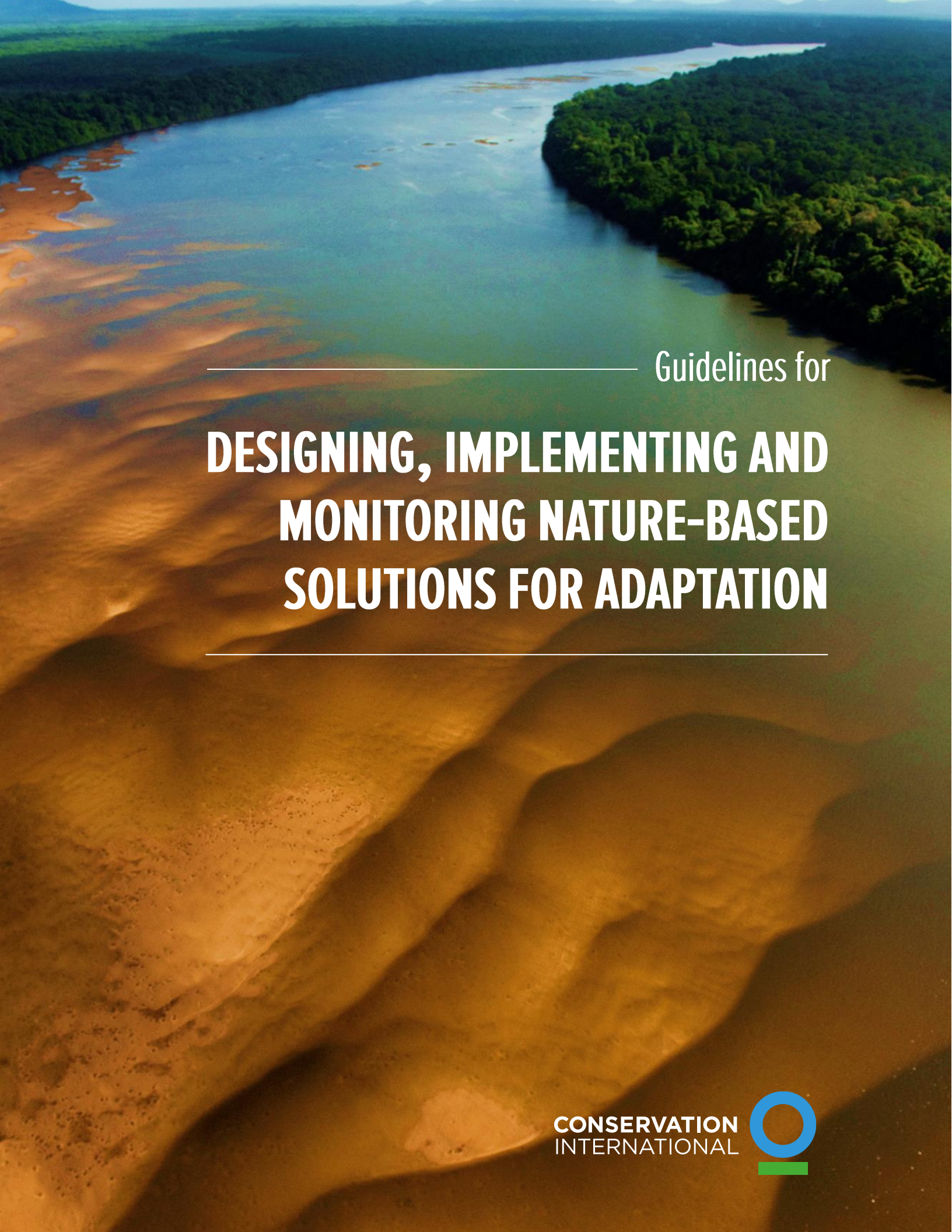

Guidelines for

DESIGNING, IMPLEMENTING AND MONITORING NATURE-BASED SOLUTIONS FOR ADAPTATION

CONSERVATION INTERNATIONAL

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Cover page: Essequibo River, the longest river in Guyana, and the largest river between the Orinoco and Amazon.

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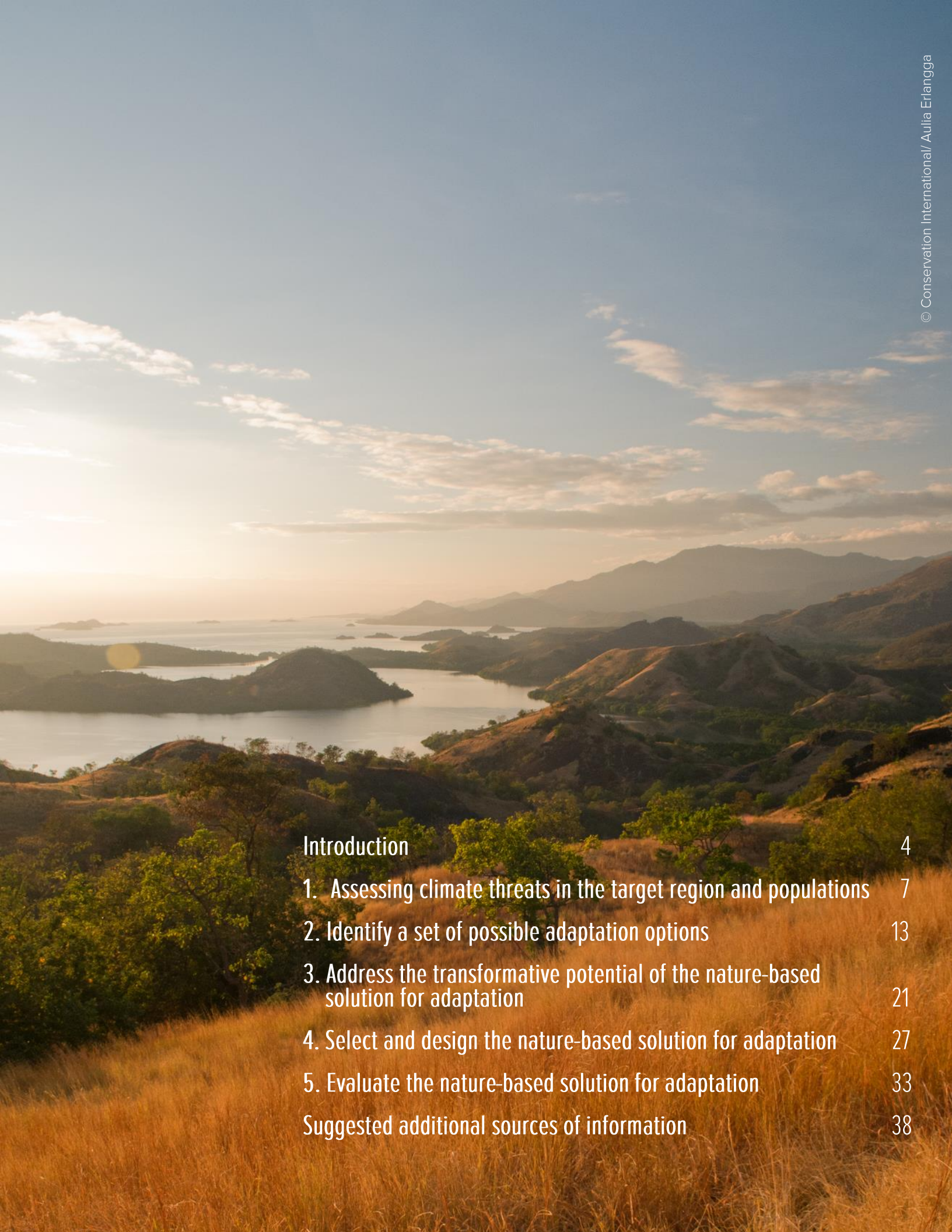


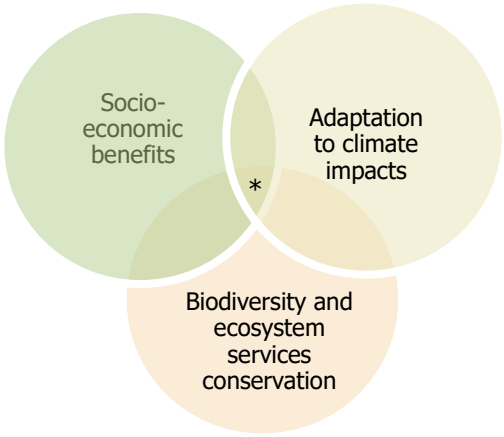
INTRODUCTION

Why is climate change adaptation important?

Climate change adaptation refers to the process of adjusting to the actual or expected variations in climate and its effects. Although climate change mitigation is needed to limit temperatures increases to 1.5°C above pre-industrial levels, climate adaptation is essential to minimize the impacts that have already occurred, and the additional warming that is locked in the system. According to the Global Commission on Adaptation, without climate change adaptation, the number of people who may lack enough water, at least one month per year, is estimated to reach 5 billion by 2050. The growth in global agriculture yields is expected to decrease by up to 30 percent by 2050. The 500 million smallholder farmers around the world will be most affected due to their limited capacity and resources to adapt. More than 100 million people within developing countries could be pushed below the poverty line by 2030. In addition to that, rising seas and greater storm surges could force hundreds of millions of people in coastal cities out of their homes, with a total cost to coastal urban areas of more than $1 trillion each year by 2050 (Global Commission on Adaptation 2019[1]). The impacts on smallholder farmers and the poorest are, however, likely to be much worse due to the additional stress of the COVID-19 pandemic. Nevertheless, it is important to understand that adaptation is not an issue of the future. Climate change events have impacted, in average, 180 million people per year (UN 2020[2]) in the past 2 decades and actions to help the most vulnerable must happen now.

