longer-term impacts become measurable. Throughout the 'backward mapping' process, ground the entire causal pathway as firmly as possible in an evidence base to ensure the sequence is as realistic and achievable as it can be. Relying on personal belief or anecdotal evidence can significantly reduce the likelihood that your intervention will be able to achieve its objectives.

3. **Identify clear indicators and spell out assumptions.** To be able to measure change and determine whether specified outcomes have been achieved, you need to select appropriate indicators (see Step 2). In an ideal world, you would select indicators for each step of the ToC's causal pathway. With limited resources, however, you may need to decide which steps are most important, provide the deepest insight and are realistic to measure.

   Given the many uncertainties involved in implementing EbA measures, the causal pathway of your intervention will inevitably be based on certain assumptions. It is important that you clearly identify and articulate them in your ToC so that you can observe whether they hold true or need to be adjusted while monitoring your intervention.

4. **Define and plan activities.** Once you have worked your way to the present in the intervention's ToC, you can start detailing and planning the specific activities of your intervention.

5. **Present the ToC as a flow diagram, accompanied by a narrative.** Although the process of developing a ToC is likely to involve many sticky notes, sheets of paper and discussions, it is important to document the results of this process in an easy-to-read and accessible format.

   ToCs are typically presented as a flow diagram, which can contain one or more results chains, depending on the size and complexity of the intervention and the level of detail you have chosen to include (see Figure 4 for an example ToC for EbA in drylands). It is advisable to create one results chain for each line of activity (e.g. one for wetland restoration and one for alternative livelihood support), showing interlinkages via connecting arrows. Doing so will also allow you to present individual causal pathways to different audiences, if needed.

   The diagram will act as the visual representation of the intervention's logic using limited text. To capture the full details and reasoning of the ToC, write up an accompanying narrative that describes the content of each of the steps, any relationships between them, their connection throughout the pathway, as well as any/all assumptions and indicators.

6. **Regularly review and modify the ToC to reflect emerging conditions and new knowledge.** The ToC approach is an iterative one. Periodically review your ToC and update it with new

information and insights, as well as any changes to planned activities, so that it accurately reflects the intervention's progress and can continue to reliably guide your M&E system. Before making changes to the ToC, be sure to consider some of the potential implications this may have and how to address them. For example, would the changes require new indicators for which no baseline information has been collected? Would they result in exceeding the budget that has been allocated to monitoring? Would you need to revisit monitoring arrangements discussed with stakeholders?

Potential limitations of a Theory of Change approach

Although the ToC approach is a well-suited basis for the M&E of EbA and has many advantages compared to other results frameworks, it also has some potential shortcomings.

For one, producing a well-developed ToC through a participatory process can be time-consuming: you will need to collectively draw up the ToC, to compile the flow diagram and narrative and to refine it based on further research and scientific evidence. If the participatory process is not well facilitated and managed, there is also a risk that the ToC may become either too comprehensive and therefore confusing (e.g. resulting in a "messy" diagram that is difficult to interpret), or too simple, presenting a reductionist view of complex problems. Although one of the key benefits of a ToC is the ability to embed an intervention within a "big picture" analysis, if this is taken too far, the ToC can become too abstract and vague.

Another potential limitation is linked to the two-dimensional format in which ToCs are presented: they tend to show a linear trajectory, although the process of moving through the steps of a causal pathway will likely occur with a series of feedbacks and interactions between different activities and outcomes.

Lastly, the usefulness of a ToC will depend on how a project team makes use of it. If the ToC is only done as a one-off exercise to fulfil a donor requirement, it will not become the powerful tool it is intended to be.

Being aware of these potential limitations is half the battle won in terms of avoiding them. Careful management and good facilitation of the ToC development process are also absolutely key and will prevent it from becoming a laborious (and potentially confusing) bureaucratic requirement rather than a vehicle for transformation.

If you have never developed a ToC, consider further reading (see additional resources below), seek out colleagues with experience for recommendations, and try out the process on a simple topic with some members of your project team before developing a full ToC for your intervention with a group of stakeholders.

*Figure — 4 — Example of how to illustrate a Theory of Change, highlighting interconnections between short- and longer-term outcomes**

The ToC flow diagram is presented here in an overview format to provide an example of what a completed ToC for an EbA intervention consisting of multiple measures can look like (the details of the diagram are not meant to be legible aside from inset on outcomes). This ToC was developed for a hypothetical EbA intervention in drylands consisting of four measures that can be applied in tandem to increase community resilience to climate change impacts arising from increasing temperatures and altered precipitation regimes, such as soil erosion and drought (see full list of measures in ToC diagram below).

The causal pathway for each of these approaches is elaborated in this ToC through four results chains that illustrate the step-by-step logic of how certain activities (dark blue boxes, e.g. identify key ecological attributes and complete baseline assessment) are intended to lead to specific outputs (light blue boxes, e.g. areas and ecosystem types for restoration identified and selected) and contribute to a number of short-, medium- and long-term outcomes (orange and pink boxes; see inset) and impacts (green boxes; reduced vulnerability of dryland communities to adverse impacts of climate change). Indicators can be developed for any of the elements of the results chain.

The four measures are very interconnected (for sake of clarity, only the most crucial interconnections are depicted in this ToC through arrows that link results chains): many of the activities contribute to outcomes across multiple results chains and the interdependencies of outcomes increase as they become longer-term. The area highlighted in this figure (see inset) illustrates such a 'convergence zone' where the short-term outcomes from the four approaches produce medium-term outcomes that are progressively interconnected in leading to long-term outcomes, which will ultimately lead to the intended impacts. The major assumptions underlying the causal relationships are shown in purple boxes.

A detailed narrative for the first results chain (restoration or rehabilitation of drylands) and an expanded view of the results chain segment showing its activities and outputs can be fond in Annexes 1 and 2.

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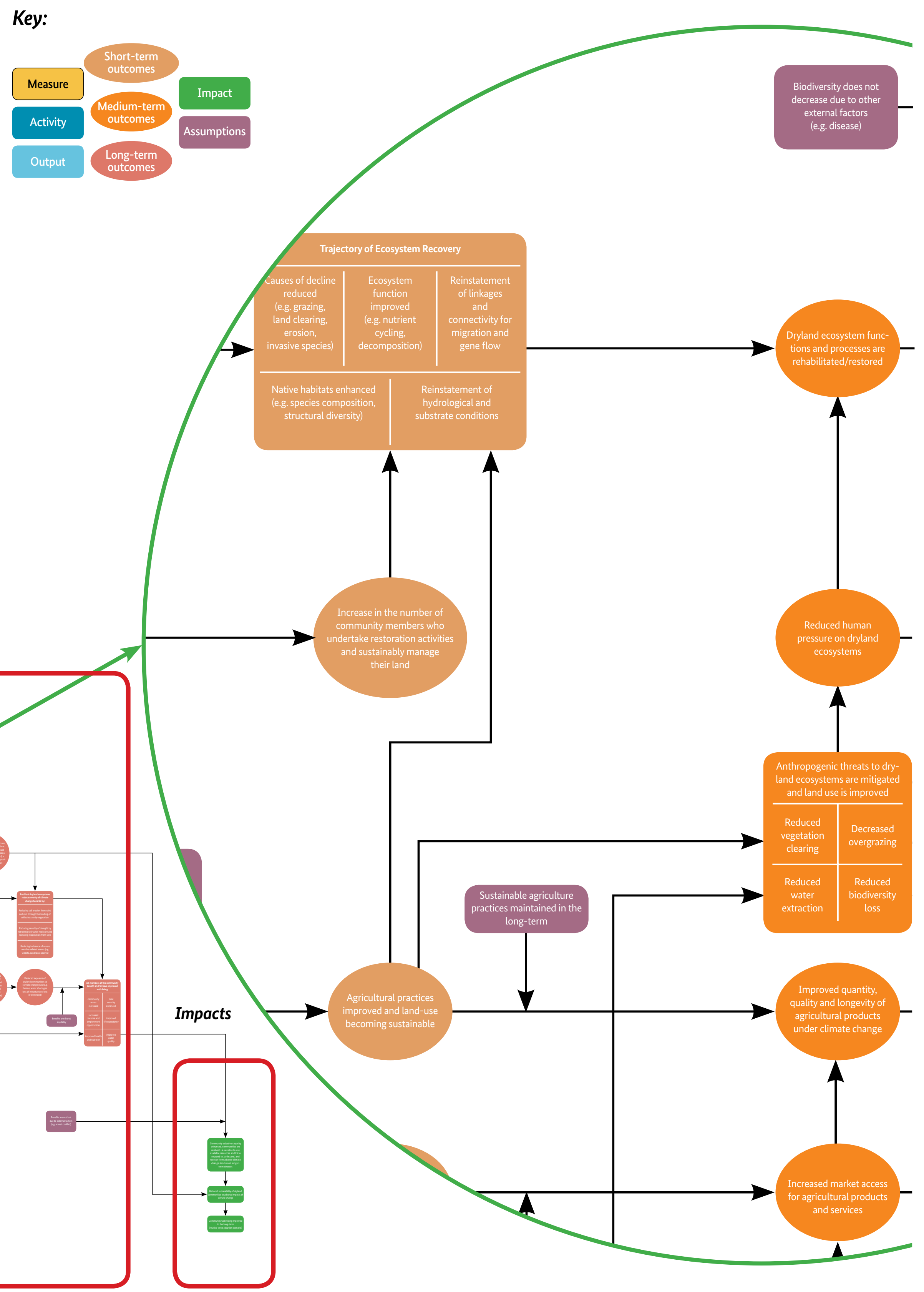
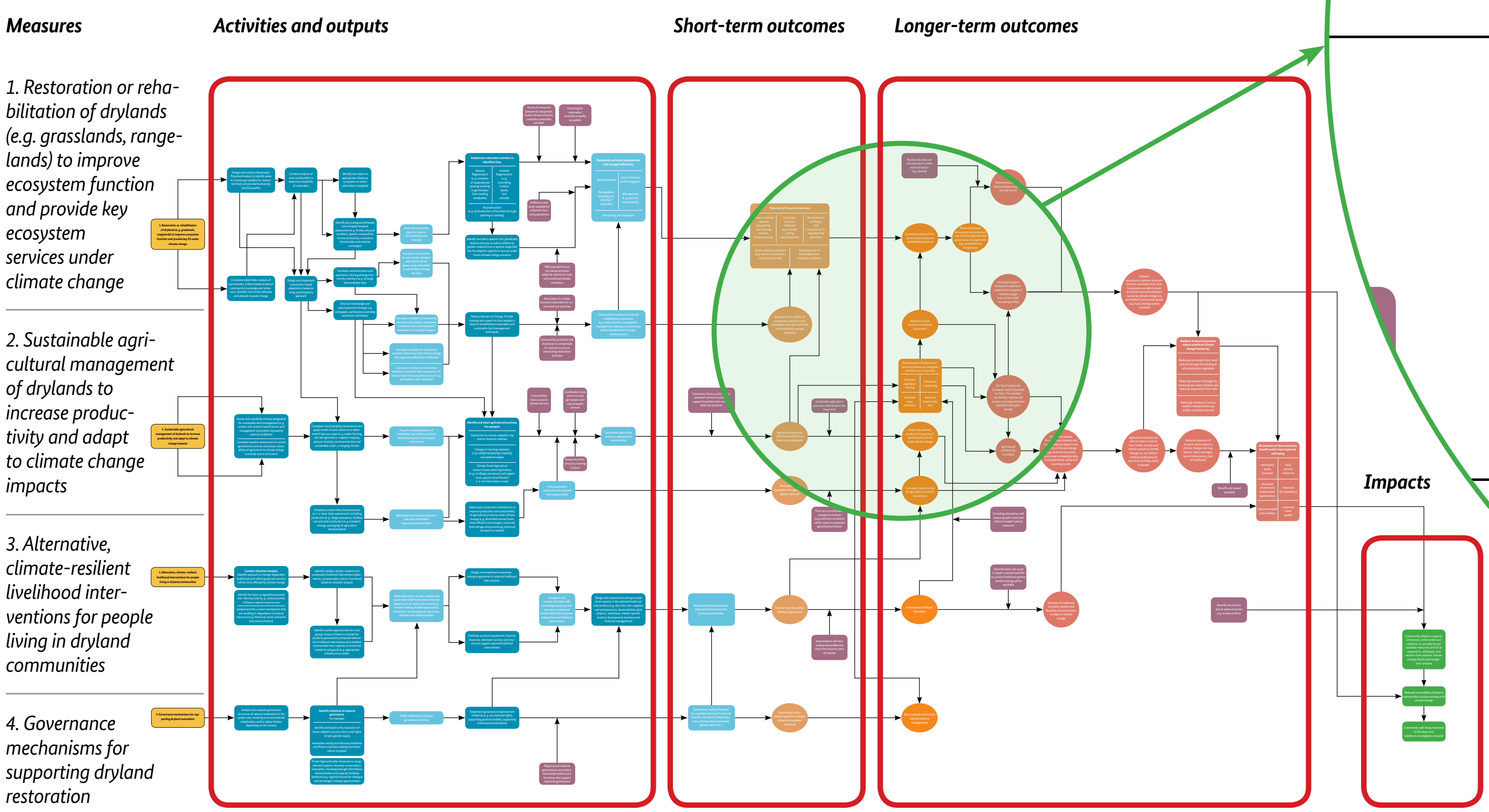




Additional useful resources

There are many guidance documents related to the Theory of Change approach that can assist you in developing and applying a ToC, for example:

CI (2013): Constructing theories of change models for ecosystem-based adaptation projects: a guidance document

Bours et al. (2014c): Guidance note 3: theory of change approach to climate change adaptation programming

Anderson (2005): The community builder's approach to theory of change. A practical guide to theory development

Margoluis et al. (2013): Results chains: a tool for conservation action design, management, and evaluation

Dickson et al. (2017): PRISM – toolkit for evaluating the outcomes and impacts of small/medium-sized conservation projects
Step 2.1, General Method Factsheet 'Completing a Theory of Change', and Evaluation Design Factsheet 'Theory-based design'

Online tools that can help you design and present a ToC are availabe at:

The Center for Theory of Change website (www.theoryofchange.org)
It gives you access to the "Theory of Change Online" (TOCO) free open-access software (www.theoryofchange.org/toco-software/).

The Lucidchart website (www.lucidchart.com)
This is an online tool for easily creating flow diagrams and charts (both free and paid versions).

The Miradi website (www.miradi.org)
With this adaptive management software you can, among other things, create flow diagrams (fee-paying).

While not the focus of this Guidebook, climate vulnerability and risk assessments are a critical first step to any EbA intervention: you need to understand the climatic (and other) risks to the social-ecological system in which you are working before you can develop a ToC or subsequent EbA measures that respond to those risks. Some useful resources for doing so include:

GIZ, EURAC and UNU-EHS (2018): Climate risk assessment for ecosystem-based adaptation: a guidebook for planners and practitioners

Munroe et al. (2015): Guidance on integrating ecosystem considerations into climate change vulnerability and impact assessments to inform ecosystem-based adaptation

Wicander et al. (2016b): Resilience and adaptation planning for communities in protected areas. A step-by-step guide

STEP 2

Defining indicators, baselines and targets

This section in brief

This section introduces the types of indicators available for M&E, highlighting the importance of focusing on outcome and impact indicators in order to understand whether EbA measures are effectively achieving their goals. It provides general guidance for selecting the best indicators for your intervention and highlights the importance of setting a baseline and identifying targets.

What are indicators and why do you need them?

Indicators are units of information (about particular objects, conditions, characteristics or behaviour) that can represent (or act as markers for) the broader environmental, socio-economic or climatic situation. They can be quantitative or qualitative.

Indicators underpin an M&E system's practical applicability: as it is not feasible to document every relevant process, parameter or change that takes place across an entire social-ecological system, you need to instead identify and monitor indicators that represent key aspects of that system. When measured over time, indicators document change, allowing you to draw more general conclusions about trends and to understand whether an intervention is meeting its objectives. If developed and used appropriately (see Box 11), indicators will allow you to know whether outcomes or impacts are on track to being achieved or not. This information should shape your adaptive management process, i.e. help you determine which adjustments need to be made to the EbA measures you are implementing.

As discussed in Step 1, indicators are an important component of results frameworks, especially a Theory of Change (ToC). By tracking indicators that are linked to your ToC, you will be able to tell which steps or results chains (if there are several in your ToC) are meeting their targets, and which ones are falling short or failing altogether. Ultimately, indicators are the

Box — 11 — Some precautions about indicators:

Keep in mind that indicators are only signals of change – they cannot capture all dimensions of a given activity.

Unrealistic expectations of what indicators can do, or oversimplifying causal relations, can result in false conclusions, a failure to learn lessons, and possibly failure of the intervention or even maladaptation.

tool that will provide evidence for an evaluation of what has worked successfully and what has not. The lessons learned from this evaluation can guide future EbA interventions and relevant policies.

Types of indicators and the importance of focusing on outcomes and impacts

Broadly speaking, there are two types of indicators: process-based and results-based. Process-based indicators provide information on the design and implementation of an intervention by focusing on input and output:

- input indicators: *measure the quantity, quality and timeliness of resources invested;*

- output indicators: *describe and quantify what is produced directly by the implementation of an activity, i.e. the short-term results.*

Results indicators measure the effectiveness of an intervention by focusing on outcome and impact:

- outcome indicators: *provide information on the medium- and long-term results of activities (i.e. immediate- and longer-term outcomes);*

- impact indicators: *measure the wider, long-term changes to which an intervention has contributed (directly or indirectly, intentionally or unintentionally).*

Although you will most likely need to monitor some process-based indicators to ensure the implementation of your intervention is on track, it is absolutely critical that you identify a robust set of results indicators. **Without tracking indicators that can provide you with information about the outcomes (and eventually impacts) of the EbA measures you have implemented, you will not be able to understand if the measures are effective, i.e. if they are delivering adaptation benefits to people, or to identify barriers to their effectiveness.**

This is especially important for EbA interventions because they are implemented in a context of uncertainty: about the type, severity and timing of climate change impacts; about the effects of climate change and other drivers on the ability of ecosystems to provide adaptation benefits to people; and about the technical details of how to implement different EbA measures in the most effective way (e.g. suitable land management practices, appropriate scales and timeframes, optimal environmental and social conditions).

EbA interventions should address these uncertainties by making informed assumptions about how measures will lead to particular outcomes and impacts (and about potential impacts of external factors) while checking the validity of these assumptions throughout the implementation process (see Step 1 for details on how to articulate risks and assumptions in a ToC). You also need a robust set of indicators in order to be able to test whether the initial ideas underpinning the intervention logic hold true.

Measuring outcomes and impacts is more challenging than tracking activities and outputs (Figure 5), which is why many EbA interventions to date have mostly monitored process. One of the main difficulties lies in the time it takes for outcomes and impacts to become measurable. This creates practical challenges because funding may have ended, making it unclear how to continue M&E activities (see Box 7 for strategies for sustaining M&E in the long-term). There are, however, various ways to make monitoring of results indicators more practicable:

- **Having a clear and logical intervention design**

  A clear and logical intervention design, best achieved through developing a ToC (see Step 1), will clarify the sequence of expected outcomes and impacts, as well as their causal links. This will help you identify appropriate points along the pathway for choosing indicators that you can feasibly measure. It will also help you make more substantiated judgements about what the changes made apparent by the indicators can tell you about the success of EbA measures.

- **Using proxy indicators**

  A proxy indicator is a substitute for a parameter that is not directly measurable. Being highly correlated with the social or environmental factor that the intervention is trying to influence, a proxy indicator can provide you with a close approximation, even though it is not an exact measure of the outcome itself (e.g. in an agroforestry intervention, using increased organic matter and nutrients in soil as a proxy for increased yields in key foods).

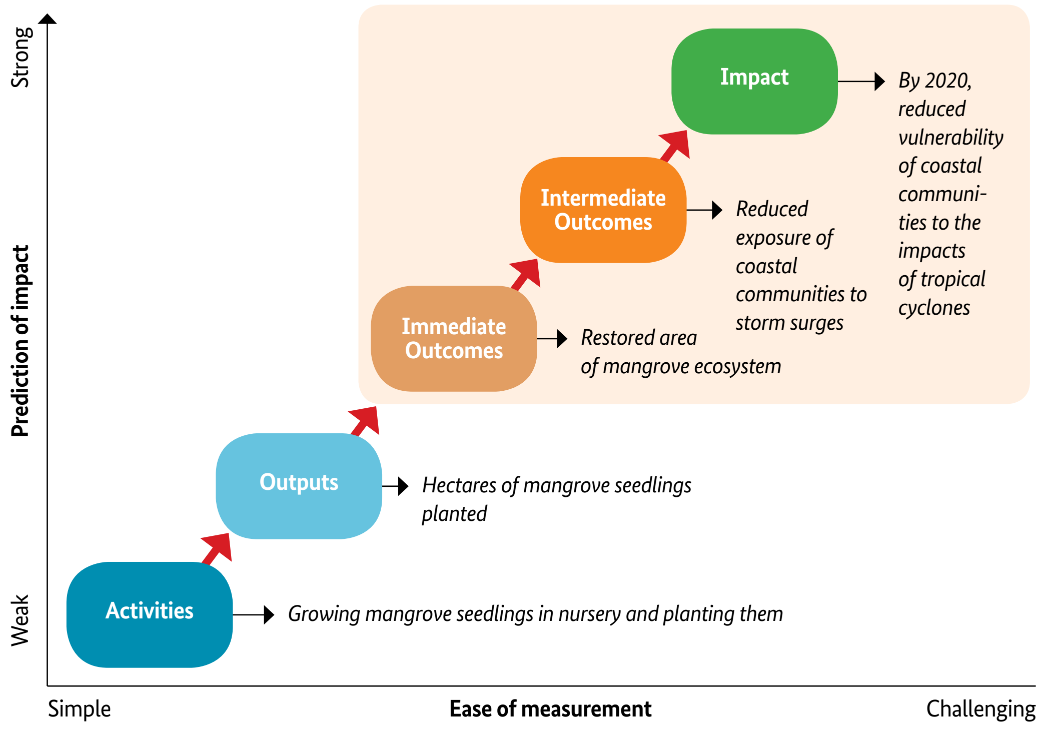


Figure — 5 — Links between the stages in a Theory of Change and typical ease of measurement versus utility of measured values as a predictor of impact (adapted from Dickson et al., 2017)

Breaking outcomes into two categories – immediate and longer-term – is one way of identifying such proxies. The short-term results of activities (i.e. immediate outcomes) can indicate the likelihood of achieving longer-term outcomes and future impacts.

To build a more reliable picture of likely future outcomes and impacts, you can measure multiple proxies, triangulating these in relation to a particular longer-term indicator (e.g. using an indicator index or composite indicators that aggregate multiple indicators to produce a single measure). For example, measuring parameters in relation to multiple staple foods, rather than a single one, would give you a better understanding of whether an agroforestry intervention is indeed increasing the resilience of the overall food supply.

Choosing the right indicators

There is no single set of universal or standard adaptation indicators. As the context of interventions is so varied, there is also no commonly accepted "best" impact indicator that can be used across all adaptation interventions (in contrast, for example, to the use of carbon dioxide emission reduction as the indicator for mitigation). Suitable indicators are particularly diverse for EbA, where each intervention has very different framework conditions (i.e. purpose, ecosystem, climate risks, target groups). As experience of developing and implementing robust M&E systems for EbA interventions (including the use of outcome and impact indicators) grows, it would be valuable to collect tried and tested indicators for different EbA measures implemented in different contexts. Such a repository has not yet been established. While a context-appropriate set of indicators would still need to be selected for each intervention, such a compilation could assist project teams in identifying indicators that have worked elsewhere. This would also increase consistency across interventions, making comparison and aggregation of results easier.