What is nature-based solutions for adaptation?

Nature-based solutions for adaptation are actions to protect, sustainably manage, and restore natural or modified ecosystems, that address societal challenges related to climate change, simultaneously providing human wellbeing and biodiversity benefits (IUCN 2020[3]). For an adaptation intervention to be considered nature-based, it must:
(1) address one or more specific climate change threats or impacts;
(2) include conservation, restoration and/or improved management of natural or modified ecosystems and/or biodiversity; and
(3) aim to help a vulnerable population adapt to the impacts of climate change, such as impacts on water and food insecurity, increased risks of disasters, human health, and livelihoods.



Some examples of nature-based adaptation actions include the conservation of mangroves to protect people against storms made more severe by climate change, the reforestation of degraded areas to prevent floods under changing climatic conditions, and the use of shade trees in coffee plantations to maintain agricultural production even as temperatures rise.

Why are guidelines for nature-based solutions for adaptation needed?

This set of guidelines on best practices for the identification, implementation and monitoring of nature-based solutions for climate change adaptation can improve consistency and the ability to compare and aggregate adaptation results achieved through NBS initiatives implemented by organizations and governmental bodies. Such consistency and aggregation can help increase the evidence base of nature-based solutions for adaptation and track adaptation goals at multiple levels, from individual project sites to global action. A key barrier to the implementation of nature-based solutions for adaptation at scale has been an underdeveloped evidence base and lack of standard methods. Addressing these issues could ultimately lead to increased funding and scaled-up implementation of this important approach.

[1] Global commission on adaptation. 2019. Adapt now: a global call for leadership on climate resilience.
[2] United Nations office for disaster risk reduction. 2020. Human cost of disasters: an overview if the last 20 years (2000-2019).
[3] IUCN Global Standard for Nature-based Solutions: a user-friendly framework for the verification, design and scaling up of NbS : first edition

What does this document cover?

This document provides general guidance and good practices for the identification, design, implementation, monitoring and evaluation of nature-based solutions for adaptation, especially for projects that already have the financial resources to implement such interventions. This document also includes information on vulnerability assessments, which are important for identifying the climate threats and impacts that nature-based solutions for adaptation meant to address. Stakeholder engagement is also addressed as it is key to ensuring that the visions of partners, governmental bodies and local communities are embedded in all the stages of the project.

The document is divided into five stages, each one addressing an important aspect of a project cycle for adaptation to climate change. In each stage, we list a set of key activities and the best practices for implementing them. We start each section with a description of the purpose and importance of the stage. We also provide examples in boxes to demonstrate some of the activities and best practices suggested.

The guidelines provided in this document can be used in a variety of different ecosystems and socioecological contexts. Please note that there are now a set of guidelines for design and effective implementation of Ecosystem-based approaches to climate change and disaster risk reduction developed by CBD secretariat and partners (Convention on Biological Diversity 2018[4]), which present complimentary information to that presented here.

What needs to be considered before this document is used?

Before you start a nature-based solution for adaptation, and before you conduct the five stages proposed here, please first check the potential applicability of a nature-based solution for adaptation in the target area. For example, ask yourself and the team if the target area needs an intervention and has the minimal biophysical conditions for a potential successful implementation. Examples of questions that should be asked upfront include: Do local communities support the implementation of nature-based solution for adaptation? Can restoration be successful is this type of terrain? Does the nature-based solution for adaptation have the highest potential to help people adapt, compared to actions that are not based on nature?

Figure 1. The stages of adaptation design, implementation and evaluation.

[4] CBD. 2018. Voluntary guidelines for the design and effective implementation of Ecosystem-based approaches to climate change adaptation and disaster risk reduction. 18 p.


1
ASSESSMENT
of climate impacts

STAGE I.

ASSESS CLIMATE THREATS IN THE TARGET REGION AND POPULATIONS

QUESTION TO BE ANSWERED:

- What are the impacts of climate change on the target region and target human population (s)?

GOALS OF THIS STAGE:

- To identify how climate threats (long-term changes in climate and/or extreme events) may negatively affect people either through the direct impacts on the system (e.g., damage to crops) or through the impacts on ecosystem services or processes (e.g., reduction in water provision, pollination, food provision and coastal protection);
- To identify the target population that exists within or outside the region (e.g., fishermen, farmers, coastal residents, downhill water users, city residents, women, children, hillside residents, or other stakeholders) that are or will be impacted by climate threats, who require adaptation support;
- To have a deeper understanding of how climate change and extreme weather events impact the target population(s) either through the impacts on the systems, or through the impacts on ecosystems and their services and processes.

WHY THIS STAGE IS NEEDED:

- The identification of the climate threats, and how they are or will affect the target region and the target population, are key for selecting nature-based solutions for adaptation as this type of approach aims to help the target population (or a subset of the target population) to adapt to a specific threat or set of climate threats, by conserving, restoring or managing ecosystems and biodiversity to increase the resilience of the target population to climate change.

WHEN TO SKIP THIS STAGE:

- If project members already know the impacts of climate change on people (through the direct impacts on the system or through impacts on ecosystem services or ecosystem processes), as well as the target population that the nature-based solutions for adaptation will target.

OUTCOMES OF THIS STAGE:

- List of potential changes in climate and/or extreme events (current, potential and expected changes over a specific time period);
- Potential impacts of climate change on people (through the direct impacts on the system or indirectly through impacts on ecosystem services or ecosystem processes);
- The identification of the target population;
- A map that presents areas where the target population have low, medium and high vulnerability to climate change, and an indication of what impacts of climate change and extreme weather events they are vulnerable to (e.g., vulnerable to coastal erosion, vulnerable to water shortages, vulnerable to crop failure).

PROPOSED ACTIVITIES:

1.Identify the current and expected changes in weather and climate in the region, and how those changes have impacted or may impact people's lives or livelihoods.

- **Why?** The identification of the impacts of a changing climate and who may be most impacted (directly or through impacts on ecosystem service or processes) is important for defining the potential adaptation actions that need to be implemented.
- Conduct a desktop study of available scientific information identify how current and expected extreme weather events and long-term changes in climate have affected or will likely affect people's lives and livelihoods in the future. These effects may be direct, or indirect through impacts on ecosystems and their services or processes in the region (examples of how climate change may impact people's livelihoods are in Box 1).

Box 1. Examples of changes in weather and climate and their impacts on people's lives and livelihoods

Stronger and more frequent storms damage the assets of **coastal communities** and infrastructure.

More intense rainfall events produce landslides that damage the assets and infrastructure of **urban communities or those living in hillsides.**

Decreases in rainfall reduce crop production affecting income and food security of **farmers.**

Changes in ocean temperature affect the distribution of certain fish species and livelihoods of **fishermen.**

Decreases in rainfall and increases in temperature reduce water availability to **communities downstream.**

2. Identify the target population(s) whose lives and livelihoods have or will be impacted by climate change

- **Why?** The revision of the information with scientists and local stakeholders can be used to validate what was found and to identify and incorporate information that was not previously considered **(see Box 2 for good practices on stakeholder engagement).**
- Examples of potential target populations include:
    - **coastal communities** whose lives and assets may be impacted by hurricanes.
    - **urban communities** or **those living on steep hillsides** whose lives and assets may be impacted by landslides caused by strong rainfall events.
    - **smallholder farmers highly dependent on rain-fed agriculture** who may be impacted by changes in temperature and precipitation as those affect crop and livestock production,
    - **fishermen** who may be impacted by the migration of fish species to other areas driven by changes in ocean temperature.
    - **communities downstream** who may be impacted by a reduction in water availability caused by an increase in temperature and decrease in rainfall.
- Carefully consider how gender may play a role on the way the extreme weather events and long-term changes in climate might impact the livelihoods of men and women in different ways.

Box 2. Good practices for stakeholder engagement

Ensure local participation in workshops conducted in all stages with invitations to representatives of different sectors:

- Community members: leaders (both men and women) of the different communities and/or villages, and others who are respected by villagers (this is culturally contextual, e.g., elders, teachers). *When access to indigenous and local knowledge is needed, it has to be done in ways that comply with the principles of free, prior, and informed consent, which is critical to ensure effective participation in the project.*
- Municipal staff: government staff working at the municipal office.
- Members of different governmental departments, such as the Department of Agriculture, Rural Development, Department of Forest Protection, Department of Environment, Agricultural Extension agents, among others.
- Members of relevant unions and private sectors, such as Women's Union, Farmers' Union, cooperatives, private enterprises.

Note: Strive for gender representation of about 50% women and men. Women who are ordinary members of women's or farmers' unions should be invited to join the workshops.

Keep stakeholders informed on activities and next stages.

- Ensure frequent communication with all stakeholders, and that these individuals receive and pass on relevant information in a timely and language-sensitive manner.

Disseminate results and experiences.

- Publish results as presentations, policy briefs, peer-reviewed publications and/or lessons learned documents; those materials must be in the local language and be made available to stakeholders.

3. Identify, in collaboration with stakeholders, the target population that the adaptation action(s) may help adapt.

- **Why?** To identify who we need to design the nature-based solutions for adaptation for.
- Review, with the help of stakeholders, such as local authorities, local communities, and researchers, the list of populations that may be impacted by climate change. From this review, identify the target population(s) that may be the most impacted by climate change.