Efforts to compile potential outcome indicators specifically for EbA have been made (Table 2) but remain limited. Until such work has been extended to include information on indicators from additional EbA intervention types across different contexts, you will need to work closely with your project team and local stakeholders to find the most appropriate indicators for your intervention. This is likely to involve developing some indicators from scratch (see Box 12), but be sure to consult other existing sources or compilations of indicators from other disciplines. As EbA draws on many long-standing fields (e.g. human development and health, biodiversity conservation, water management, climate change adaptation), many indicators developed in these other fields will be suitable for EbA interventions. Regardless of the process you use to identify indicators, be sure to do so in a participatory way with field staff and local stakeholders in order to ensure that the indicators make sense in context and, importantly, are feasible to measure given the available knowledge and resources.

There are various methods for developing indicators. Some general steps to get you started include:

1. **Review the intervention's ToC.** As a first step to choosing the right indicators for your intervention, you and the team of people you are working with should (re)familiarise yourselves with the ToC (or other results framework) of the intervention. Selecting indicators

that link back to points along the causal pathway of your intervention is critical to ensuring that your monitoring will provide information on whether or not the EbA measures are achieving their objectives.

As you are unlikely to be able to monitor indicators for each step along the results chain, reviewing the ToC will help you identify which steps to prioritise for indicator development, based both on having a set of process and results indicators, as well as on practical feasibility.

2. **Develop a "long list" of potential indicators.** Having identified priority points along the intervention's ToC, you and your team can brainstorm indicators that might be able to track change in relation to those points. For the outcome and impact indicators, some key questions to consider in your discussions include:

- How would we know that change has happened related to this outcome?
- How will we know success when we see it?
- What would be the evidence of this change?

To further guide you in this process, consider the focal areas of EbA interventions, including:

- ecosystem health, *(e.g. condition and status of soils, vegetation cover, pollinators, biodiversity)*
- ecosystem services delivered to vulnerable populations, *(e.g. provision of water, food, erosion control)*
- economic/livelihoods variables, *(e.g. income levels, employment, food security)*
- governance, *(e.g. institutional capacity, decision-making structures, distribution of cost and benefits)*
- adaptive capacity, *(e.g. people's ability to respond to or recover from climate shocks, social networks, access to information)*
- disaster risk reduction, *(e.g. trends in damage to assets from landslides or flooding, crop failure)*
- impacts of key climate hazards that are already occurring, *(e.g. damage to assets resulting from drought, temperature extremes, heavy rainfall)*
- co-benefits, *(e.g. health, biodiversity, carbon mitigation)*
- context. *(i.e. factors in the wider environmental, socio-economic and political landscape that can affect the project; information on current climate conditions may be needed to interpret observed changes in ecosystems and livelihoods)*

Considering the above will encourage you to generate a list of indicators that span the climatic, socio-economic, ecological and political factors shaping and influencing EbA interventions.

Table – 2 – Example indicators for measuring longer-term adaptation outcomes that can be achieved through EbA, suggestions on how, where and when to collect data, and immediate outcome indicators that can be used in mid-term evaluations and/or in case the longer-term 'gold standard' indicators cannot be tracked due to lack of data, financial resources or time (adapted from Donatti et al., 2019).

STEP 2

EbA interventions	**Expected adaptation outcomes from EbA interventions**	**Example 'gold standard' indicators for longer-term outcomes**	**Suggestions for how to measure indicators**	**Suggestions for where and when to measure indicators/collect data**	**Example indicators for immediate outcomes**
Establishment of marine no-take zones; mangrove restoration	Reduced loss of assets of coastal communities and infrastructure due to storm surges following extreme events (e.g. hurricanes, typhoons)	Percentage of infrastructure damaged after extreme events, including: * Facilities (e.g. % of hospitals, schools and other facilities damaged) * Homes (e.g. % of houses damaged) * Roads (e.g. % of km of roads damaged) * Agricultural land (% of hectares of agricultural crops or assets damaged) * Cultural and recreation sites (% of area damaged) * Protected areas (% of area damaged)	Use of satellite images to take stock of existing infrastructure, agricultural land and extent of ecosystems (e.g. see UNISDR 2017) ------ Information on damages collected during emergency response measures	Records of damage after an extreme event, before the intervention was implemented (i.e. the baseline) Data collection after an extreme event, when the intervention was implemented (ideally in areas with/without intervention)	Erosion rates (costal or hillside) under average weather conditions before and after implementation
High-altitude forest restoration and protection	Reduced loss of assets of urban and non-urban communities and infrastructure due to extreme weather events (e.g. hurricanes, typhoons and storms; flooding; landslides; heatwaves; and fires)				
Coral reef restoration; rangeland management; policy development for regulating forest use	Reduced impacts of climate change on ecosystems that maintain livestock production, marine and freshwater fisheries, and natural products for household consumption or commercial harvesting	Prevalence of moderate or severe food insecurity in the population after extreme weather events or through time ------ Average income from sustainable crop and/or livestock production, sustainable marine and freshwater fisheries, and/or small-scale eco-tourism per household after extreme weather events, or through time	Questionnaire for communities to gather information on % of the population (incl. gender and other social differentiation) that is food insecure (e.g. see the Food Insecurity Experience Scale from FAO for set of relevant questions) ------ Surveys with communities to gather information on income from crop and/or livestock production, sustainable marine and freshwater fisheries, and/or tourism, per household engaged in those activities, as well as the number of income sources ------ Census data and other relevant data held by local administration	Records of the situation after an extreme event or through time (e.g. yearly basis, during crop harvest season) before the intervention was implemented (i.e. the baseline) ------ Data collection after an extreme event or through time (e.g. yearly basis, during crop harvest season), when the intervention was implemented	Crop, livestock and fish production for household consumption in the growing/production season before and after implementation of the EbA intervention ------ Crop, livestock and fish production for cash income in the growing/production season before and after implementation of the EbA intervention
Training on improved agriculture practices; implementation of these agriculture practices (e.g. agroforestry, soil conservation)	Reduced negative impacts of climate change on livestock and crop production for subsistence or cash income (mainly through avoided physical damage)				
Implementation of agriculture practices (e.g. agroforestry and soil conservation)	Reduced impacts of climate change on ecological interactions (e.g. pest and disease regulation, pollination) that affect crop and livestock production for subsistence or cash income				
Forest restoration; capacity building on forest restoration	Reduced impacts of climate change on water quality and quantity for human use under extreme events (e.g. droughts flooding, heatwaves, changes in precipitation through time)	Percentage of population (incl. by gender and other social differentiation) with access to sufficient quantities and quality of drinking water during extreme events, or through time ------ Percentage of deaths and missing persons in various demographic groups after extreme events	Use census information or questionnaires/surveys to obtain data on the number of people in a location that have access to water year-round and during extreme events ------ Use local or national statistics to obtain the number of people that have died from extreme weather events (e.g. see UNISDR 2017)	Records of the situation after an extreme event or through time (e.g. yearly basis) before the intervention was implemented (i.e. the baseline) ------ Data collection after an extreme event or through time (e.g. yearly basis), when the intervention was implemented	Water availability per capita for human consumption before and after implementation of the EbA intervention ------ Not available
High-altitude forest restoration and protection	Reduced loss of lives in urban and non-urban communities due to extreme weather events (e.g. hurricanes, typhoons and storms, associated flooding, landslides, extreme heat, fires)				
Establishment of marine no-take zones; mangrove restoration	Reduced loss of lives in coastal communities due to extreme weather events				
Swamp forest restoration; development and restoration of overflow areas and reed marshes	Reduced impacts of climate change on the incidence of vector-borne diseases associated with extreme weather events (e.g. flooding, drought)	Number of years lost due to vector-borne diseases among various demographic groups within the population ------ People's years lost due to diseases related to climate change, respiratory distress and heat stroke during extreme events among various demographic groups within the population (if possible)	Use of national or regional statistics on occurrence of disease or death	Records of situation after an extreme event, before the intervention was implemented (i.e. the baseline) ------ Data collection after an extreme event, when the intervention was implemented	Prevalence of vector species before and after implementation of the EbA intervention ------ Levels of air pollution before and after implementation of the EbA intervention ------ Local average air temperature before and after implementation of the EbA intervention
Establishment of green roofs and trees in urban areas	Reduced negative health effects (e.g. respiratory distress and heat stroke) due to extreme temperature and fires				

This is important, as only a mix of such variables will provide you with a complete picture of the changes resulting from a multi-disciplinary approach such as EbA (e.g. allowing you to assess whether the ecological processes you are restoring or managing are delivering the intended social adaptation benefits under changing climatic conditions). It will also help you understand why an intervention might be having unexpected results.

Keep in mind that you may not need to develop all indicators from scratch. You can consult existing lists of indicators that have been used by other sectors (e.g. in wider climate change adaptation, development and biodiversity). Discuss any such indicators with your team to determine whether or not they would be suitable in the context of your intervention, keeping in mind the limitations of standardised indicators (see Box 13).

Box — 12 — Developing indicators using a five-step approach: the case of Vietnam

From 2014 to 2019, the Institute of Strategy and Policy on Natural Resources and Environment (ISPONRE) and GIZ worked on behalf of the Ministry of Natural Resources and Environment of Vietnam (MONRE) and the International Climate Initiative of the German Federal Ministry for the Environment, Nature Convervation and Nuclear Safety (BMU-IKI) to help the Vietnamese government and society adopt good ecosystem management practices that can support their adaption to climate change (Nguyen et al., 2017). This project involved the implementation of various EbA measures in the Ha Tinh and Quang Binh provinces, including forest restoration and protection, as well as a number of capacity-building and awareness-raising activities for local farmers.

As part of its M&E system, the project developed a Theory of Change (ToC), which was used as the basis for identifying indicators. The project used a five-step approach to develop specific indicators (largely based on the BMU-IKI funded GIZ (2016) Concept Note 'Development of Indicators and Guidelines for Monitoring & Evaluation of Ecosystem-based Adaptation Measures', the BMZ and BMU-IKI funded GIZ (2013) training manual 'Integrating climate change adaptation into development planning' and the BMZ-funded GIZ (2013) guidebook 'Adaptation Made to Measure'): (1) defining the subject (taken from the ToC); (2) specifying the quantity of change; (3) defining the quality of change; (4) defining a time horizon; and (5) specifying disaggregation (e.g. by gender, geographical reference), where applicable.

The information generated from working through these five steps was then combined into one subject-specific indicator for short, medium and long timeframes corresponding to specific outputs, outcomes and impacts as defined in the ToC. This process was repeated for each theme identified in the ToC. Indicators were developed in this manner for different topics, including awareness-raising, income-generating and restoration activities. This indicator development process was highly participatory, which was key to developing the indicators in a way that was relevant for the communities involved. Two example outcome indicators developed in Quang Binh using this process are below:

Box continues on the next page -->

Box – 12 – (continued) – Developing indicators using a five-step approach: the case of Vietnam

STEP 1: *Define subject*	*Climate change awareness-raising through building in-depth understanding and sharing knowledge*	*Training on, and application of forest restoration and protection*
STEP 2: *Specify quantity of change*	*50% of the households in the selected community and 30% of the population in the additionally selected communes, particularly women, youth union and farmer association members*	*30 households* ------ *10 ha of acacia and casurina forest have grown by about 70 cm, reaching an average height of 120 cm*
STEP 3: *Specify quality of change*	*Gained knowledge and awareness on climate change, and have seen its implications in practice; are sharing their knowledge with others*	*People apply forest restoration and protection skills, which leads to the forest growing and eventually providing ecosystem services (reduction of drifting sand; groundwater provisioning and soil moisture retention)*
STEP 4: *Define time horizon*	*2016-18 (2 years)*	*2016-18 (2 years)*
STEP 5: *If applicable, specify disaggregation*	*Men and women in Hoa Binh village, Quang Trach district* ------ *Men and women in four other communes in Quang Binh province, particularly women, youth union and farmer association members*	*Men and women in Hoa Binh village, Quang Trach district*
Combine 5 steps into 1 outcome indicator	*Over two years, 50% of the households in Hoa Binh village and 30% of the population in the additionally selected communes in Quang Binh province, particularly women, youth union- and farmer association members, have gained knowledge and awareness on climate change, have seen its implications in practice and are sharing their knowledge with others*	*30 households (men and women from Hoa Binh village alike) apply their forest restoration and protection skills, which leads to 10 ha of acacia and casurina forest growing by 70 cm within two years (2016-18), and reaching an average height of 120 cm. The forest can provide first ecosystem services, particularly the reduction of drifting sand, groundwater provisioning and soil moisture retention*

3. **Refine your indicator list.**

There are several things you can do to help you narrow down your "long list" of indicators and further refine the ones you want to work with:

- Identify which are process and which are results indicators and make sure that your final set includes a sufficient number of robust, immediate and, ideally, longer-term outcome indicators. *You may also consider including indicators that can track assumptions you have made in the ToC, as well as indicators that capture information on context (e.g. climatic and wider political factors). If your intervention has the means to continue M&E in the long term (e.g. if you are able to establish long-term funding, or partner with research institutions (see Box 14) or local communities who will take responsibility for continued monitoring), be sure to include impact indicators.*

- Consider which of the outcome or impact indicators can be disaggregated by different populations of interest. *As such sub-groups (e.g. marginalised groups, women, children) are all affected differently by climate hazards and by the implementation of your intervention, some of your final indicators should ideally be able to shed light on these differential impacts.*

- Verify whether any of the indicators on your "long list" overlap with other higher-level monitoring and reporting processes. *If they do, and if they are suitable for the local context, including these in your final set might facilitate their long-term monitoring, as such higher-level processes (e.g. at district, sub-national, national level) tend to be mandated by government and supported by the necessary resources (e.g. financial, staff). In such cases, you will need to collaborate and coordinate with the relevant partners.*

Box — 13 — *Some precautions for using standardised indicators*

! *Avoid over-simplification. Standardised indicators (e.g. number of beneficiaries, or size of the area under new management regime) can be relatively simple to report on and are attractive because they can be used to compare, consolidate and present data concisely. This may be useful for a range of purposes, including accountability, comparative research, and global policy analysis. However, standardised indicators may not reflect the local context and can fail to capture key lessons, which can result in a misleading set of conclusions (Bours et al., 2014).*

- If your EbA intervention is part of a wider adaptation programme, try to coordinate M&E efforts across the programme and exchange information and expertise on indicator development. *Ideally, you may be able to identify a set of "core" indicators that are consistent across different interventions in the wider programme (complemented by localised ones). If you use this approach, make sure that the programme agrees on consistent and robust methods for data collection and analysis so that results are comparable.*

- Take into account the technical and financial feasibility of measuring the indicators. *This includes considering data availability and the skills of those who will be collecting and analysing M&E data. Indicators that are too complex and costly to measure, understand or interpret will not be particularly useful. Also, make sure that your final number of indicators is manageable given the expected timeframes for reporting and your budget for M&E.*

Box — 14 — Achieving long-term M&E through integration with national agricultural research systems: the case of Burkina Faso

Understanding whether EbA interventions are achieving their intended longer-term outcomes and impacts requires long-term M&E. However, carrying out such continuing M&E can be challenging, as the financial and human resources needed for collecting and assessing data typically cease to be available when projects end. In order to address this challenge, the International Union for Conservation of Nature (IUCN) has been working closely with national research institutes in four West African countries (Burkina Faso, Ghana, Niger and Senegal)[3] to integrate monitoring for EbA measures, such as farmer-managed natural regeneration (FMNR), into their long-standing monitoring and evaluation processes.

Traditionally, these research institutes have been monitoring and evaluating only ecological parameters. As ecological parameters on their own cannot provide the full picture of whether EbA measures are delivering adaptation benefits, IUCN – with the support from the CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS) – has been working with the national research institutes to integrate socio-economic monitoring into their ongoing ecological M&E processes. This includes monitoring behaviour change in farmers and other relevant stakeholders, such as scientists and agricultural extension officers (Somda et al., 2017).

In Burkina Faso, this process started in the Northern region in 2012. Scientists, agricultural extension officers and community members were trained on planning, monitoring and evaluating adaptation outcomes, defined as the effects of the proposed interventions on target groups, relevant agro-ecosystems and changes in vulnerability. During the planning stage, stakeholders identified climatic and non-climatic hazards, desired ecological and behavioural changes (i.e. changes in agricultural practices, partnership, knowledge and organisation; Somda et al., 2017) and associated progress markers/targets for monitoring. As the use of tools for monitoring ecological changes is relatively straightforward and stakeholders were more familiar with them, the training sessions focused on building capacity in the use of the most significant change technique with which to collect behavioural change data on the identified target areas.

IUCN and partners are in the process of officially handing over the responsibility for the continuation of the integrated M&E processes to the national agricultural research systems.

[3] Institut de l'environnement et de recherché agricole (INERA, Burkina Faso) ; Institut sénégalais de recherche agricole (ISRA, INRAN, Senegal); Institut national de recherché agricole du niger (Niger) ; Council for Scientific and Industrial Research /Savanna Agricultural Research Institute (CSIR/SARI, Ghana); with support from the World Agroforesty Center (ICRAF).

- Align your indicators with accepted standards. *Once you have agreed on your final selection of indicators, verify and revise them against indicator standards to ensure that they are robust and well-formulated. The **SMART** criteria (**S**pecific, **M**easurable, **A**ttainable, **R**elevant and **T**ime-bound) are widely recognised, and in the adaptation community, **ADAPT** principles (**A**daptive, **D**ynamic, **A**ctive, **P**articipatory, **T**horough) are increasingly being promoted (Villanueva, 2012). At the heart of the ADAPT principles is the need for integrated and thorough M&E approaches that emphasise constant monitoring and flexibility, reflect local context, perceptions and needs, enhance capacities to deal with uncertainty, and understand the processes of change. Interpreting results will also be easier if your indicators are consistent, representative, and measurable at different spatial and temporal scales. For the purpose of communicating about the indicators, especially with stakeholders not involved in the process of developing them, make sure that they are clear and simple.*

Setting a baseline and establishing targets

After selecting a final set of indicators, you need to establish a baseline against which change in the indicators can be measured. A baseline is a description of the initial condition/situation before an intervention takes place. It provides a critical reference point for comparing the situation before and after an intervention and assessing changes.

Some relevant baseline information may be available from other ongoing initiatives in the project region, or national statistical systems. However, especially in remote areas, data availability can be poor, and it is likely that you will need to collect baseline data at the start of your intervention. Depending on the indicators in relation to which you are establishing a baseline, this data may be quantitative or qualitative.

In order to better understand to what extent the project is making progress towards reaching its overall objectives, you will also need to establish a set of specific and measurable targets. To do so, think about what the ideal ecological or socio-economic scenario is that you would like your intervention to achieve by a certain point in time. Monitoring indicators against such targets will allow you to build an understanding not only of whether your intervention is generally achieving its objectives, but also whether it is doing so in a way that is meaningful in terms of reaching its adaptation goals. Establishing quantitative targets that specify potential achievements and are time-bound is essential to ensuring a desired level of performance. The key to establishing realistic and motivating targets is practicality. Factors to consider in establishing targets include:

- past trends (i.e. change observed over previous periods);
- how well others have done;
- the presence of objective international, sectoral or other quality standards.

Additional useful resources

Bours et al. (2014b): Guidance note 2: selecting indicators for climate change adaptation programming

This paper provides useful additional background information on indicators in the context of climate change adaptation more broadly. It highlights that adaptation can draw strongly on other disciplines for indicators, but that adaptation indicators need to be measured in combination in order to understand an intervention's contribution toward adaptation.

CARE (2013): The Community Score Card (CSC): a generic guide for implementing CARE's CSC process to improve quality of services

This is a useful source in relation to understanding social differentiation, including gender, which is important in the context of developing indicators that can capture such differences. The Community Score Card is helpful for addressing the needs of community-based (and gender-sensitive) monitoring of interventions.

Dickson et al. (2017): PRISM – toolkit for evaluating the outcomes and impacts of small/medium-sized conservation projects

Sections 2.1 and 3 of this toolkit provide information on how to develop indicators and on example indicators.

The following resources contain useful lists of example indicators and/or repositories from different fields (more such lists exist in relation to specific topics, so remember to do a general search for available indicators when working to find suitable ones for your intervention):

Rizvi et al. (no date): Ecosystem-based adaptation monitoring & evaluation – indicators. A compilation and review of literature

GIZ and IISD (2014): Repository of adaptation indicators. Real case examples from national monitoring and evaluation systems

GIZ and WRI (2011): Making adaptation count: concepts and options for monitoring and evaluation of climate change adaptation

Climate-Eval (2015): Good practice study on principles for indicator development, selection, and use in climate change adaptation monitoring and evaluation

World Development indicators (available at: http://datatopics.worldbank.org/world-development-indicators/)

Biodiversity Indicator Partnership (available at: https://bipdashboard.natureserve.org/bip/SelectCountry.html)

STEP 3

Operationalising the monitoring and evaluation system

This section in brief

This section provides an overview of elements that are key to operationalising any M&E system for EbA, including choosing the right evaluation design, carefully thinking about the types of data you can collect, as well as considerations for effective and efficient data collection, entry, analysis and interpretation.

Evaluation design options

As part of making your M&E system operational, you need to give some thought to the evaluation design you intend to use (Table 3). A good evaluation design will help you understand what changes have occurred due to the project and/or due to other contextual factors. It should allow you to answer the following questions:

- What difference did the intervention make?
- How did it make this difference?
- What other factors were relevant?

Evaluations that consider these questions produce stronger and more useful findings than those that simply observe what has happened. A flawed evaluation design, on the other hand, can lead to results being misinterpreted or doubted.

To be able to respond to these questions, data collection needs to be designed in a way that will allow you to distinguish what amount of the total change that has taken place can be claimed by your intervention. This is known as 'attribution'.

As EbA is inherently complex, long-term, and spans different sectors and levels of intervention, determining attribution is particularly challenging. You may feel it is impossible to isolate and collect data on all the different factors, risks and assumptions that can influence the outcomes and impacts of your intervention.