4. Assess vulnerability of the target population to climate change using the selected methodology.

- **Why?** To identify the exposure, sensitivity and adaptive capacity of the target population to climate change.
- Assess each component of vulnerability (exposure, sensitivity and adaptive capacity). Assigning a score to each component of the target community is highly recommended so scores can be tracked through time and thus used in the monitoring and evaluation of the adaptation action. Ideally the scores should be calculated for the highest resolution as possible (e.g., pixels, households, communities).
- Even though there is not a standard methodology to calculate the vulnerability score, it could be a rating system for each of the three components. The vulnerability score is calculated as the sum of exposure and sensitivity scores (where a high number means a high exposure and/or high sensitivity) minus the adaptive capacity score (assuming that a high number means a high adaptive capacity). Please note that the scores can then be transformed to a grading system (not vulnerable, marginally vulnerable, highly vulnerable, severely vulnerable) (see Map 1).

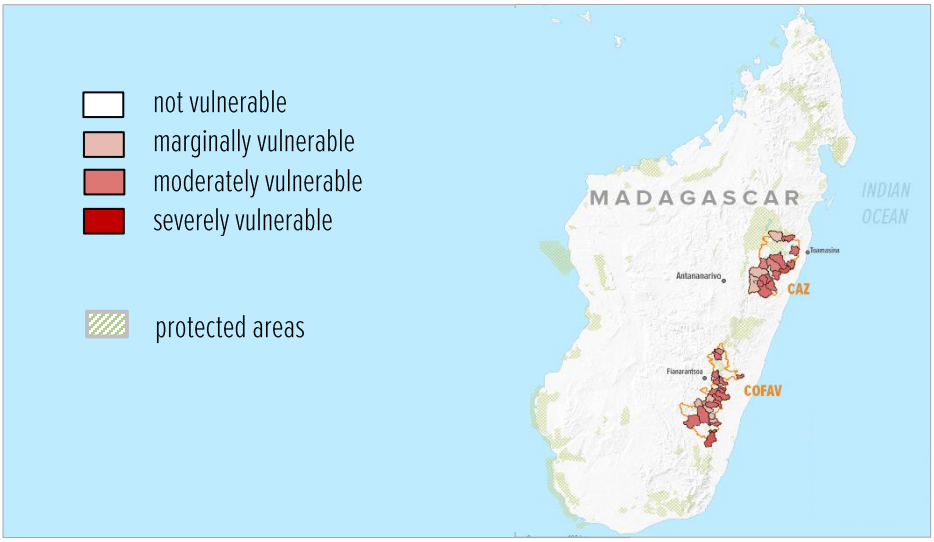
Table 1. Components of vulnerability to climate change, a description of each component and possible ways to assess it.

Component	Description	Ways to assess it
Exposure	Refers to changes in climate or weather (e.g., rainfall changes, temperature changes, changes in sea level, increased incidence of hurricanes and droughts, etc.) that are affecting or will affect the region where the target population lives.	- historical climate-related data -modeling work on how temperature and rainfall may change or studies/interviews on people's perceptions of changes in weather and climate. -Potential sources of data: Climpact
Sensitivity of the system or ecosystem services	Refers to the impacts that changes in climate or weather cause on the livelihoods of the target population (e.g., by affecting crop production, fisheries, and by affecting ecosystem services and processes that they rely on (i.e. water, wild food, pest control, ecotourism, nutrient cycling).	-modeling of how changes in temperature and precipitation may affect crop production, provision of water and other ecosystem services -interviews of stakeholder's perceptions on how extreme weather events have changed crop productivity, water availability or other aspects of their livelihoods. - Potential sources of data: IPCC reports, NAPAS and NAPs of countries, World Bank's Climate Change knowledge portal.
Adaptive capacity of the target population	Refers to whether the target population can adjust to the changes in climate and weather and its impacts. Capabilities include human, social, financial, physical, and natural capital, institutions and entitlements, knowledge and information, decision-making and governance.	- census data that can inform the adaptive capacity of the target population (i.e. literacy, income, ownership of assets) that are available to the target population. - interviews with local communities' members or local experts to get information on aspects related to adaptive capacity when census data is not available or incomplete - Potential sources of data: Living Standards Measurement Study; IPUMS; Conservation International's Resilience Atlas

5. Prepare a map that shows the vulnerability scores for the unit of analysis (e.g., pixels, landscapes, households, communities)

- **Why?** This map, developed by overlapping the multiple variables needed to calculate the vulnerability score, will visually help to identify those who are the most vulnerable in the target region.
- Descriptions of the information gathered, methods used and what the score means should clearly explain what factors contribute to high vulnerability. An example of such map can be found below.

Map 1: Vulnerability of smallholder farmers to drought events in CAZ and COVAF, Madagascar, based on surveys in 2,729 households, that include information on exposure, sensitivity and adaptive capacity of farmers (Source: Sustainable forested landscapes in Eastern Madagascar Project).



6. Consult the project team and stakeholders to review and validate the information gathered on the vulnerability assessment.

- **Why?** To make sure stakeholders agree with the findings of who are the most vulnerable within the target population, the factors that lead to this vulnerability and what impacts associated with climate change and extreme weather events they are most vulnerable to.
- Invite communities, local leaders, technicians, scientists and other stakeholders to participate in a meeting where information on vulnerability will be shared and discussed (see Box 3 for examples of stakeholders to invite).
- Present the final map of vulnerability, as well as the variables that were used to calculate each of the 3 components of vulnerability (exposure, sensitivity, adaptive capacity).

Box 3: Examples of stakeholders to be consulted.

- **Local stakeholders:** associations based on livelihoods (farmers, fishers, forest users), women's groups, indigenous groups, community leaders, local business and companies, landowners.
- **NGOs:** conservation, food security, healthy and development organizations.
- **Government:** (local and national) Public agencies (water, agriculture, forestry, fisheries, health, disaster management), statistical offices, meteorological offices.
- **Academia:** Members of local universities, agricultural research organizations, academics with research on the target area and research institutes.
- **Private sector**: representatives of businesses that operate in the target region.

2

IDENTIFICATION
of adaptation actions

STAGE II.

IDENTIFY A SET OF POSSIBLE ADAPTATION OPTIONS

QUESTION TO BE ANSWERED:

- What are the most appropriate adaptation actions to address climate change impacts in the target region and population?

PURPOSE OF THIS STAGE:

- To identify the adaptation outcome to be achieved;
- To identify the adaptation options (including Nature-based solutions for adaptation) that could help the most vulnerable communities achieving the adaptation outcome;

WHY THIS STAGE IS NEEDED:

- To ensure that the suite of adaptation actions are the best options to help the target population adapt to climate change and achieve the adaptation outcome.

WHEN TO SKIP THIS STAGE:

- If you already know which adaptation actions will be implemented to help the most vulnerable people adapt to climate change.

OUTCOME OF THIS STAGE:

- Descriptions of the possible adaptation actions that could be used to address the climatic threats and impacts on the target population, and descriptions of how they could help the most vulnerable people adapt to climate change.

ACTIVITIES PROPOSED FOR THIS STAGE:

1. Identify the adaptation outcome to be achieved to help the target population address the climate threats.

- **Why?** The identification of the adaptation outcome based on the impacts of climate change on the target population is critical for informing which adaptation measures to implement.
- Based on the impacts of climate change on the target population, identify the adaptation outcome that should be achieved. The list of adaptation outcomes presented in Table 2 were based on studies that implemented Nature-based adaptation solutions and the outcomes that were expected. As those guidelines were prepared specifically for nature-based solutions for adaptation, the stages presented here focus on this type of approach.

2. Discuss with the project team and with target local stakeholders a shared future vision and what actions are needed to achieve the desired adaptation outcome.

- **Why?** To ensure that the adaptation action to be implemented has the highest chance to be successful, and to adjust or disregard actions that may not be sufficient in achieving the desired adaptation outcome.
- Develop a common and shared understanding of "where we are today and where we want to be". The gap between the current and future situations represents the adaptation actions that need to be implemented. Please keep in mind that, in certain situations and contexts, nature-based solutions for adaptation are not the most appropriate type of intervention to address the vulnerability of the target population and to achieve the adaptation outcome.

3. Conduct a consultation with stakeholders to identify if and which nature-based solution(s) for adaptation can be implemented (examples of stakeholders are listed in Box 3).

- **Why?** The knowledge and the different perspectives that stakeholders have will help to identify the nature-based solution for adaptation that can be successful in achieving the adaptation outcome.
- Identify, together with the stakeholders, the suite of Nature-based adaptation options that can be implemented to achieve the adaptation outcome. For example, if the target population are communities living on hillsides whose lives and assets may be impacted by landslides caused by strong rainfall events, and the adaptation outcome to be achieved is landslide risk reduction, what is the suite of Nature-based adaptation options that could be implemented to address these risks? The suite of Nature-based adaptation options can then be prioritized, based on the number of beneficiaries, co-benefits provided and risks.
- Note: **This activity and the previous workshop/meeting could be organized at the same time**

Table 2. Adaptation outcomes of different nature-based solutions for climate change adaptation.