The most rigorous option for determining attribution is using an experimental design (e.g. randomised control trial) in which you compare your intervention to, ideally, several control sites where no adaptation measures have been implemented (see Box 15). This approach, *Table — 3 — Evaluation design options (adapted from Dickson et al., 2017; for more details about each design option, consult original source)*

Design type	Description	Examples	Advantages	Disadvantages/Risks
Matching designs	Comparing the results of the intervention to a control group/site that is not subject to the intervention. Control group/site selected to be as similar as possible to the group/site targeted by the intervention	Comparing the vulnerability of one or more communities within an area(s) that received intervention support with that of communities in similar area(s) that did not receive intervention support	If done properly, matching designs eliminate many of the potential sources of bias that could affect the validity of an evaluation	Often higher costs and require more resources than other designs ------ Technically demanding to choose parameters for matching sites and to acquire data from outside project area ------ Subject to a number of challenges relating to logistics and ethics
Theory-based designs	Checking that results support the project's Theory of Change (ToC)	Checking achievement of longer-term outcomes ------ Contribution analysis (i.e. exploring attribution through assessing the contribution an intervention is making to observed results; sets out to verify the ToC behind an intervention and simultaneously takes into consideration other influencing factors)	Uses pre-existing ToC ------ Often less resource intensive and not subject to many of the challenges associated with traditional matching designs	Requires a thorough understanding of the mechanisms that drive change and the ecosystems and people impacted (e.g. a well-developed ToC) ------ Potential to focus only on expected impacts and ignore unintended or negative impacts
Before–after designs	Measuring the situation before the intervention and then again after the intervention	Comparing the knowledge/awareness of participants before and after a training workshop	Can be useful if the outcome/impact is short-term or is part of a simple causal chain	Can only imply (rather than prove) that change occurred due to the intervention ------ If contextual factors before and after the intervention were not identified, a false counterfactual can be produced (Gertler et al., 2011)
Participatory impact assessment	Asking beneficiaries, members of wider community and/or relevant project stakeholders questions about what changes have occurred and then discussing the reasons for the answers given	Asking beneficiaries to identify all food sources that contribute to their household food intake and to distribute counters among different variables to illustrate the relative proposition of household food derived from each source (e.g. to determine if/to what extent drought tolerant food crops contribute to food source)	Relatively cheap, does not require a baseline study or control group ------ Usually the best way of understanding how the project has affected beneficiaries and/or wider community	Participants' memories can change over time and views can differ ------ Not validated/measured in absolute terms
Interviewing key informants	Asking certain key individuals if they observed any changes, what they believe caused observed changes and how these changes happened	Asking beneficiaries if they feel flooding in their fields has reduced and what they think led to that change	Relatively cheap, does not require a baseline study or control group ------ Useful for verifying results collected from other methods	Key informants need to be familiar with the project and the outcome/impact being evaluated ------ Perceptions may be inconsistent/inaccurate

Box — 15 — Using randomised control trials in the context of adaptation: climate-informed agriculture in central Tunisia

In Central Tunisia, the 'Mind the Gap' project, implemented by the International Center for Agricultural Research in the Dry Areas (ICARDA) with financial support from the German Federal Ministry for Economic Cooperation and Development (BMZ), has been working with smallholder farmers to identify effective approaches for adapting local agricultural production to climate change.[4] Among such approaches is the use of a new barley variety that can better cope with irregular rainfall and has higher resistance to diseases, all of which are projected to worsen under climate change.

To understand which agricultural extension service design is best suited to encourage smallholder farmers to adopt this new barley variety, the project is implementing randomised control trials (RCT) over the course of three years. These RTCs involve 560 smallholder farmers who have been divided into four groups of 140 randomly selected farmers. Each group has been given a different combination of extension services related to the new barley variety (e.g. improved farm management training, extension information via SMS, women empowerment training). One control group of 140 farmers is not benefitting from any services. The four groups and their individual components are being rigorously evaluated in terms of the costs and effects of adopting the approaches on farm productivity, household livelihoods and gender differences. This evaluation will be based on data gathered during baseline- and follow-up surveys.

To address the ethical implications of not providing the control group with adaptation options while also having them participate in baseline- and follow-up surveys, the project will provide the control group with support beginning 1.5 years after current project activities end. This time lag corresponds to an accepted practice in development projects, which typically start in one community and gradually scale up measures to other communities.

however, can be challenging, especially in small- to medium-sized interventions with restricted budgets and capacity. It also requires carefully considering the ethical issues of allowing people in the control site to be exposed to climate change impacts without supporting their own adaptation actions.

Alternative approaches include statistical analysis of data from across a number of sites (which makes it possible to assess how different factors influence the outcomes, but requires very large datasets), and defining a 'business-as-usual' scenario through expert opinion or combined socio-economic and environmental modelling; however, due to the long timescales and complex human-environment interactions that are involved, assessments of what would have happened without an intervention will likely always involve a degree of uncertainty that needs to be acknowledged.

Given the complexities involved in determining exact attribution, you can also assess the contribution of your intervention to achieving adaptation outcomes. To do so, you should consider the above questions and use an evaluation framework that illustrates the contributing factors and the relationships between them (e.g. based on a Theory of Change; ToC). While this will not give you a quantification of the change resulting from your intervention (as would determining attribution), you will still learn a lot about your intervention.

[4] International Center for Agricultural Research in the Dry Area (ICARDA) 'Mind the Gap' project https://www.icarda.org/media/drywire/mind-gap-bringing-climate-smart-solutions-field-tunisia

Important data considerations

Data types

Equipped with your ToC, a set of indicators and a plan for evaluation design, you will next need to consider your options for data collection. To assess indicators, you can collect quantitative data, which is numerical (i.e. numbers or answers such as yes or no to closed questions), and qualitative data, which is non-numerical (i.e. observations, answers to open questions, written, audio, visual or video evidence).

Although quantitative data can be more straightforward to analyse (e.g. using standard statistical analysis methods), qualitative data can provide critical insights and information that quantitative data cannot capture (e.g. the underlying reasons, opinions and motivations behind changes in behaviour). This is why choosing a combination of both – a mixed methods approach – is best. Using such a combination of data types can improve an evaluation by ensuring that the limitations of one type are balanced by the strengths of the other.

It is also important to use several types of information (e.g. scientific, technical, non-technical, indigenous knowledge). Furthermore, you need to think about if and how to disaggregate data by gender and other socially differentiated categories. Different social groups have different capacities, vulnerabilities and opinions about the relations and structures around them. In particular, the disaggregation of data by gender is necessary to understand how women and men, girls and boys experience and respond to climate-related risks and opportunities. Capturing this data will allow you to manage and address gender-related inequalities.

Sampling strategy

Sampling is the process of selecting units (e.g. people, sites, species) from a 'population' of interest, studying these in greater detail, and then drawing conclusions about the larger population. This is important, as you will not be able to collect data from the entire population affected. Therefore, you will need to collect data from a subset – a sample – and use these to make inferences about the entire population of interest (the sample size will differ depending on the size of the respective target unit). For this method to be reliable, the characteristics of the sample must reflect the characteristics of the population targeted by the activity.

Controlling for bias

Bias refers to errors that occur during data collection, analysis or interpretation that reduce the reliability of the evaluation results. Potential sources of bias when collecting ecological data include observers putting differing amounts of effort into data collection; the fact that some habitats are easier to survey than others; or local conditions, such as weather, affecting data collection. There are also many potential sources of bias when gathering information from people: some stakeholders are easier to reach than others; leading questions make certain answers more likely; participants' memories change over time; or participants are unwilling to share certain information. By identifying the sources of potential bias, you can work out whether it will have a significant impact on the reliability of your conclusions and whether or not it can be minimised, reduced or measured and allowed for during analysis. If bias cannot be controlled in these ways, you should use a different method.

Ethical considerations

Before implementing any data collection methods, you need to do an ethical review of these to identify potential issues they may create in relation to the stakeholder groups, habitats or species being targeted. Ethical considerations include the time participants may spend away from work and family in order to participate in your activities/research; revealing locations of threatened or valuable/sought-after species; the need to get participants' free, prior and informed consent for participation/interviews; ensuring confidentiality and anonymity; and safe storage of data. Failing to consider such ethical implications can have severe consequences for the validity of evaluation results and runs the risk of negatively affecting your intervention's target, while also potentially posing serious reputational risks for your organisation.

Putting data collection into action

Making a plan

In order for M&E to be implemented successfully, it needs to be well planned and coordinated. To do so, you will need to write up a monitoring plan in consultation with your project team. Core elements of this plan should include:

- the indicators and data collection methods chosen;
- staff assigned for each component and their responsibilities;
- a timetable for the main monitoring activities and components;

- reporting requirements (e.g. formats, frequency) for the donor and others;
- a budget for all components of your M&E system (with funding sources identified).

Assigning staff and responsibilities

Monitoring tasks are often seen as less urgent than other day-to-day management activities. To ensure that M&E activities are carried out with the same degree of effort and attention as others, you should clearly specify and assign M&E responsibilities in the job descriptions of relevant staff. Be sure to explain to your M&E team their roles, why they are important and how they contribute to the intervention. The staff responsible for M&E should also be given enough time for data entry, management, analysis and interpretation.

An integrated approach to monitoring can only be effective if the individuals responsible for the different types of monitoring (e.g. ecological, socio-economic, climatic) work as a team. The structure and roles of this team should be consistent over time and collect data at agreed times.

If possible, include members of the local community in the monitoring team. This will increase their active support and involvement in activities, incorporate their perceptions and knowledge, and build their capacity to take over monitoring activities in the longer term.

Data collection and its frequency

The collection of monitoring data will be determined by the evaluation design and the methods you have chosen for tracking the appropriate indicators (see Steps 1 and 2). To ensure that data is collected in a consistent way across different M&E staff over time, you need to agree on a protocol for gathering and recording data. This will involve, for example, designing standardised field data sheets and interview questionnaires, using designated equipment for taking measurements (Annex 4), and agreeing on timing and frequency for data collection. Once the protocol has been agreed by the M&E team, you should practise the approaches with the relevant staff to make sure that everyone has understood the procedures and knows how to apply the methods as well as resolve any potential issues.

The frequency of data collection (e.g. annually, monthly, daily) will depend on the parameter being monitored. Consider, for example, collecting data in a way that is representative of any regular changes or fluctuations in the local environment, following extreme weather events, or in line with the timing of certain activities. To maximise data collection efficiency, you should determine ways in which to collect as much of the needed information as possible on the same day, by the same people, and from the same transects, plots, or community groups.

To further reduce the workload of data collection in the field, you should also consider using new, automated monitoring technologies that can collect data on a number of environmental parameters on a regular basis (see Box 16). Also consider spatial and other digital solutions for remotely collecting environmental and social data (see Box 17 for an application in Thailand, and Annex 3 for example remote sensing indicators and quantification used in Rwanda).

Box — 16 — *Automating environmental monitoring to reduce data collection workload: the ITT SmartSense*

The Institute for Technology and Resource Management in the Tropics and Subtropics (ITT) at the Cologne University of Applied Science has developed low-cost sensor technology for reliable and comprehensive automated collection and monitoring of environmental data, known as the ITT SmartSense (see http://itt-smartsense.info). The SmartSense is a small device with sensors that records measurements and sends the readings to a remote server using a mobile network. These measurements are stored in a database that can be accessed anytime in common formats, such as Excel spreadsheets. This automated process eliminates the need for M&E teams to collect certain environmental data and enter measurements, thereby also avoiding inconsistencies that can arise from manual data entry. Furthermore, the SmartSense is equipped with features that make it practical and easy to maintain, including weather-proof protection, solar-powered autonomous operation and long battery life, low battery alerts, and 'device offline' alerts.

Three variations of the SmartSense device have been developed, focusing on agriculture, water, and weather monitoring. The agriculture monitoring device provides continuous recording of important soil parameters, including soil temperature, soil moisture and ambient temperature. It also has the ability to connect additional sensors for measuring, for example, solar radiation, UV and trunk diameter. The water monitoring device measures the level, pressure and temperature of water, and numerous water quality parameters like nitrate, pH, salinity, and heavy metal. The weather monitoring device measures air temperature, relative humidity, wind speed, rainfall, solar radiation, and air pressure. Many of these parameters are potentially important indicators for EbA interventions, such as ecosystem health and climate conditions (see Step 2).

The SmartSense has been operationalised as part of a Water Fund project in Latin America, run in partnership with The Nature Conservancy. The project aims to provide a steady source of funding for the conservation of over 7 million acres of watershed and to secure drinking water for nearly 50 million people. Five autonomous SmartSense devices have been installed in the watershed associated with the Rio de Janeiro Water Fund. On an hourly or daily basis, these devices are collecting data on numerous environmental parameters, including soil moisture and temperature, nitrate, pH, turbidity, phosphorus, and water level.

Box — 17 — *Spatial tools and digital solutions for M&E in Thailand*

A large number of living weirs (a weir in which a temporary bamboo frame is gradually replaced by the roots of Banyan trees) have been installed in Thailand over the last decade through community-led initiatives (Living Weir Network, Thailand), primarily to reduce the impacts of flooding and drought. To date, there is limited evidence on their effectiveness and potential benefits. In order to monitor and assess the long-term effectiveness of living weirs and other nature-based solutions for water resources management, the water component of the Thai-German Climate Programme (TGCP); and the lead water agency of Thailand, the Office of the National Water Resources (ONWR), are launching a joint research initiative with Thai universities to develop and pilot spatial and digital solutions for monitoring various EbA measures.*

The pilot methodology will include the use of Unmanned Aerial Vehicles (UAVs, i.e. drones) and remote sensing for quantitative data collection. Depending on the pilot site, potential data products from UAVs and satellite imagery could include several types of time series (i.e. change in river morphology, land-use change, change in vegetation health and soil moisture mapping.

The use of remote methods for collecting socio-economic data is also being explored. This includes the possibility of using online survey platforms to conduct household surveys and disseminating the surveys through LINE, a widely used communication app in Thailand. To ensure that sufficient qualitative data is collected, household surveys are to be administered in the field, e.g. via KoboToolbox, a proven survey data collection, analysis, and management platform. Existing field and water data (e.g. groundwater level, well levels, biodiversity) from different levels of government agencies will also be used – or collected during field visits, if suitable data is not available. The qualitative and quantitative data sources will be triangulated to provide a comprehensive picture of how the EbA measures are performing.

As local participation is key to the long-term success of local-level M&E, the initiative will include the identification of pathways for implementing the M&E activities in close collaboration with river basin committees (RBCs) and the respective communities in the selected river basins. Furthermore, students from Thai partner universities as well as local water sector agencies will be encouraged to participate in the implementation of the methodology and will have the opportunity to gain practical experience in data collection in the field. This M&E approach will provide evidence on the role of ecosystem services in climate change adaptation at the local level, support planning at river basin scale, and contribute to national-level adaptation reporting to international frameworks.

**See https://www.thai-german-cooperation.info/en_US/thai-german-climate-programme-water/*

Data entry, storage and cleaning

Collecting monitoring data is only one step of the process. In order to be able to effectively make use of the data collected, you and your team will also need to store, analyse and report on the data. **These other steps are likely to take as much time as the data collection itself, so be sure to account for this in your planning.**

It is important that you agree on a standard protocol of how to name different types of data collected, or photos taken, and that all M&E staff are thorough and consistent in their data entry. Make sure to review the first round of data entry carefully, so as to avoid mistakes or confusion from the beginning.

The data should be entered and stored in a computerised format according to an agreed filing structure as soon as possible, ideally within 2 weeks of collecting the data (Annex 5). Despite following good data entry and storage standards, errors are likely to occur. You will therefore need to do quality checks and 'clean' the data to eliminate entry errors and inconsistencies in your datasets. To help ensure this is done regularly, and datasets are kept up-to-date, it is advisable to assign this responsibility explicitly to someone in your team.

Data analysis and evaluation

The data analysis will be determined by the unit of analysis, i.e. the 'who' or 'what' that is being analysed (which is different from the unit of data collection), as well as the indicators to be evaluated/reported on. Analysing quantitative data involves examining numbers to look for patterns and trends. Analysing qualitative data involves extracting observations, lessons and trends from written or other kinds of narrative data (e.g. interviews and field observation notes).

Especially for EbA interventions, where results are influenced by ecological and social factors, you should use a mixed methods analysis (considering a combination of quantitative and qualitative data types as well as various data sources) to answer a specific question of your evaluation (see Box 18). This will improve the evaluation by ensuring that the limitations of one data type are balanced by the strengths of another. It will also allow you to triangulate results, which means combining multiple methods and perspectives with various data sources in order to cross-check the results. Triangulation is a crucial step in the evaluation process, as it will help you reduce the risk of bias associated with using a single data source (see Box 19).

Box — 18 — The art of interpreting results

'Interpreting your results is part science, part art. It requires the ability to think critically to make judgements in relation to your evaluation questions, based on the information you have gathered, your understanding of the risks, assumptions and external factors that may influence the project's outcomes and impacts and any potential sources of bias. [...]

There is a temptation to be overly scientific and to focus too much on quantitative results (e.g. numbers or graphs). However, the most useful interpretations are typically those that carefully consider the information available, and then use this information to provide an interpretation of what happened to explain the project's results.

For example, the fact that long-term impacts are not measurable within the project's timeframe means that you will often need to use information collected on intermediate [i.e. longer-term] outcomes to explain the likelihood of future impacts [...] so you may often need to examine qualitative evidence (interpretations) both from participants and from your own observations and understanding of the situation, to explain and contextualise the project's results' (Dickson et al., 2017).

Box — 19 — Triangulating M&E results in Miraflores, Peru

In an effort to evaluate the biophysical and social impacts of EbA measures implemented in Miraflores, Nor Yauyos Cochas Landscape Reserve in Peru, assessments of three different types of data were used in order to help understand the changes in pasture conditions (Min, 2018). These included openly available remote sensing data on vegetation cover, monitoring data on pasture condition collected by bodies external to the intervention, and data from interviews aimed at capturing local perceptions. The remote sensing data revealed some improvement (while potentially being influenced by confounding factors); the monitoring data, though limited, indicated improved conditions; and the interviews showed disagreement in responses, but an average increase in perceptions that pasture conditions had improved.

While these results were somewhat inconclusive due to a scarcity of data, all sources indicate improvements in pasture condition. This represents a first step towards constructing a picture of what is changing, and the use of three separate data sources makes this preliminary conclusion more reliable. These parameters need to continue to be monitored while the project team also works to determine why changes are happening, i.e. determining contribution or attribution of the EbA measures.

Additional useful resources

Dickson et al. (2017): PRISM – toolkit for evaluating the outcomes and impacts of small/medium-sized conservation projects

Sections 2.2 and 4.0 provide information on evaluation design; section 2.2 provides information on data collection, cleaning, and analysis. In these sections and the Method Factsheets, you will find both conceptual background information and many practical materials.

GIZ, UNDP and Ceval (2015): Impact evaluation guidebook for climate change adaptation projects

This guidebook contains detailed information on different options for evaluation design that can be applied in the context of climate change adaptation in general. The annexes include additional specifics on selected approaches.

Dhehibi et al. (2018): Designing and conducting randomised controlled trials (RCTs) for impact evaluations of agricultural development research

This manual provides detailed information on carrying out a randomised control trial in the context of a climate change adaptation project, using a project in Tunisia as an illustrative example.

The BetterEvaluation website (www.betterevaluation.org)

This website is dedicated to improving evaluation and contains a plethora of information on evaluation options and approaches, including the steps needed for carrying them out and additional resources to support evaluations.

Many resources exists that provide information and detailed guidance on data collection, ranging from comprehensive books on methods from different disciplines to field guides to manuals developed by projects and programmes in a specific context (you should identify your data collection needs in the context of your intervention and find relevant resources that can support you and your team). Examples of the latter resource type containing simple, practical guidance designed in the context of coastal ecosystems include:

Wicander et al. (2016a): Monitoring and evaluating adaptation interventions in Niumi National Park, the Gambia, and Sangomar Marine Protected Area, Senegal. A guide for protected area managers, staff and community associations

Sriskanthan et al. (2008): Socioeconomic and ecological monitoring toolkit: Huraa Mangrove Nature Reserve

STEP 4

Using and communicating the results

This section in brief

This section discusses the need to use M&E results to inform adaptive management, as well as to communicate results to external audiences, including donors, policy makers, communities and the wider adaptation community.

Using evaluation results to inform adaptive management

One of the most important functions of M&E is that the results enable you to manage your intervention adaptively: they help you to identify needs and opportunities for improving the EbA measures or to change them altogether if they are ineffective or causing maladaptation (see Section 2).

Once the monitoring results have been evaluated, you should discuss them with stakeholders involved in (and affected by) the implementation of your intervention (e.g. community representatives, protected area staff, local government, technical advisors), and decide jointly how to adjust interventions and management strategies. Adjust your monitoring plan accordingly and revise targets and indicators, if necessary. You should also re-visit and update the intervention's ToC, taking into account any relevant lessons learned from the evaluation.

As M&E is an iterative process, you can do such a review as often as is useful (e.g. if positive/negative changes become apparent from the data) or required (e.g. donor reporting periods), even if you have not yet monitored all your indicators. Unlike communicating evaluation results to external audiences (which is usually done towards the end of the intervention), internal learning from results can (and should) occur at any stage of the project cycle.

Mid-term reviews are often a good point at which to take stock as you will usually have implemented at least some of the EbA measures by then and should have some indication of outputs and early/immediate outcomes. Longer-term outcomes are likely not to become apparent until the end of the initial funding cycle for an intervention – or perhaps beyond. Therefore, you will need to infer longer-term outcomes and impacts based on your interpretation of the M&E data to date in relation to the causal pathways established in the intervention's ToC. Ideally, you will have identified ways in which to continue M&E activities beyond the initial funding period of an intervention (see Box 7), for example by securing funding for a second phase, anchoring M&E activities in local community groups or government offices, or partnering with universities/research institutions operating in the area (see Box 14).

Communicating to different audiences

It is important to consider the most effective formats for communicating M&E results to different audiences, including written materials, presentations, or more creative outlets (e.g. infographics, cartoons, photographic reporting – see Box 20). Make sure that results are presented in a simple manner and that they are accessible to a wide range of different users. Keep in mind the different backgrounds of your audiences (e.g. technical, non-technical, sectoral, cultural, linguistic) and the terminology they are likely to be familiar with. Some techniques for increasing accessibility include using plain language, removing information that distracts from the main message, and employing visual methods to draw attention to certain details. Developing an engaging narrative can also help communicate the story of your intervention.

Key external audiences for communicating M&E results include:

- **Donors:** A report prepared for the donor(s) will often be one of the main communication outputs of an intervention. It is important not to treat such reporting as a box-ticking exercise to fulfil funding requirements. Rather, it is an opportunity to communicate findings, to show what your intervention has achieved and what has been learned – both the positive and the negative.

Box — 20 — Multi-pronged communication of M&E results in Mount Elgon, Uganda

As part of the Global Ecosystem-based Adaptation in Mountain Ecosystems Programme (implemented by UNEP, UNDP and IUCN, funded by BMU-IKI), piloted in Uganda, Nepal and Peru, the Ugandan project devised a diverse and innovative set of strategies for communicating the results of the intervention. It used M&E results as a platform for engaging both with internal and external audiences, including by:

- *Sharing the outputs and outcomes of the EbA measures with stakeholders during 'reflection meetings', which were arranged as needed during the life of the project. These meetings were also broadcast on local FM radio to reach a wider group of people.*
- *Sharing successes through 'farmer-to-farmer' visits. These were a key learning tool for farmers both within and outside the project area.*
- *Featuring the project in annual International Mountains Day celebrations, which included radio and TV discussions that resulted in information being widely disseminated.*
- *Disseminating lessons learned from M&E through two climate adaptation centres that were built in the region, providing a learning resource on climate change adaptation for local communities.*

Many project teams are reluctant to report negative results. However, the majority of funders understand that project activities can be subject to a number of external influences, and that many uncertainties are associated with implementing EbA measures. Donors will therefore appreciate your reporting negative results, especially if you can demonstrate what you have learned from them and how you plan to make improvements.

- **Communities:** Effectively communicating results to local communities is key, as they are the stakeholders directly affected by the intervention. You can do so by holding public meetings that involve local community members and any relevant external stakeholders (e.g. technical experts). This offers an opportunity to discuss M&E results and to ensure they reflect locally perceived changes. You can use meetings with this wider group of stakeholders to discuss your planned management responses, which can help strengthen participatory management.

  As EbA measures often have impacts beyond just one locality (e.g. downstream communities affected by upstream activities), you should consider organising similar meetings with communities that are not the direct beneficiaries. This can help raise awareness of the wider effects of EbA on a landscape level and potentially build support for replication or wider implementation.