Adaptation outcome	Description of the outcome	Examples of Nature-based solutions for adaptation
Disaster risk reduction 	Reduced loss of assets of coastal communities and infrastructure due to extreme weather events	Establishment of marine non-take zones; Restoration of mangroves
	Reduced loss of assets of urban and non-urban communities and infrastructure due to extreme weather events	Protection and restoration or high-altitude forests; Soil conservation on steep slopes
Food security 	Reduced impacts of climate change on ecosystems that maintain livestock production, marine and freshwater fisheries, and natural products for household consumption	Restoration of coral reefs; Rangeland management
	Reduced negative (and direct) impacts of climate change on livestock and crop production (mainly through physical damage) for household consumption	Implementation of agriculture practices (e.g. agroforestry and soil conservation)
	Reduced impacts of climate change on ecological interactions (pest, diseases, pollination) that affect crop and livestock production for household consumption	Implementation of agriculture practices (e.g. agroforestry and soil conservation)
Livelihood improvement 	Reduced impacts of climate change on ecosystems that maintain livestock production, marine and freshwater fisheries, and tourism for profit	Restoration of coral reefs; Rangeland management
	Reduced negative (and direct) impacts of climate change on livestock and crop production (mainly through physical damage) for profit	Implementation of sustainable agriculture practices (e.g., agroforestry and soil conservation)
	Reduced negative impacts of climate change on ecological interactions (pest, diseases, pollination) that affect crop and livestock production for profit	Implementation of sustainable agriculture practices (e.g., agroforestry and soil conservation) and planned grazing practices
Water security 	Reduced impacts of climate change on water quality and quantity for human use	Forest restoration; Spring restoration and removal of alien invasive species
Human health and security 	Reduced impacts of climate change on the incidence of vector borne diseases	Restoration of swamp forests; development and restoration of overflow areas and reed marshes
	Reduced negative health effects (respiratory distress and heat stroke) due to temperature extremes and fires	Establishment of green roofs and tree planting in urban areas
	Reduced loss of lives in urban and non-urban communities due to extreme weather events	Protection and restoration or high-altitude forests
	Reduced loss of lives in coastal communities due to extreme weather events	Establishment of marine non-take zones; Restoration of mangroves

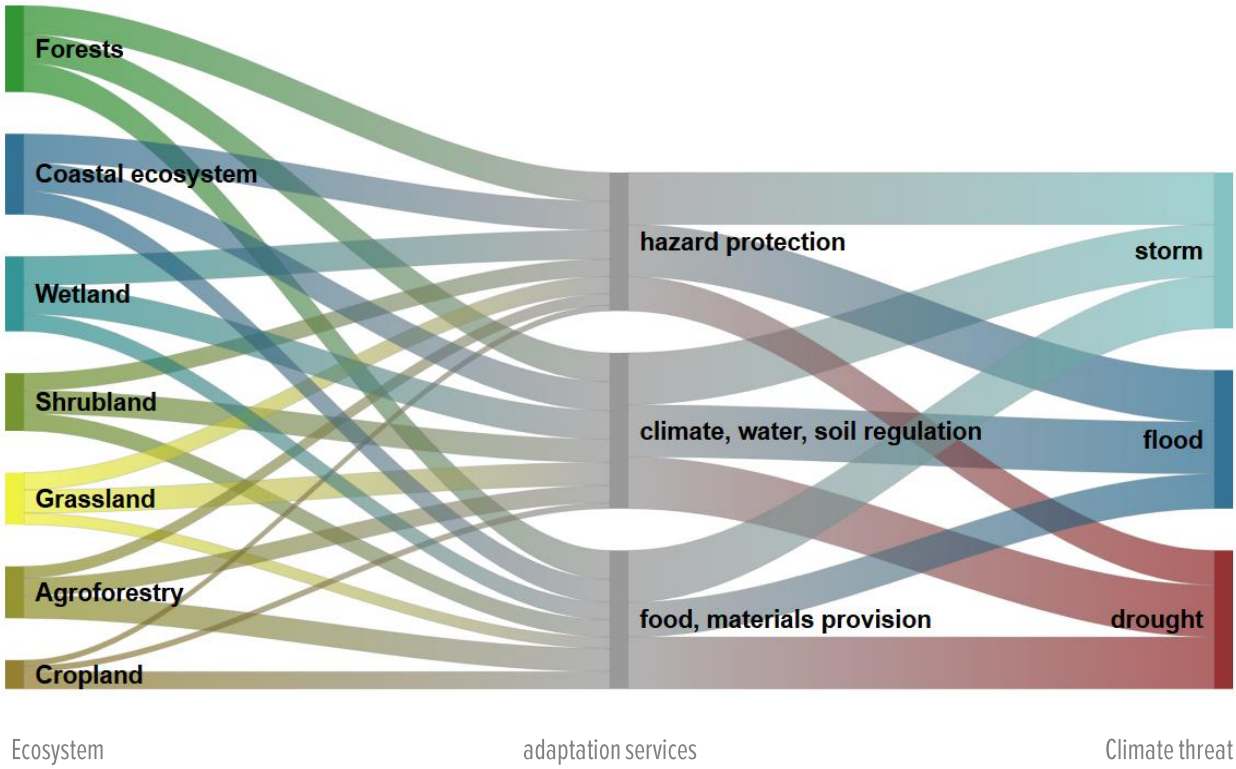


Figure 2: Several ecosystems provide a variety of benefits that can contribute to people's adaptation. The thickness of the line represents the provision of an adaptation service by a particular ecosystem and the potential of an adaptation service to address a specific climate threat (Source: survey with adaptation experts conducted by Conservation International, 2020).

4. Review literature on current and future impacts of climate change on ecosystems and biodiversity that are the focus of the nature-based solution for adaptation.

- **Why?** Climate change can impact the ecosystems and biodiversity, potentially undermining their ability to reduce the vulnerability of people to climate change. For example, an increase in sea temperature may negatively impact coral reefs and reduce the ability to provide an adaptation outcome such as coastal erosion risk reduction. Understanding those impacts are important to determine the types of management that should be done and whether those ecosystems and biodiversity can in fact help people adapt under changing climatic conditions.
- Assess the status of the ecosystem and biodiversity that are the focus of the nature-based solution for adaptation (e.g., mangrove, coral reefs, cloud forests, specific plant species used in restoration and agroforestry).
- Understand how climate change may impact those ecosystems and biodiversity that are the focus of the nature-based solution for adaptation through existing studies and/or expert opinion. Please note that if the ecosystem or biodiversity that will be the focus of the nature-based adaptation intervention is highly vulnerable to climate change, this information needs to be considered during the selection and design of the nature-based adaptation solution (see item 6). For example, if restoration needs to be implemented, the use of plant species that cannot survive in future climate conditions should be disregarded.

5. Identify complementary measures (infrastructure, technical capacity, policies and regulations) to each of the Nature-based solutions for adaptation, if necessary.

- **Why?** Nature-based solutions for adaptation alone may not be able to deliver the desired adaptation outcome.
- To be successful, nature-based solutions for adaptation may be also require the implementation of infrastructure measures (e.g., construction of breakwater), technical capacity building efforts (e.g., on agricultural practices) or development of new policies and regulations (e.g., on the protection of ecosystems) (see Table 3). This is particularly important for developing transformative approaches (see stage III: transformative potential).

Table 3. Examples of complementary measures that could potentially be implemented in combination with the Nature-based solutions for adaptation to achieve adaptation outcomes.

Risk	Nature-based adaptation solution	Complementary measure	
Storm surges	Coral protection	Construction of seawalls	reduce the loss of assets of coastal communities and infrastructure located by physically protecting the communities against stronger and more frequent storms
Extreme rainfall events	Implementation of agroforestry	Training for farmers on how to incorporate and maintain trees in agricultural systems	reduce the loss of agriculture productivity due to extreme rainfall events

6. Identify how the selected intervention (combined with complementary measures if applicable) can help the most vulnerable to adapt to climate change within the target population.

- Why? The articulation of how the nature-based solution for adaptation will help achieve the desired adaptation outcome is key to preparing the theory of change, and for monitoring and evaluation purposes.
- Examples of such articulation include:
    - The restoration of mangrove (*nature-based solution for adaptation*) to reduce the risk of coastal erosion (*desired adaptation outcome)* of coastal populations (*target population*) resultant from more frequent storm surges (*climate threat*);
    - Implementation of trees in agricultural lands (*nature-based solution for adaptation*) to improve the food security (*desired adaptation outcome*) of smallholder farmers (*target population*) due to extreme rainfall events (*climate threat*).

7. Identify the potential number of beneficiaries, co-benefits and tradeoffs of the nature-based solution for adaptation, and potential impacts on biodiversity identified through consultation with stakeholders.

- **Why?** Nature-based solutions for adaptation provide multiple biodiversity, mitigation and social co-benefits (Box 4). The identification of those variables can help select the intervention to be implemented among the suite of possible Nature-based solutions for adaptation.
- Some factors to consider are included below. If time and resources are available, additional data should be compiled to address each of them. If time and resources are limited, a simple ranking of the different nature-based adaptation options regarding each one of the following is sufficient:
    - Potential number of direct beneficiaries with the implementation of the nature-based solution for adaptation (e.g., people whose vulnerability will be reduced by the nature-based solution for adaptation);
    - Biodiversity co-benefits (e.g., key species that may be protected or re-introduced to the area due to the Nature-based solution for adaptation; facilitation of habitat connectivity, contribution of NBS to the conservation of threatened species or ecosystems);
    - Mitigation co-benefits (e.g., potential carbon stored, or emissions avoided).

8. Identify potential risks and constraints to and trade-offs of the implementation of each nature-based solution for adaptation (see Annex 3).

- **Why?** This information could also help select the nature-based solution for adaptation to be used. This information can be identified through a workshop/meeting (please note that this workshop can be the same as the one described previously under this topic—see point II.3) and a review of relevant background information.
- Possible risks and constraints to, and trade-offs of, the implementation of nature-based solutions for adaptation include:
    - High costs for implementing and maintaining the intervention;
    - Lack of political will and interest;
    - Lack of institutional support;
    - Limited capacity to implement, maintain and monitor the intervention;
    - Technical limitations (e.g., insufficient vegetative material or seeds of native species for reforestation, limited knowledge of appropriate species);
    - Legal and cultural limitations;
    - Long timeframes for the delivery of adaptation benefits;
    - Possible trade-offs at different temporal scales.

Box 4. Examples of co-benefits that can be achieved through Nature-based solutions for adaptation, as well as potential risks, constraints and trade-offs associated to the implementation of nature-based solutions for adaptation.

a. Examples of **biodiversity** co-benefits of Nature-based solutions for adaptation:

- Conservation of genetic diversity, species and ecosystems
- Assistance in species movement and natural re-introduction of species
- Establishment of nursery areas for marine and aquatic species
- Enhanced connectivity of landscapes, facilitating animal movement
- Improvement in ecosystem resilience to climate change and other threats (i.e. sedimentation, pollution)

b. Examples of **mitigation** co-benefits that can be achieved through Nature-based solutions for adaptation:

- Reduced deforestation, resulting in reduced emissions of greenhouse gases
- Reduced forest burning and degradation, reducing emissions of greenhouse gases
- Increased carbon sequestration through forest restoration
- Increased carbon sequestration by agroforestry and soil conservation practices

c. Examples of **social** and economic co-benefits of Nature-based solutions for adaptation:

- Conflict resolution because of increased water availability
- Enhanced water supplies due to watershed restoration
- Increased food security and income due to improvement in fisheries and natural resource management
- Increased food security and income through the implementation of fruit trees in agricultural fields
- Improvement in the aesthetic value of the area due to more trees
- Diversified livelihood
- Establishment of networks due to training on and implementation of the Nature-based adaptation intervention

d. Examples of **risks and constraints** of Nature-based adaptation:

- High costs of implementation and monitoring
- Limited capacity for implementation and monitoring
- Lack of buy-in from the target community
- Lack of buy-in from local governments
- Limited capacity to implement, maintain or monitor the intervention
- Legal limitations
- Cultural limitations
- Long timeframes for results to appear

e. Examples of **trade-offs** of nature-based solutions for adaptation:

- limited access to natural resources due to protection measures
- loss of productive area when restoration is implemented
- reduction in productivity after agroforestry is first implemented

3

TRANSFORMATIVE potential

STAGE III.

ADDRESS THE TRANSFORMATIVE POTENTIAL OF NATURE-BASED SOLUTIONS FOR ADAPTATION

QUESTION TO BE ANSWERED:

- Do the most promising nature-based solutions for adaptation need to be transformative to achieve the adaptation outcome?

GOALS OF THIS STAGE:

- To understand the transformative potential of each nature-based solution for adaptation. Transformative adaptation actions are strategies that address the impacts of climate change through fundamental shifts in the interactions of people and nature.
- To design locally appropriate nature-based solutions for adaptation that re-shape unsustainable interactions between people and nature.

WHY THIS STAGE NEEDS IS NEEDED:

- To decide whether the nature-based solution for adaptation should be transformative in order to achieve the desired adaptation outcome;
- To identify the elements of transformative adaptation that can be integrated into the proposed nature-based solution for adaptation.

WHEN TO SKIP THIS STAGE:

- If the transformative potential of the nature-based solution for adaptation has already been identified or if the nature-based solution for adaptation aims to maintain the current system in the same state (i.e., by using coping responses or incremental adaptation).

OUTCOME OF THIS STAGE:

- For the most promising nature-based solutions for adaptation, identify their potential to drive transformative adaptation and the supporting activities needed to achieve that potential.

ACTIVITIES PROPOSED FOR THIS STAGE:

1.Develop a simple cause-effect diagram to understand the interactions between the social and ecological aspects of the system and how it may change under different conditions.

- **Why?** Cause-effect diagrams not only clarify the complexity of a system, but also detect the key changes that need to happen in the system for adaptation to take place (Figure 3).
- Develop cause-effects diagrams that show the interconnections between key social and ecological variables in the system and how they lead to positive or negative feedback loops.
- Revise the adaptation outcome to be achieved by nature-based solution(s) for adaptation and whether the target system may require transformative adaptation (see Box 5).

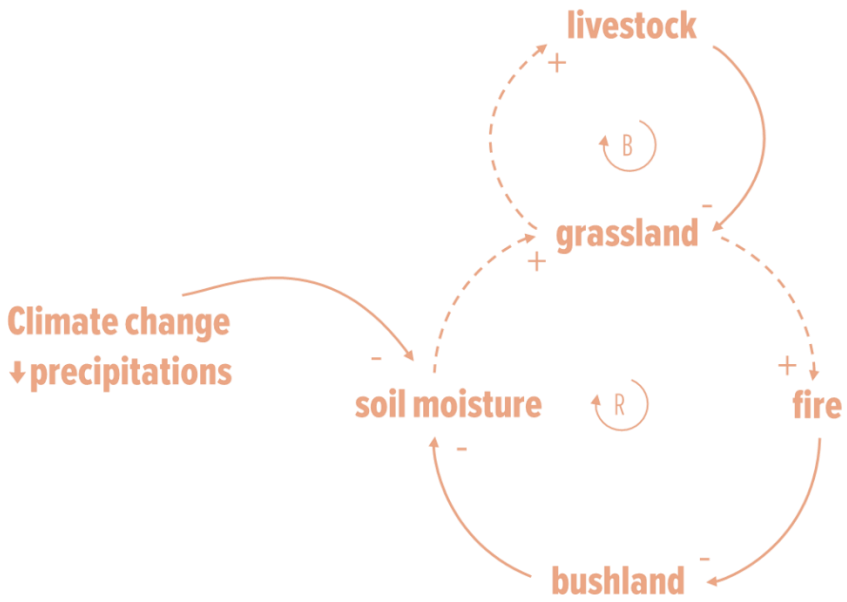


Figure 3: Cause-effect diagrams show the interconnections between key variables in the system of interest. In this example, low precipitation reduces soil moisture, favoring the growth of bushes and trees. This phenomenon reduces the income opportunities from savannahs for local communities as dense tree cover limits cattle production and wildlife observations (Fedele et al. 2020[5]).

Box 5: When to consider the use of transformative adaptation?

- In places expected to be severely impacted by climate change (e.g., high mountains, coastal zones, coral reefs, dry lands, wetlands), where there is a high risk that non-transformative adaptation strategies will fail
- In places reaching adaptation limits (e.g., rural areas, marginal agricultural land, low-lands), where there is a high risk of maladaptation and further environmental degradation
- In places already degraded by climate change (e.g., coasts under sea level, dried out wetlands, degraded lands), where transformative adaptation is the only viable option

5 Fedele, G., C. I. Donatti, C. A. Harvey, L. Hannah, and D. G. Hole. 2020. Limited use of transformative adaptation in response to social-ecological shifts driven by climate change. Ecology and Society 25(1):25.

2.Identify which characteristics of transformative adaptation can inform the development of the nature-based solutions for adaptation.

- **Why?** The principles or best practices of nature-based solutions for adaptation can be linked to the six characteristics of Transformative Adaptation (Table 4).
- Nature-based solutions for adaptation that are transformative can include a mix of interventions related to ecosystem management and policies (e.g., protection or restoration of wetlands), but also socioeconomic interventions (e.g., livelihoods diversification, payment for ecosystem services, improved value chains), as well as technical interventions (e.g., climate-hazards early warning systems, infrastructure improvements).
- Adjust the set of nature-based solutions for adaptation to meet specific characteristics of transformative adaptation to achieve the desired adaptation outcome.

3.Assess the transformative potential of the most promising nature-based solutions for adaptation.

- **Why?** Nature-based solutions for adaptation can be transformative when designed as part of an integrated approach that fully takes into consideration best practices and future changes.
- Transformative nature-based solutions for adaptation should go beyond managing ecosystems for immediate material benefits or climate-proofing existing development to current conditions. Depending on the context, examples of transformative nature-based solutions for adaptation include changing land uses (e.g., implementing agroforestry, restoring wetlands), and revitalizing ecological values (e.g., reconsidering farmers' traditional practices).
- Identify the potential of the proposed nature-based solutions for adaptation to be considered transformative (see Table 5). Depending on the potential identified, adaptation options can be prioritized or adjusted.

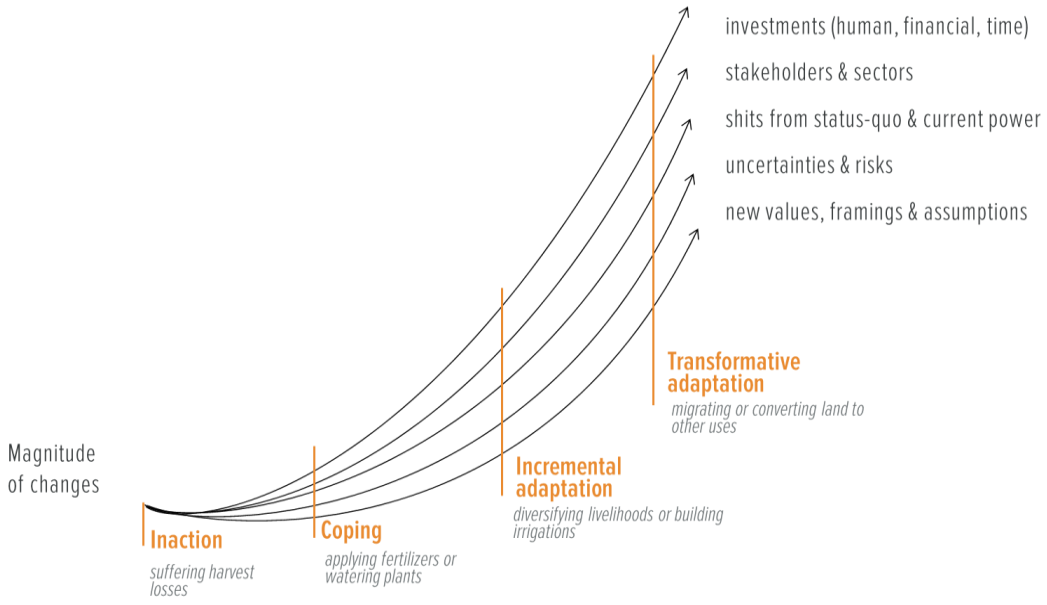


Figure 4. Four types of adaptation responses to the impacts of climate change along a gradient of increasing magnitude of changes. Examples from the agricultural sector in italic (Fedele et al. 2019).[6]

6 Fedele, G., C. I. Donatti, C. A. Harvey, L. Hannah, and D. G. Hole. 2019. Transformative adaptation to climate change for sustainable social-ecological systems. *Environmental Science & Policy* 101:116-125.

Table 4. The 6 characteristics of transformative adaptation and examples related to the interactions between people and nature, i.e. from a social-ecological perspective (based on Fedele et al. 2019[5]).

	**Re-structuring** altering fundamental features or interactions in ecosystems and societies	*Changing croplands with sedentary farmers to communal grasslands with pastoralists.*
	**Path-shifting** shifting the current trajectory of a social-ecological system towards a different direction.	*Shifting from subsistence to market-based livelihoods.*
	**Multiscale** spanning multiple spatial, jurisdictional, sectoral or trophic scales.	*Involving local, regional, national agencies in forest management.*
	**Systemwide** triggering systemic changes at large scale.	*Covering entire watersheds or landscapes.*
	**Innovative** introducing new functions or states for that location.	*Introducing early warning system for climate-related hazards in places that did not have that previously.*
	**Persistent** leading to long-term impacts, even if not necessarily irreversible.	*Institutionalizing land-use policies or management committee.*

Table 5. Typologies for the qualitative assessment of the transformative adaptation potential of a set of actions based on the six characteristics of transformative adaptation (Fedele et al. 2019[5]).

Potential to achieve transformative adaptation	Very low (0-20%)	Low (20-40%)	Medium (40-60%)	High (60-80%)	Very high (80-100%)
Re-structuring 	Maintaining the same current interactions between people and nature	Re-structuring social-ecological system flows (e.g., information, materials)	Re-structuring social-ecological system processes (e.g., land management, plans, natural resources use, collaborations)	Re-structuring social-ecological system organization (e.g., land-related livelihoods, morphology, institutions, businesses)	Re-structuring social-ecological system goals (e.g., power dynamics, governance, land cover, business models, value systems)
Path-shifting 	Maintaining similar business-as-usual development	Shifting towards resilient land management (e.g., practices, uses)	Shifting towards resilient land-use strategies (e.g., livelihoods, coordination, plans)	Shifting towards resilient land-use approaches (e.g., anticipatory, integrated, multipurpose, empowering)	Shifting towards sustainably resilient social-ecological systems (e.g., governance reforms, new financial mechanisms)
Multiscale 	Involving partially one single scale (sector, governance, spatial, or business)	Involving one single scale (sector, governance, spatial, or business)	Involving two levels within a scale or across two scales (sector, governance, spatial, or business)	Involving three levels within a scale or across three scales (sector, governance, spatial, or business)	Involving four levels within a scale or across fours scales (sector, governance, spatial, or business)
Systemwide 	Covering few villages or communities	Covering several parts of a landscape or seascape	Covering entire landscapes, seascapes, protected areas, watersheds	Covering entire provinces, districts or geographies (multiple landscapes, entire coasts, deltas, mountains)	Covering entire regions, states, or most of a country or multiple countries
Innovative 	Using existing solutions or practices	Introducing new knowledge or practices	Introducing new technologies or management	Introducing new social behaviors or production systems with integrated and holistic approaches	Introducing new mixes of all previous solutions
Persistent 	Collaborating with existing institutions, but actions mostly driven by project staff	Strengthening resilience of existing institutions or signing agreements	Mainstreaming or institutionalizing climate resilience in updated government plans or policies	Partnering with government or private sector for implementation of resilient institutions, management bodies, services	Same as previous + embedding in government or market sustainable financial mechanisms

4

DESIGN
of selected actions

STAGE IV.

SELECT AND DESIGN THE NATURE-BASED SOLUTION FOR ADAPTATION

QUESTION TO BE ANSWERED

- What is the most appropriate nature-based solution for adaptation to be implemented?

PURPOSE OF THIS SECTION:

- To provide steps for the prioritization of the nature-based solution(s) for adaptation in case several options exist.

WHY THIS STAGE NEEDS TO BE DONE:

- Sometimes, several nature-based solutions for adaptation can achieve the same adaptation outcome, therefore the selection of the Nature-based solution needs to be based on factors such as the magnitude of the intervention, benefits, trade-offs, costs, buy-in, and capacities to implement and monitor it.

WHEN TO SKIP THIS STAGE:

- If the Nature-based solution for adaptation has already been selected.

OUTCOME OF THIS STAGE:

- Identification of nature-based solution for adaptation to be implemented.

ACTIVITIES PROPOSED FOR THIS STAGE:

1.Consult stakeholders and community members to review the nature-based adaptation options and prioritize them (please note that consultations and meetings described in various stages can be organized at the same time-- whenever possible try to include members of the multidisciplinary team to get input from different perspectives).

- **Why?** A suite of Nature-based solutions for adaptation could be identified to help reduce the vulnerability of the target community by achieving the desired adaptation outcome. In those cases, a prioritization of both the solution and the implementation location may need to be done. When prioritizing, the following order of importance is suggested (please note that you may want to weight some criteria more heavily than others based on the feedback from the multidisciplinary team):
    - Magnitude of the intervention (the higher the magnitude, the higher the prioritization);
    - Number of beneficiaries of the adaptation outcome provided by the nature-based solution for adaptation (the higher the number of beneficiaries, the better);
    - Biodiversity, mitigation and social co-benefits provided by the nature-based solution for adaptation (adaptation measures with greater co-benefits should be ranked higher);
    - Trade-offs of implementing the nature-based solution for adaptation (the lower the number or magnitude of the trade-offs, the higher the prioritization);
    - Costs of the nature-based solution for adaptation, and ability to leverage additional funds if needed (the lower the costs, the higher the prioritization);
    - Buy-in and political will (the higher the buy-in, the higher the prioritization);
    - Support from stakeholders (community leaders, local cooperatives, government, etc.), especially from the communities that will be the beneficiaries of the nature-based solution for adaptation (adaptation measures with greater support should be prioritized);
    - Technical and financial capacity to implement, track and monitor the nature-based solution for adaptation (the higher the capacity of a given nature-based solution for adaptation, the higher the prioritization).

2.Conduct studies or rely on existing ones to define the details of the nature-based solution for adaptation to be implemented.

- **Why?** The details of the intervention (number of hectares restored or protected, area that should be under an improved management, number and density of trees to be planted) should be identified based on scientific studies or previous experience on how much of the climate threats can be addressed by the intervention.

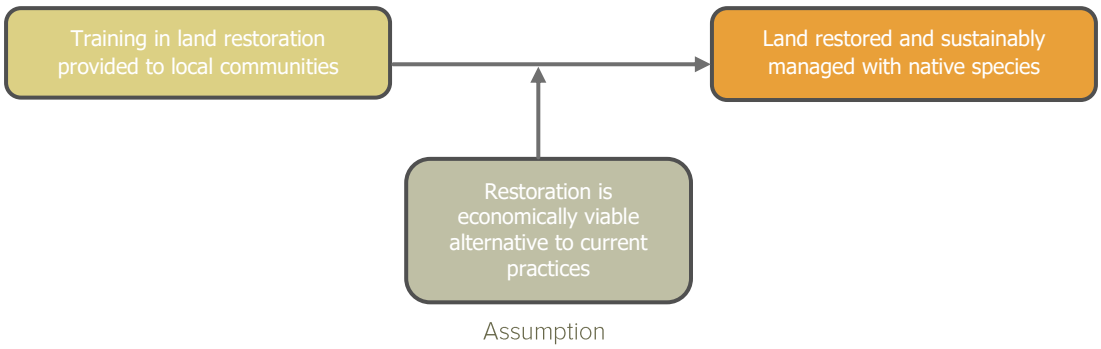
- Calculate how much of the climate-driven threats can be reduced by each of the Nature-based solutions for adaptation. For example, if mangrove restoration is to be implemented to reduce the loss of assets of coastal communities, we need to know how many meters of mangrove need to be planted from the shoreline to reduce the impact of waves. This information will allow us to understand the magnitude of the intervention that is needed to achieve the desired adaptation benefits. It will also allow us to identify the magnitude of complementary adaptation measures (e.g., grey infrastructure, evacuation/early warning systems, financial inclusion measures, etc.) needed. This information will also help us to identify collaborators, such as engineers, disaster risk reduction specialists, finance sector experts, and to define the costs of the selected intervention.

3. Prepare a theory of change for the selected nature-based solution for adaptation.

- **Why?** This information will be important during the monitoring and evaluation process as the theory of change shows the activities to be implemented, their outputs and outcomes, and their connections with the adaptation outcome to be achieved.
- Use a theory of change (ToC)[7] to map the relationship between the adaptation outcome of the nature-based solution for adaptation and the intermediate and early changes that are required to make it happen (see Figure 5).

4. Identify the assumptions related to the intervention to be included in the theory of change

- **Why?** Assumptions related to the nature-based solution for adaptation need to be identified and discussed as they may prevent the adaptation action from achieving the ultimate adaptation outcome.
- For example, if the nature-based adaptation intervention implemented is restoration of wetlands one of the assumptions is that the restoration will increase the extent and ecological health of the wetland. If the Nature-based solution for adaptation is forest protection, one of the assumptions is that protection will be effective in the long-term. If the nature-based solution for adaptation also entails building local capacity, it is assumed that there are people who can build this capacity and that the target audience will put the acquired knowledge into practice.



5. Revisit the theory of change periodically to update activities and assumptions

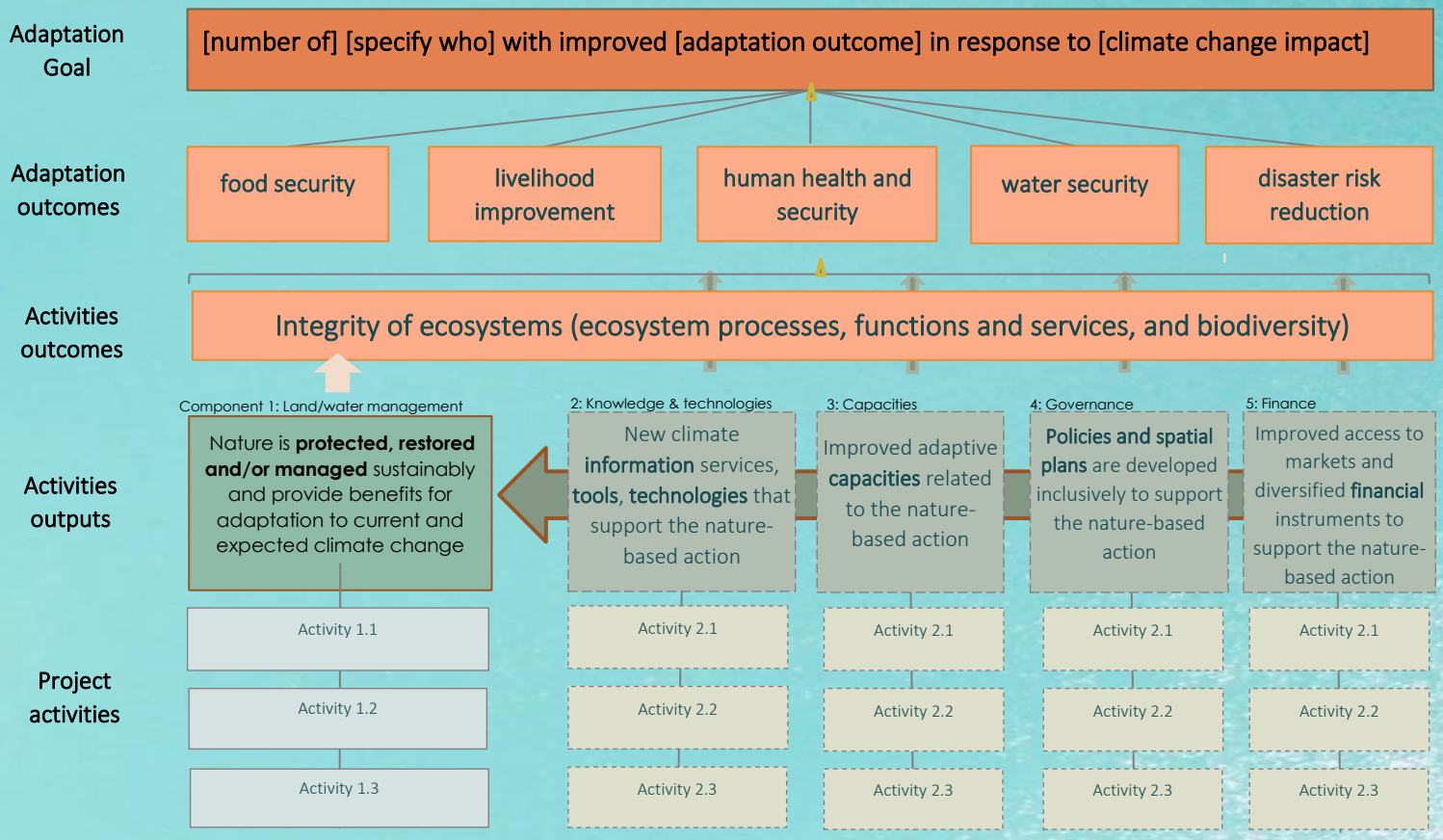
- **Why?** As the selected nature-based solution for adaptation is implemented, the theory of change should be reviewed and updated periodically to ensure the proper delivery of the adaptation outcome and that the activities are being implemented as planned, given that ecological and social conditions may change over time.
- This can be done when milestones of the nature-based solution for adaptation are reached, for example when monitoring and evaluation information is available or when a report to the donor is due.
- In any case, activities, assumptions and other information on the theory of change should be reviewed every 6 months or so.

[7] Conservation International. 2013. Constructing Theories of Change for EbA projects.

This is a generic example/template:

- not all project outputs, and at least one adaptation outcome have to be included.
- more specific information related to the context of the project should be added to the boxes, such as target population, target ecosystems and climate impact.
- lines between boxes representing the effects of the activities should be added.

Figure 5. Illustrative theory of change for nature-based adaptation projects. The total number of people that will directly benefit from the nature-based solution for adaptation (nature-based solutions activities + enabling activities) needs to be estimated or calculated. The theory of change should identify the adaptation outcome to be achieved, as well as project activities to be implemented and outputs (adapted from CI Adaptation strategy 2021).



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5

EVALUATE actions

STAGE V.

EVALUATE THE EFFECTIVENESS OF NATURE-BASED SOLUTIONS TO ACHIEVE ADAPTATION OUTCOMES

QUESTION TO BE ANSWERED

- How can the nature-based solution for adaptation be monitored and evaluated through time in order to determine its effectiveness?

PURPOSE OF THIS STAGE:

- To identify the indicators to monitor and evaluate the success of the nature-based solution for adaptation in achieving the stated adaptation outcome.

WHY THIS STAGE NEEDS TO BE DONE:

- To track progress on the activities, outputs and the adaptation outcome of the Nature-based solution for adaptation. This will provide information about the success of the project and more broadly help to increase the evidence base of nature-based solutions for adaptation.

WHEN TO SKIP THIS STAGE:

- When a framework is already selected for monitoring and evaluating the Nature-based solution for adaptation.

OUTCOMES OF THIS STAGE:

- Identification of indicators to track the outputs and outcomes of the Nature-based adaptation intervention, when and how they will be measured.

ACTIVITIES PROPOSED FOR THIS STAGE:

1.Define the indicators that will be used to assess the success of the nature-based solution for adaptation and its effectiveness in achieving the adaptation outcome.

- **Why?** Given that nature-based solutions for adaptation can be implemented to achieve a variety of adaptation outcomes, it is important to identify indicators that will inform the success of a nature-based solution for adaptation in achieving a specific adaptation outcome. Suggested indicators are presented in Table 6. Indicators should have the goal of measuring the adaptation outcome that the nature-based solution for adaptation is planning to achieve in the long-term.

2.Describe the indicators used to monitor the nature-based solution for adaptation, as well as any assumptions made.

- **Why?** It is important to describe what will be measured through time, and any assumptions made for the adaptation outcome to be achieved.
- Indicators that will be used to track the Nature-based solution for adaptation should be clearly described in a monitoring and evaluation protocol and any assumptions made should be included in the theory of change.
- An indication of when selected metrics and indicators will be collected (i.e., both within the lifetime of the nature-based solution for adaptation and thereafter) is also desirable.

3.Engage with scientists, researchers and the government that may already be collecting information on indicators so those can be used to track the success and the adaptation outcome of the nature-based solution for adaptation, and information collected can also be used in existing monitoring and evaluating systems.

- **Why?** There is a possibility that the metrics and indicators that need to be tracked through time are already being measured (probably at a different scale, e.g., national level) by other initiatives or by the government (through national monitoring and evaluation frameworks), especially in the framework of UNFCCC's Nationally determined contributions. These existing data collection processes need to be identified so efforts are not duplicated.
- Identify other initiatives in the broader region or at the national level similar to the one to be implemented, to check whether other projects or entities are already collecting information that may be used to monitor and evaluate the nature-based solution for adaptation.

4.Collect baseline information and describe the situation prior to implementation.

- **Why?** Our recommendation is that all metrics suggested in table 6 are taken prior (baseline), during (midline) and after (endline) the implementation of the nature-based solution for adaptation. In that way, metrics collected in the midline and endline can be compared to metrics collected at baseline to assess progress on achieving adaptation outcomes. For some indicators, we suggest that the metrics are taken after an extreme weather event (if the nature-based solution for adaptation was implemented to address such type of event) within each one of those time periods if possible.

Figure 6. A visual representation of the data collection for the monitoring and evaluation of nature-based solutions for adaptation, in relation to the implementation of the intervention.

5. Involve local communities and stakeholders in monitoring the effectiveness of the nature-based solution for adaptation, to achieve community buy-in and enhance local capacities.

- **Why?** To ensure that there is ownership of the nature-based solution for adaptation from the local communities and sustainability after the project ends, while important information for monitoring and evaluation is collected.
- Partner with local institutions that can recruit members of the community (both local community members and other types of stakeholders, such as universities and research institutions) to conduct the monitoring activities.

6. Analyse monitoring results and make changes if necessary:

- **Why?** To ensure that the intervention is on track to achieve the desired adaptation outcome.
- If the intervention seems to be working, i.e. activities are on-track and delivering the expected outputs and outcomes as identified in the theory of change: the exit strategy should be re-evaluated to make sure the intervention is sustainable after the implementation stage ends, and will continue to be monitored after the projects ends
    - Develop a plan on how the intervention will continue to be monitored and maintained after the project ends, the budget for these activities and who will be responsible to conduct them. This can be simply a set of activities that need to be done or continue over time to ensure the delivery of the adaptation benefits provided by the nature-based solution, and budgets associated to those.
- If the intervention is not showing the expected results (activities are not on-track and/or are not delivering the expected outputs and outcomes as identified in the theory of change) the sustainability of the intervention should be evaluated, and the intervention should be re-designed if necessary.
    - Identify what should be changed in the intervention (increase the restored area, incorporate an engineer or more 'traditional' activities as part of the intervention) and if such change may allow the delivery of the expected adaptation outcome. In that case, the theory of change should be updated.
    - If the proposed changes are unlikely to deliver the expected adaptation outcome, an alternative nature-based solution for adaptation, or an adaptation action not based on nature should be considered. In that case, an updated theory of change should be prepared, as well as a new monitoring and evaluation plan.

Table 6. Indicators suggested to measure each adaptation outcome. Please note that the advanced indicators are the most appropriate to assess the achievement of an outcome (based on Donatti et al. 2020[8]).

	Basic Indicators			Intermediate indicators			Advanced indicators		
Adaptation outcome	**Description**	**Suggested metric**	**Suggested sources of information**	**Description**	**Suggested metric**	**Suggested sources of information**	**Description**	**Suggested metric**	**Suggested sources of information**
Disaster risk reduction	Changes in biophysical variables	Coastal and hillside erosion; flooding area	Satellite images	Changes in the perception of damages to assets and infrastructure due to extreme weather events	Perception of infrastructure damaged after extreme events (flood, storm, landslides), for example: hospitals, schools, homes, roads, agricultural land, as well as cultural, protected or recreation areas.	Household surveys or key informant interviews	Changes in loss of assets and infrastructure (and monetary value) due to an extreme weather event	Percentage of infrastructure damaged after extreme events (flood, storm, landslides), for example: hospitals, schools, homes, roads, agricultural land, as well as cultural, protected or recreation areas	Satellite images or government inventories/assessments
Food security	Changes in number of meals per day	Daily food intake for 30 days, during or after an extreme weather event	Household surveys	Changes in the consumption of specific items or expenditure index	Number of days per month that certain items were consumed	Household surveys	Changes in food security index	Food security index	Consolidated Approach to Reporting Indicators of Food Security (CARI) following the World Food Program (WFP) method.
Water security	Changes in water flow	River water flow or perceptions on water availability for daily uses	local data on daily river flow or household surveys/interviews	Changes per capita access to water	Per capita access to water	Local data on per capita access to water or household surveys	Changes in water security index	Water supply and demand	Water supply and demand models such as WEAP, ecosystem service models such as InVEST, information collected through Freshwater Health Index)

[8] Donatti, C.I., Harvey C.A., Hole D., Panfil S., Schurman H. 2020. Measuring the adaptation outcomes of Ecosystem-based adaptation. *Climatic Change* 158: 413-433.

Basic Indicators				Intermediate indicators			Advanced indicators		
Adaptation outcome	**Description**	**Suggested metric**	**Suggested sources of information**	**Description**	**Suggested metric**	**Suggested sources of information**	**Description**	**Suggested metric**	**Suggested sources of information**
Human health and security	Changes in the incidence of vector species that transmit climate-sensitive diseases (e.g. Malaria, dengue fever, west Nile virus, cholera, Lyme disease)	Incidence of vector species that can transmit diseases associated with extreme rainfall events	Ecological surveys on species that can transmit climate-sensitive diseases	Changes in the number of people admitted to hospitals with vector-borne diseases associated with extreme rainfall events	Number of people admitted to hospitals with vector borne diseases associated with extreme rainfall events	Data on hospital admissions	Changes in the number of deaths or years lost due to vector borne diseases associated with extreme rainfall events	Number of deaths or years lost due to vector borne diseases associated with extreme rainfall events	National or regional statistics on deaths in a particular location and in a particular timeframe
	Changes in local (human-human or human-wildlife) conflicts	Existence and frequency of conflicts on water and other natural resources	Interviews with key informants or community leaders	Changes in the frequency of local conflicts over natural resources	Number of conflicts over natural resources that household members have been involved in	Household surveys	Changes in the number of deaths or injuries resultant from conflicts over natural resources	Number of people and animals dead or injured resultant from conflicts over natural resources	Household surveys, or local level statistics, ground and aerial surveys (for dead wildlife)
	Changes in local air temperature and local air pollution	Local levels of air temperature and pollution	Local data on daily air temperature and air pollution	Changes in the number of people admitted to hospitals that have experienced heat stroke or respiratory distress due to extreme temperatures or fires	Number of people with heat stroke and respiratory distress admitted to hospitals	Data on hospital admissions	Changes in the number of deaths or years lost due to heat stroke or respiratory distress due to extreme temperature or fires	Number of deaths or years lost due to heat stroke or respiratory distress due to extreme temperature and fire events	National or regional statistics about Disability-adjusted life year (DALY) a measure of overall disease burden, expressed as the number of years lost due to ill-health, disability or early death (WHO methodology)
Livelihood improvement	Perception of changes in productivity or yields per area and season	Average crop or livestock production per hectare per season	Household surveys, key informant interviews, or governmental or trade statistics	Changes in income or proxy for income	Average monthly income from selling crops or livestock, or proxy related to products sold or bought	Household surveys or key informant interviews	Changes in income (or proxy) from sustainable crop and/or livestock production, sustainable marine and freshwater fisheries, and/or small-scale eco-tourism per household	Average income (or proxy) from sustainable crop and/or livestock production, sustainable marine and freshwater fisheries, and/or small-scale eco-tourism per household	Household surveys

ANNEXES

SUGGESTED SOURCES OF INFORMATION FOR EACH STAGE

STAGE I. ASSESSING THE CLIMATE THREATS FACING THE REGION AND THE TARGET POPULATIONS

- GIZ. 2017. The vulnerability sourcebook. Concept and guidelines for standardized vulnerability assessments.
- Care. 2019. Climate Vulnerability and Capacity Analysis Handbook
- AR5 Climate change 2014: Impacts, adaptation and vulnerability
- UNFCCC NAPAS and NAPs of countries
- World Bank's Climate Change knowledge portal
- World Bank's Living Standards Measurements Study
- IPUMS's Census microdata
- Conservation International's Resilience Atlas
- Climpact

STAGE II. IDENTIFY A SET OF POSSIBLE ADAPTATION OPTIONS

- Secretariat of the Convention on Biological Diversity (2019). Voluntary guidelines for the design and effective implementation of ecosystem-based approaches to climate change adaptation and disaster risk reduction and supplementary information.

STAGE III. IDENTIFY THE TRANSFORMATIVE POTENTIAL OF THE NATURE-BASED INTERVENTION(S)

- Conservation International. 2019. Nature-based transformative Adaptation handbook.
- United Nations Research Institute for Social Development. 2019. Transformative Adaptation in Coastal Cities.

STAGE IV. SELECT AND DESIGN THE NATURE-BASED SOLUTIONS FOR ADAPTATION

- Conservation International. 2013. Constructing Theories of Change for EbA projects.

STAGE V. EVALUATE THE NATURE-BASED ADAPTATION INTERVENTION

- GIZ. 2020. Guidebook for monitoring and evaluating Ecosystem-based adaptation interventions of EbA Interventions.
- Dickson et al. 2017. PRISM-toolkit for evaluating the outcomes and impacts of small/medium-sized conservation projects.

GLOSSARY

Activities: Specific actions implemented each output or outcome on the pathway to change.

Adaptation: Adjustment in natural or human systems in response to actual or expected climatic stimuli or their effects, which moderates harm or exploits beneficial opportunities.

Adaptive Capacity: Ability of systems, institutions, humans, and other organisms to adjust to potential damage, to take advantage of opportunities, or to respond to consequences.

Climate change vulnerability: Degree to which a system is susceptible to, and unable to cope with, adverse effects of climate change.

Ecosystem services: Benefits that humans gain from the natural environmental and functioning ecosystems.

Ecosystem processes: Physical, chemical and biological processes that link organisms and their environment.

Exposure: The presence of people, livelihoods, species or ecosystems, environmental functions, services, and resources, infrastructure, or economic, social, or cultural assets in places and settings that could be adversely affected.

Climate change mitigation: Intervention to reduce the source of greenhouse gasses or enhance their sinks.

Nature-based solutions for adaptation: Actions to protect, sustainable manage, and restore natural or modified ecosystems, that address societal challenges related to climate change, simultaneously providing human wellbeing and biodiversity benefits.

Outcomes of Nature-based solutions for adaptation: Changes to ecological or social systems that result from the nature-based action.

Outputs of Nature-based solutions for adaptation: Products or events produced by a nature-based action.

Participation: Process through which members of a community or organization are involved in and have influence on decisions related to t activities that will affect them.

Sensitivity: The degree to which a system or species is affected, either adversely or beneficially, by climate variability or change. The effect may be direct (e.g., a change in crop yield in response to a change in the mean, range, or variability of temperature) or indirect (e.g., damages caused by an increase in the frequency of coastal flooding due to sea level rise).

Target population: Population under a type of livelihood (fisherman, farmers, indigenous communities) that is the target of the nature-based solution for adaptation.

Theory of Change: Conceptual model of the activities, outputs, outcomes and goals of a project that forms the basis for strategic planning, on-going decision-making, monitoring and evaluation.

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