  When you organise meetings or workshops in communities, be sure to take any factors into account that might prevent key stakeholders from being able to attend (e.g. gender, ethnic minority, physical disability) and make any necessary adjustments to allow them to participate (e.g. by organising break-out groups or separate meetings for women only, or by assisting people with disabilities) in order to ensure this process is as inclusive as possible.

- **Policy makers:** Communicating M&E results to relevant policy makers is critical for several reasons. For one, being able to demonstrate EbA effectiveness (or at least aspects thereof) through concrete results will help build the 'business case' for EbA and raise the awareness of key decision makers about the potential of EbA as a viable adaptation approach.

  Greater buy-in from policy makers increases EbA's chances of being more widely adopted across sectors and institutionalised by governmental and non-governmental actors (including the private sector). Such institutionalisation is critical as it is often a key determining factor of adaptation (as well as conservation and development) finance, which is typically allocated based on national or subnational government plans. Securing long-term financing will both support the implementation of EbA interventions as well as M&E activities. It could also contribute to the scaling up of EbA interventions, which to date have largely been implemented at relatively small scales or as pilots. However, to have greater impact, EbA needs to be applied at broader scales, within and across ecosystems and political boundaries.

- **Wider adaptation community:** Given the many uncertainties associated with EbA, it is critical you share M&E results with the wider EbA and adaptation communities of practitioners and scientists. The evidence base can only be strengthened by sharing (the positive and negative) lessons on effectiveness. Not only will this help other interventions improve future EbA practices, but sharing what worked well in the design and implementation of your M&E system can also help improve M&E processes across EbA interventions. This will propel a virtuous cycle of generating more results that can feed into the evidence base. For example, sharing indicators or ways of maintaining long-term M&E processes could benefit the entire community.

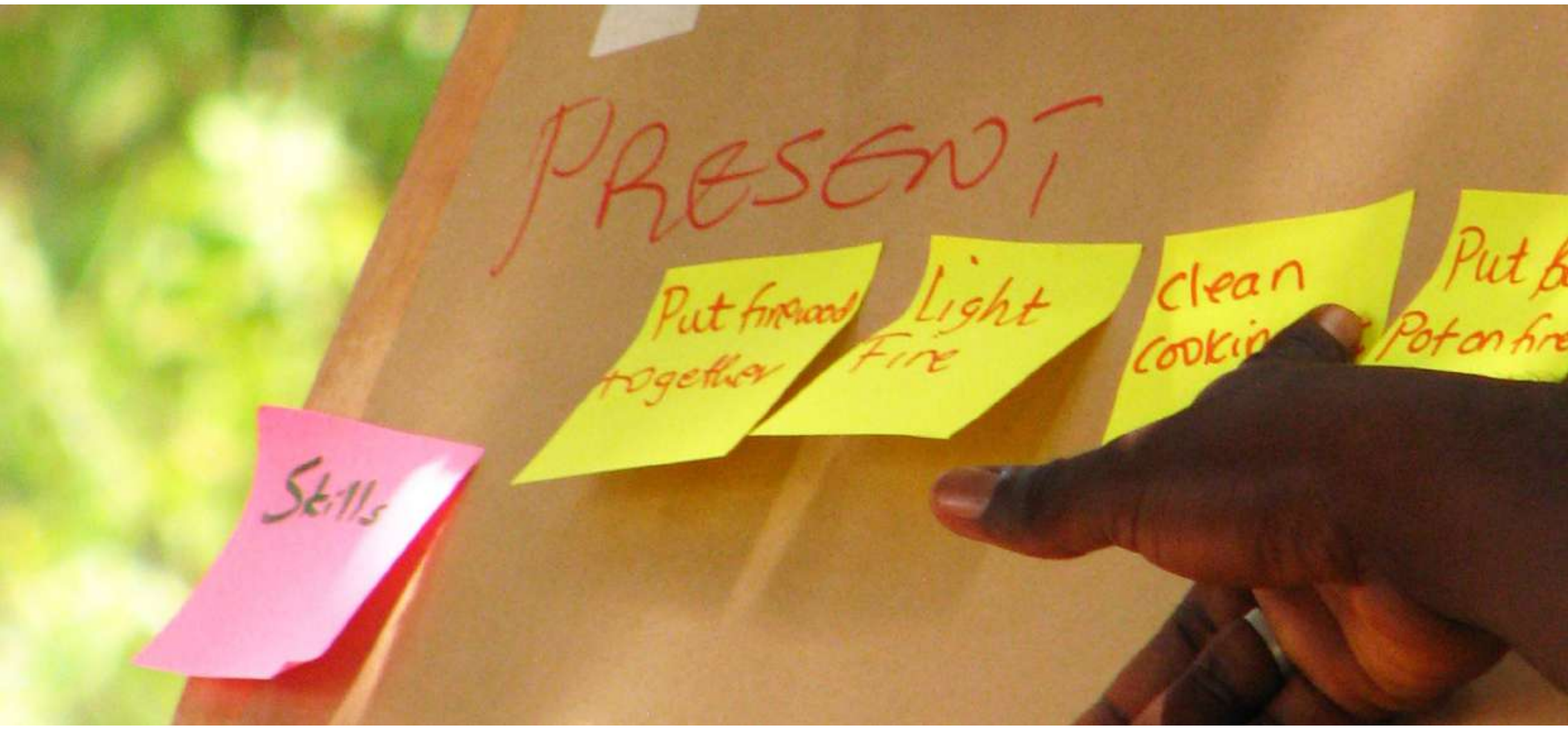
Additional useful resources

BetterEvaluation (2012): Communicating evaluation findings

This blog post on the BetterEvaluation website summarises some great tools, methods and tips for enhancing your communication and evaluation reporting.

Lammert et al. (2017): Effectively Communicating Evaluation Findings

The tool presents guidance and strategies that can be used to identify key audiences and understand their information needs, and to develop evaluation and communication plans that will generate useful information about the project's findings for different audiences. It was developed as part for the U.S. Department of Education, but contains much useful information to consider in the context of communicating evaluation results of EbA interventions.



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ANNEXES

Annex – 1 – Narrative description of results chain 1 of Theory of Change presented in Figure 4

Results chain 1: restoration or rehabilitation of drylands (e.g. grasslands, rangelands) to improve ecosystem function and provide key ecosystem services under climate change[1]

Results chain 1 presents an approach for restoring degraded areas to enhance ecosystem functioning and provide key ecosystem services (ES) to communities in the face of climate change. The goal is not to recreate historical dryland habitats, but to strengthen ecosystem capacity to adapt to, and recover from, perturbations caused by climate change. The underlying assumption of this results chain is that:

> *'If formerly degraded dryland areas with high biodiversity and ES value are enhanced and restored to increase the resilience of ecosystems to expected changes in climate, they will decrease the severity of climate change impacts on communities and improve livelihoods and well-being.'*

The chain begins with the completion of a restoration potential analysis and cost-benefit analysis (or equivalent) to determine whether restoration is a feasible option in any given context (6,7). These analyses also acknowledge that an appropriate reference ecosystem should be selected to

[1] Prepared by UNEP-WCMC, 2019.

guide restoration targets and provide a basis for monitoring and assessing outcomes (8). Upon selection of sites where restoration is feasible, key attributes that influence the capacity of a restored ecosystem to be resilient to climate change impacts are identified and assessed (9,10). Such attributes may include: extent of vegetation cover, soil quality, extent of erosion, connectivity to remnant vegetation and presence of nurse plants (3,11,14).

The extent to which restoration activities can be completed will depend on the level of resilience and degradation present at the project site(s) (8). For example, where damage is low and connectivity high, pre-existing biota should be able to recover after cessation of degrading practices (natural regeneration). In contrast, where damage is high, drylands can be highly resistant to restoration (3) and significant reconstruction of abiotic (e.g. erosion repair) and biotic components, including reintroduction of species, may be required.

Plant selection should aim to include a diverse mix of dryland species to maximise growth and survival under a changing climate. This is based on evidence that diverse species assemblages can mitigate reductions in plant annual net primary productivity during drought (15,16). Species selection should also aim to encourage genetic adaptation over time to increase resilience to climate change (17,18). Strategies include selecting a small amount of germplasm of species from a 'future climate' – that is, a region with a current climate similar to that which is predicted for the area being restored (17).

Documented lessons from dryland restoration programs indicate that planting multi-species assemblages on carefully selected sites alone is of little use if restoration activities are not implemented and managed effectively (4). This includes employing suitable techniques for site preparation, seed collection, propagation, revegetation, pest control and monitoring and evaluation (4,8). For example, successful restoration techniques can take advantage of existing plant patches within a degraded ecosystem to improve soil properties and alter microclimatic conditions. Alternatively, restoration may opt to plant species in a spatial configuration that resembles patterns observed in drylands that are known to optimise source-sink dynamics (1). It is imperative that those in charge of the restoration process are provided with training and technical support for all stages of dryland restoration.

The involvement of communities in co-management of dryland restoration activities can improve the chance of success (4). Involving local communities requires the completion of a stakeholder analysis to understand people's behaviours, values and attitudes towards change. This information, coupled with previous restoration analyses, is used to develop a community-based adaptation (CBA) programme (20). CBA is a community-led process, based on communities' priorities, needs, knowledge, and capacities which should aim to empower people to plan for and use biodiversity and ES to help them adapt to climate change (21).

As part of a CBA program, a number of interventions including campaigns, workshops and site visits may be implemented to raise awareness and improve knowledge about restoration, biodiversity, ES and their ability to mitigate the adverse effects of climate change (22-24). Once local stakeholders are aware and informed, training in the implementation of dryland restoration techniques, including site preparation, nursery establishment, planting and sustainable land management, can be completed.

Effective implementation of restoration techniques will lead to the ecosystem commencing on a trajectory towards recovery. The trajectory of recovery is the progressive improvement over time of key attributes (identified earlier in this results chain) in comparison to the reference ecosystem. A degraded ecosystem can be considered to have been restored when it regains sufficient biotic and abiotic resources to sustain its structure, ecological processes and functions with minimal external assistance or subsidy (25). If this desired state is maintained, it will interact with biotic and abiotic flows and social and economic interactions, to provide key ES (26,27). This includes water availability, increased productivity and reduced soil erosion, among others (4,28).

Ultimately, ecosystems that have been restored while considering climate change from the project outset are healthy, productive ecosystems, with a lower risk of ecosystem collapse (4). Restored ecosystems can, in turn, increase the contributions of ecosystems to livelihoods, land productivity, environmental services and the climate resilience of human and natural systems (4). Resilient ecosystems subsequently support the capacity of social-ecological systems to endure major and uncertain disturbances, such as drought, without severe, long-term consequences for livelihoods and the environment.

References corresponding to narrative of results chain 1:

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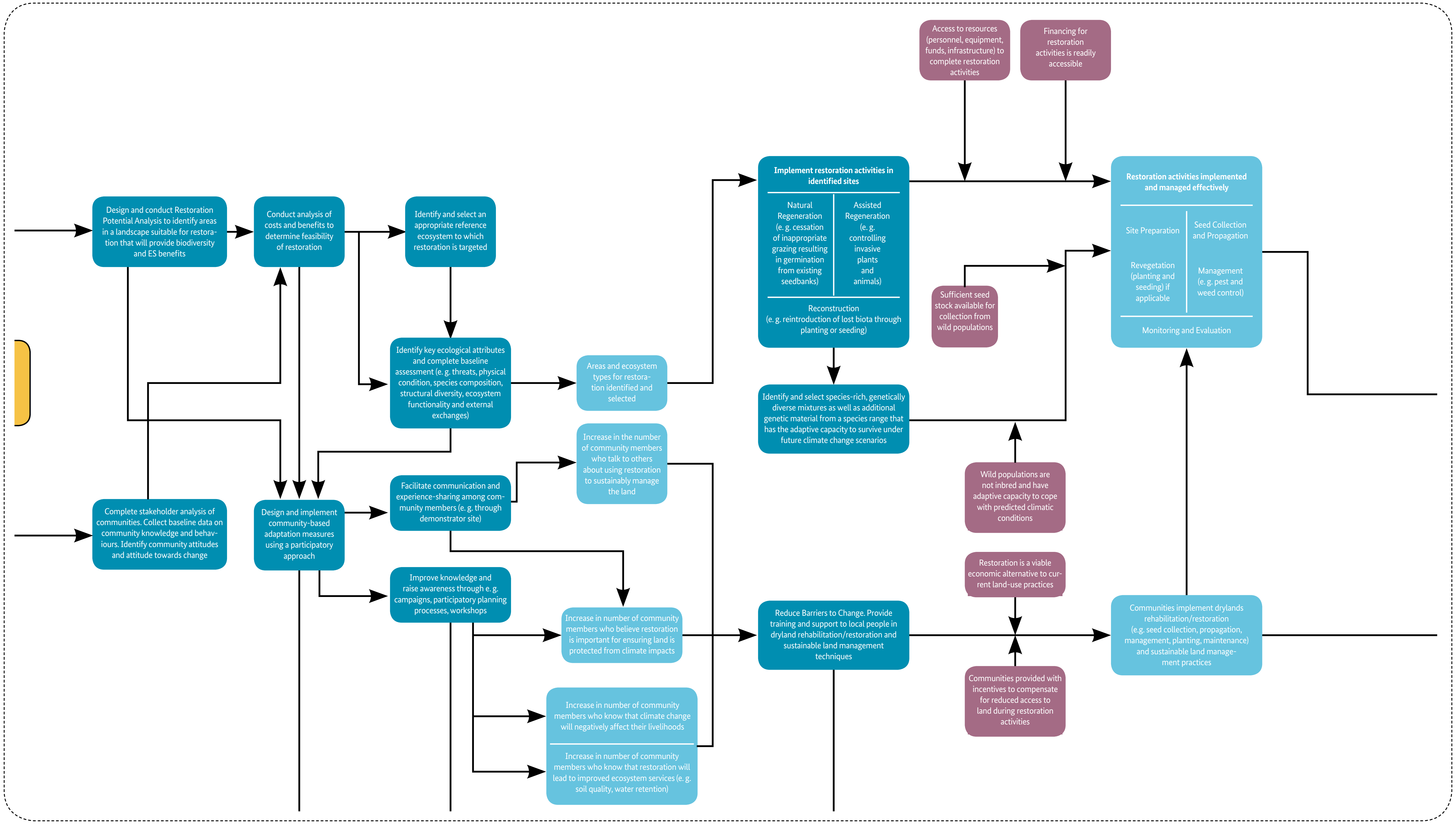
Annex—2—Expanded view of results chain 1 segment showing its activities and outputs (refer to Theory of Change presented in Figure 4)[2]



[2] Prepared by UNEP-WCMC, 2019.

Annex — 3 — Using remote sensing to support M&E: example indicators from Rwanda

As part of the Wetlands Ecological Integrity Assessment in Rwanda,[3] the ARCOS Network is using remote sensing to assess the status (state-pressure-responses) of soil, hydrology, land use/ land cover change. Many of the indicators (Table 4) being measured are also applicable to EbA interventions.

Table — 4 — Remote sensing indicators being measured under the Rwandan Wetlands Ecological Integrity Assessment

Category	No.	Level	Indicator	Details	Quantification
1. Hydrology	1.1	State	Surface water connectivity and flow	Inflow and outflow	GIS map showing rivers, streams and infiltration
	1.2	Pressure	Hydrologic alterations (stressors)	Settlements, and industries, potential sites for water abstraction for irrigation, and agriculture encroachment	Area of land under agriculture near wetlands ------ Density of settlements and industries ------ Large scale irrigation projects
	1.3	Response	Tree planting & restoration of vegetation cover	Types of soil and water management practices such as woodlots, agroforestry	Area of land under terraces and vegetation cover

Table continues on the next page -->

[3] See www.arcosnetwork.org/en/project/using-ecological-integrity-assessment-and-advanced-information-management-to-guide-wetlands-management-and-decision-making-in-rwanda

Table — 4 — (continued) — Remote sensing indicators being measured under the Rwandan Wetlands Ecological Integrity Assessment

Category	***No***	***Level***	***Indicator***	***Details***	***Quantification***
2. Soil	*2.1*	*Pressure*	*Soil acidification*	*Soil pH*	*Area (ha) of soil with pH < 5*
			Degradation	*Degraded area*	*Are (ha) of wetland that lost water/dried out*
			Exhaustion	*Nutrients and organic matter*	*Area (ha) of wetland with poor nutrient and organic matter content*
			Soil sealing	*Asphalt or concrete or settlement*	*Area (ha) of wetland with presence of settlements, asphalt or concrete*
3. Biota	*3.1*	*State*	*Vegetation community and types*	*Vegetation classification and distribution (map)*	*Vegetation community groups (density, types and distribution)*
	3.3	*Pressure*	*Extent of disturbance (invasive species)*	*Type and severity of invasive species*	*Area (ha) of invaded space*
4. Landscape setting	*4.1*	*State*	*Surrounding land use/land cover*	*Current and historical use of land*	*Primary use (agriculture, settlement, forest)*
	4.2	*State*	*Buffer zone state*	*Protected or not*	*Area (ha) of buffer zone protected*
	4.3	*Pressure*	*Population/ development pressure*	*Settlement, industries, agricultural intensification projects*	*Area of land under settlement, intensive agriculture* ------ *Number and size of industries*
	4.4	*Response*	*Wetland integration in land-use plan*	*Policies, law, strategic plan or master plan in place*	*Number of regulatory documents with provisions for wetland management*

Annex – 4 – Suggested monitoring equipment and notes on their use[4]

It is important that your measuring equipment is both practical and accurate. If, for example, a measuring bucket has the wrong volume markings, then that error will be present in every measurement. This is called systematic bias. Alternatively, a factor that introduces errors, which vary in severity each time randomly, is random bias. Both of these forms of bias can create significant problems when undertaking analysis and forming conclusions from your monitoring data, so be sure to take measures to overcome these.

The following list provides suggestions on useful general equipment that can support most monitoring activities, as well as some notes on their use:

- Pens/pencils

  Pencils are often the preferred choice for taking notes in the field as ink can run if it comes in contact with water.

- Note paper

  You should always bring extra note paper to record additional information regarding your sites. This will enable you to quickly write down anything that may have happened that does not fit in the description of your data collection sheets.

- Survey sheets
  - *Any questionnaires or data forms should be created in a standardised format before the interview/data collection starts.*
  - *Certain information should always be recorded on these, including: name of data recorders, date, time and location (ideally in coordinates).*

- Clip boards

  Survey sheets and note paper need to be legible for later data entry so, if possible, use a clip board with a waterproof cover to avoid damaging the paper.

- Global Positioning System (GPS)

  You can easily forget where you took measurements in the past, and markers such as tape can be blown away. Taking measurements with GPS is a very accurate and effective method of showing where you have collected data and how to find the same location for future measurements.

- Digital camera

[4] Adapted from Wicander et. al. (2016a).

- Example equipment for ecological monitoring (exact equipment needed will depend on the ecosystem you are working in and the data you need to collect in line with the intervention's indicators):
  - *Cast nets*
  - *1 litre buckets*
  - *Measuring tape (minimum length of 25m)*
  - *Highly visible tape to mark areas of interest*
  - *Nylon rope*
  - *Binoculars*
  - *Plastic containers of various sizes for specimen collection*

- Identification guides for birds, crabs, fish, mangrove species, mangrove associate plant species, mammals, other invertebrates (e.g. molluscs, butterflies, etc.)

Annex – 5 – Guidance on data management[5]

One person in your field team should be responsible for collating field data sheets. On each day of the monitoring exercise, the completed sheets should be reviewed as soon as is possible before the end of the day in order to highlight any inconsistencies/errors in data collection so that these issues can be resolved with the assistance of the data recorder concerned (e.g. any missing data can be collected during the next day's field work). Data sheets should be carefully stored and kept for reference even after data has been copied.

All data should be inputted electronically on the day that it is collected. If this is impractical due to lack of computer facilities, the data should be inputted within 2 weeks of returning from the field. All monitoring data collected should be stored in computerised format (e.g. Excel spreadsheet, MS Access or specialist monitoring package such as SMART (www.smartconservationtools.org)). If available, electronic, packaged databases (e.g. Oracle, Microsoft SQL Server, or Microsoft Access for PC users, or FileMaker Pro for MAC users), rather than MS Excel, should be used for quantitative data because they can better deal with large quantities of data, can more easily record changes over time, take less space, can be duplicated, and enable efficient, accurate data entry and retrieval, safe storage and better accessibility (IUCN, 2004). However, using databases requires specialist technical capacity that may not be available within your team, or they may incur additional costs if they are not open source.

Regardless of the data management system used, a number of procedures are recommended when managing data electronically (adapted from IUCN, 2004, and Sriskanthan et al., 2008):

- **Data collection:** Agree on the terms, format and abbreviations before data are collected, and use them consistently. Always indicate measurement units and be clear about how dates are to be recorded. Maintain a logbook as a back-up. Fill in all fields on data sheets to show that no data are missing and note any problems or irregularities. Transcribe data onto clean datasheets after returning from the field if necessary and make photocopies so that the originals can be stored.

  Image files should also be named in a way that allows easy reference, including a description of what the photo is depicting, the date the photo was taken and a location reference, if possible. For example:
  - File name: brug_gym_15apr15_SQ3; information: Bruguiera gymnorhiza, 15 April 2015, strip quadrat 3
  - File name: plntd_seedlings_17apr15_nurs; information: planted seedlings, 17 April 2015, nursery

- **Designing the database:** This should be done jointly by the staff responsible for the monitoring, research or management programmes and those responsible for information tech-

[5] Adapted from Wicander et. al. (2016).

nology. A management-oriented database must have data entry, verification and analysis pages designed for easy use by non-specialist staff. Focus on what is relevant or essential for the analysis so that the required outputs are obtained. Numerical data fields are preferable for analysis; comments can be added in text fields.

- **Data entry:** A key aspect of data entry is quality control. The following procedures are recommended:
  - Enter data as soon as possible after collection; it is best if the data collector does this or at least is available for consultation.
  - Enter raw data. These can be aggregated later to produce summaries (e.g. daily averages, site totals), but it is generally impossible to extract raw data from a summary.
  - Be consistent, as abbreviations, misspellings and data entered in a different format will not be recognised and risk being lost.
  - Customised data-entry forms assist by:
    - allowing (or requiring) users to select entries from a list (e.g. species, pre-determined ranking systems) which makes data entry quicker and ensures that the same terms are used every time:
    - standardising formats (e.g. the user has to enter dates as dd-mm-yy) and preventing entry of text into numerical fields:
    - automatically filling in data fields from entries made in other fields, which speeds up data entry and provides additional checks.

- **Data verification:** Summary analyses of data should be carried out regularly to check that the data being collected are what is required, and that data entry is accurate and complete.

- **Data archiving:** Data must be archived for future users and backed up in case of damage or loss. Back-ups are short-term copies of current work. An archive remains in storage as a record of a database at a particular time, and should be conducted regularly, perhaps every few months. Back-ups are done much more frequently (e.g. weekly) and a new back-up is written over the old one.

FEBA
Friends of Ecosystem-based Adaptation

About the Friends of EbA

FEBA is an informal network of more than 70 institutions with an interest in sharing knowledge and collaborating on Ecosystem-based Adaptation. Members work together through joint workshops and meetings at major international conferences, and collaborative working groups on priority topics for EbA knowledge generation and policy informing.

This document is an output of the FEBA Working Group on Monitoring & Evaluation.

The below FEBA members were involved in its development or endorsed its publication: