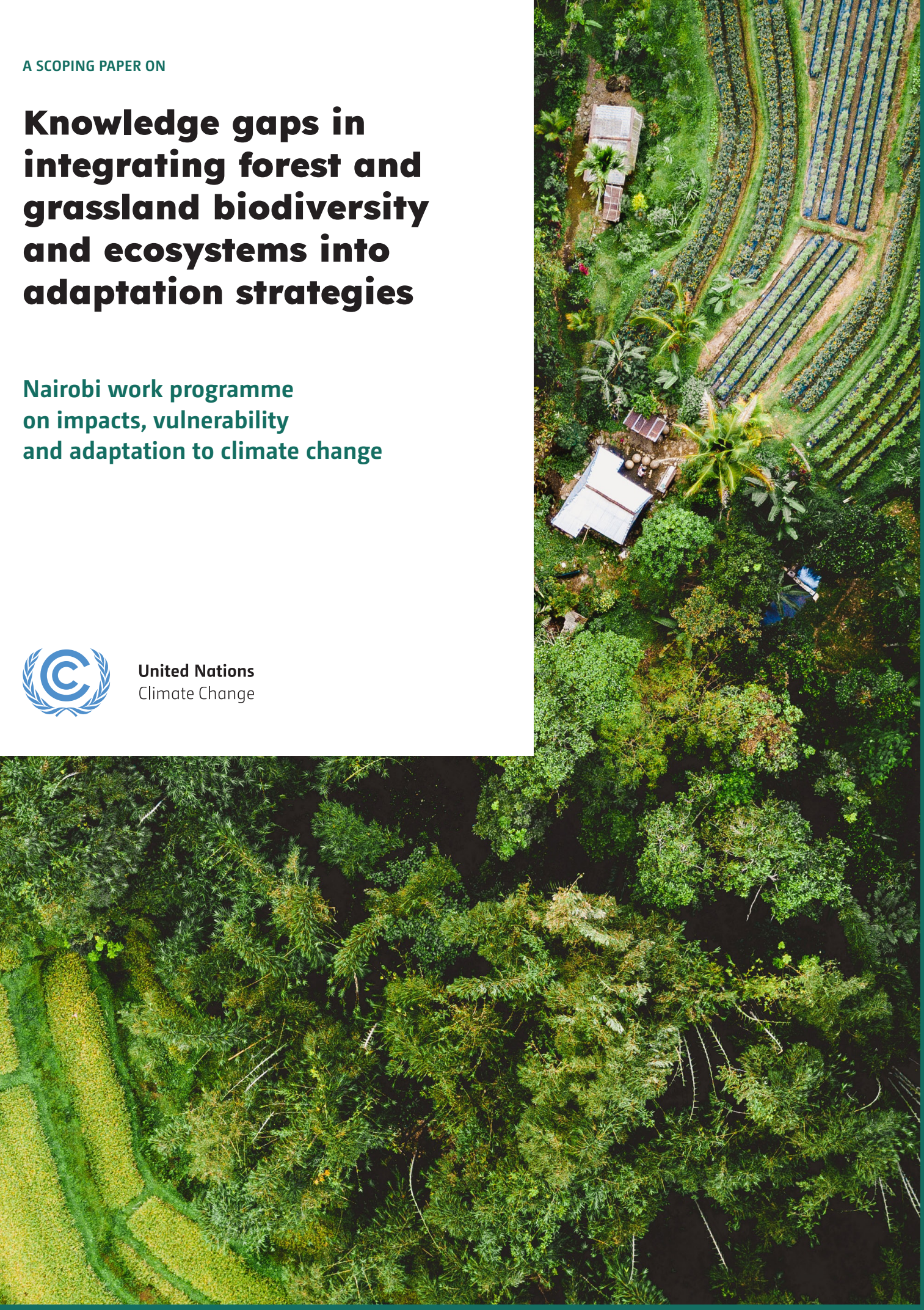
A SCOPING PAPER ON

Knowledge gaps in integrating forest and grassland biodiversity and ecosystems into adaptation strategies

Nairobi work programme on impacts, vulnerability and adaptation to climate change

United Nations
Climate Change



Knowledge gaps in integrating forest and grassland biodiversity and ecosystems into adaptation strategies

United Nations
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ABBREVIATIONS AND ACRONYMS

AC — Adaptation Committee

CBD — Convention on Biological Diversity

COVID-19 — coronavirus disease 2019

EbA — ecosystem-based adaptation

Eco-DRR — ecosystem-based disaster risk reduction

FAO — Food and Agriculture Organization

FEBA — Friends of EbA

GAN — Global Adaptation Network

GCF — Green Climate Fund

GEF — Global Environment Facility

HKH — Hindu Kush Himalayas

ICIMOD — International Centre for Integrated Mountain Development

IIED — International Institute for Environment and Development

IPBES — Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services

IPCC — Intergovernmental Panel on Climate Change

IUCN — International Union for Conservation of Nature

LAKI — Lima Adaptation Knowledge Initiative

LCIPP — Local Communities and Indigenous Peoples Platform

LDC — least developed country

LEG — Least Developed Countries Expert Group

NAP — national adaptation plan

NbS — nature-based solutions

NDC — nationally determined contributions

NGO — non-governmental organization

NWP — Nairobi work programme on impacts, vulnerability and adaptation to climate change

PCCB — Paris Committee on Capacity-building

REDD+ — reducing emissions from deforestation; reducing emissions from forest degradation; conservation of forest carbon stocks; sustainable management of forests; and enhancement of forest carbon stocks (decision 1/CP.16, para. 70)

SBI — Subsidiary Body for Scientific and Technological Advice

SCBD — Secretariat of the Convention on Biological Diversity

SCFDG — Standing Committee on Finance Sustainable Development Goal

UNCCD — United Nations Convention to Combat Desertification

UNDP — United Nations Development Programme

UNEP — United Nations Environment Programme

UNFCCC — United Nations Framework Convention on Climate Change

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Thematic Expert Group members: See Annex I

All photos are freely available from Unsplash and Canva

Foreword by the Chair of the Subsidiary Body for Scientific and Technological Advice

Dear reader,

Stronger and more ambitious climate action is required to achieve the objectives of the Paris Agreement. The Paris Agreement notes "the importance of ensuring the integrity of all ecosystems, including ocean, and the protection of biodiversity, recognized by some cultures as Mother Earth".

Climate change, biodiversity and ecosystems are inextricably linked. The loss of forest and grassland biomes undermines a large, systematic source of adaptive capacity. Knowledge gaps about the role forest and grassland biodiversity plays in adaptation services has yet to be fully integrated into adaptation strategies.

The Nairobi work programme (NWP), UNFCCC's knowledge-to-action hub on adaptation and resilience partnered with its biodiversity thematic expert group to analyse knowledge needs and identify ways to better integrate forests and grasslands biodiversity and ecosystems into adaptation solutions.

This scoping paper highlights knowledge gaps in four areas: data and methods; capacity; governance; and cross-cutting issues such as gender responsiveness, meaningful engagement of traditional communities and addressing issues such as social safeguards.

These knowledge gaps were determined by reviewing relevant peer-reviewed and grey literature on biodiversity and adaptation in grasslands and forests. The review included national reports submitted as part of the UNFCCC process and recent assessment reports by IPBES and the IPCC covering biodiversity, ecosystem services and climate change, with a focus on land.

The NWP will continue its work with the biodiversity thematic expert group to share knowledge with Parties, constituted bodies and institutional arrangements under the UNFCCC. It will continue to co-design actions in collaboration with NWP partners to address the knowledge gaps identified in this paper. These activities will be showcased at the NWP's 14th Focal Point Forum at COP26 and in future UN Climate Change Conferences.

I invite Parties, NWP partners and other actors to take concerted efforts to address knowledge gaps discussed in this paper, in particular supporting national efforts in formulating and implementing national adaptation plans.

Mr. Tosi Mpanu Mpanu
Chair of the Subsidiary Body for Scientific and Technological Advice

About the SBSTA:
The SBSTA was established to provide timely information and advice on scientific and technological matters to the UNFCCC process. At the 21st Conference of the Parties in Paris, governments agreed that mobilizing stronger and more ambitious climate action is urgently required to achieve the goals of the Paris Agreement.

KEY MESSAGES

THE IMPORTANCE OF FORESTS AND GRASSLANDS FOR ADAPTATION

- In a changing and increasingly uncertain world, nature can be humanity's strongest ally in adapting to climate change and reducing disaster risk. The work summarized in this scoping paper responds to an SBSTA mandate to the NWP to prioritize the thematic area of forests and grasslands[1] and the AC's invitation[2] to the NWP to address linkages between biodiversity and adaptation. As part of this thematic work, the secretariat collaborated with an expert group on biodiversity and adaptation[3] to assess current knowledge, gaps and challenges, including by reviewing case studies showing where and how biodiversity and ecosystems (with a focus on forest and grassland ecosystems) have been integrated into adaptation strategies at various scales.

- The new case studies included in this report show how forests and grasslands are being integrated into adaptation strategies, such as by:

  - Developing participatory catchment plans to ensure pastoral access to water;

  - Diversifying livelihoods with community forest enterprises involving honey production;

  - Using traditional knowledge to restore mountain grasslands;

  - Establishing conservation corridors for connecting fragmented forest habitats and protected areas.

- Forest and grassland biomes cover one third and one half of the Earth's surface, respectively. They support innumerable essential ecosystem services for people and communities, including the provisioning of food and fodder and the

1 See https://unfccc.int/documents/199148, para. 18(c).

2 See AC15 AC/NWP/2019/1 which provided advice on the delivery of the NWP mandate. AC 17 AC/NWP/2020/1 subsequently provided further advice.

3 See annex I.

regulation of water supply. These biomes also provide essential adaptation services, such as buffering from climate extremes, regulating hydrological cycles, protecting soils, regulating temperature in urban areas, reducing food insecurity and providing options for economic diversification, particularly during periods when climate change impacts reduce agricultural yields.

- Biodiversity underpins ecosystem processes and functions, as well as the adaptation services ecosystems provide. The loss of biodiversity due to interacting drivers of change – including climate change and land-use change – alters ecosystem functioning and reduces ecological integrity and the corresponding capacity of ecosystems to provide essential services, including adaptation services.

INTEGRATING FOREST AND GRASSLAND ECOSYSTEMS INTO ADAPTATION STRATEGIES

- The integration of forest and grassland biodiversity and ecosystems into adaptation strategies provides a critical opportunity to realize benefits for mitigation, biodiversity conservation, avoidance of land degradation and desertification, the enhancement of livelihoods and other facets of sustainable development.

- Multiple options for adaptation strategies that integrate forest and grassland biodiversity and ecosystems exist. Among these are community-based approaches, ecosystem-based approaches and hybrid strategies integrating engineered (hard) approaches with nature.

- Ecosystem-based adaptation (EbA) and ecosystem-based disaster risk reduction (Eco-DRR) are types of nature-based solutions (NbS). These common terms encompass the use of biodiversity and ecosystems in addressing societal adaptation to global change.

- Political momentum for implementing NbS is increasing, signalled by the fact that NbS are featured as a key adaptation strategy in a recent analysis of nationally determined contributions (NDCs) under the Paris Agreement.

- In many cases, the most appropriate adaptation strategies to respond to a community's vulnerability and risks combine a suite of interventions, including community- and ecosystem-based approaches combined with livelihood diversification and innovative financing mechanisms.

ACHIEVING MULTIPLE BENEFITS

- Actions to restore and conserve biodiversity and ecosystems also provide co-benefits to human health and well-being, including reducing the risk of disease transmission by reducing contact and the exchange of pathogens between humans and wildlife. Such ecosystem-based approaches play an integral role in COVID-19 pandemic recovery, yielding economic benefits, avoided losses, and societal and environmental gains.

- Enhancing climate resilience through the conservation and restoration of ecosystems is a priority of the Paris Agreement, the Sustainable Development Goals and the Sendai Framework for Disaster Risk Reduction. NbS are expected to be a key component of the post-2020 Global Biodiversity Framework and key for achieving the vision of "living in harmony with nature by 2050".[4]

CHALLENGES

- While momentum for integrated approaches to adaptation, including EbA and NbS, is growing, knowledge gaps hamper their widespread implementation.

- Forest and grassland biomes face critical threats from multiple drivers of change, reducing their potential to deliver adaptation services. The first global assessment report on biodiversity and ecosystem services emphasizes that nature and its vital contributions to people are deteriorating worldwide. Actions to conserve and restore biodiversity and ecosystems will be crucial components in integrated adaptation strategies.

- In this paper, the review of case studies, which were contributed by experts or are available in the literature, revealed challenges related to the following:

    - **Knowledge gaps in data and methods**, including knowledge about linkages between biodiversity and ecosystem functioning; constraints and limits to adaptation; ways of appraising adaptation options; and comprehensively valuing the social, economic and environmental benefits, to be realized over time, of EbA strategies;

    - **Knowledge gaps in capacity**, including engaging actors across sectors and disciplines, sustaining investments

4 See the CBD decision: https://www.cbd.int/decision/cop/?id=12268.

beyond project timelines, scaling up innovative financing mechanisms, and engaging in long-term monitoring and evaluation programmes;

- **Knowledge gaps in governance**, including addressing the challenges of weak mandates and institutional support for adaptation; siloed approaches across sectors; lack of adequate mechanisms for cross-sectoral, transboundary cooperation across scales and for equitable and genuine bottom-up participatory processes and decision-making; and fully considering and balancing trade-offs;

- **Cross-cutting challenges**, including under-recognition and under valorization of traditional knowledge, the knowledge of indigenous peoples and local knowledge systems; insecure land tenure and lack of recognition of customary access and rights; and differentiated vulnerabilities of women and men, and of vulnerable communities, groups and ecosystems.

CONCLUSIONS AND NEXT STEPS

- The biodiversity and ecosystems of forest and grassland biomes are critical to consider in the synergistic implementation of global agreements on sustainable development, including on climate change, biodiversity and sustainable land management. Recent global assessment reports on biodiversity, ecosystem services and climate change are unequivocal in urging governments to implement ecosystem-based approaches, including NbS such as conservation, restoration and improved land management in adaptation as well as mitigation. Delays will increase the costs – both adaptation and mitigation costs – to society. Failure to protect biodiversity in forests and grasslands will degrade the capacity of natural systems to buffer society from the impacts of climate change and undermine the provision of ecosystem services essential for sustainable development.

- Adaptation and mitigation co-benefits can be linked through conservation and restoration of forest and grassland ecosystems, including through EbA and NbS or hybrid approaches to adaptation, while ensuring social and environmental safeguards are in place.

- Traditional knowledge, the knowledge of indigenous peoples and local knowledge systems play a crucial role in adaptation planning and implementation, not only to supplement traditional scientific knowledge, but as a contribution of worldviews, values, spiritual beliefs, customs and traditions that promote resilience to global change.

- There are many examples of how countries are already using integrated approaches with forests and grasslands to adapt to climate change, as evidenced in the literature and by the national reports and case studies analyzed in this paper. These strategies include developing participatory catchment plans to ensure pastoral access to water, diversifying livelihoods with community forest enterprises involving honey production, using traditional knowledge for restoring mountain grasslands, and establishing conservation corridors for connecting fragmented forest habitats and protected areas.

- Initiatives that have focused on enhancing climate resilience through the conservation and restoration of ecosystems provide critical lessons learned regarding innovative financing mechanisms, multi-actor and multi-stakeholder participation, integration of diverse values and knowledge systems, gender-responsive planning and action, risk management, and capacity-building. This paper includes case studies of such initiatives.

- Scaling up conservation and restoration actions in forest and grassland ecosystems will be an important next step in enhancing resilience to global change. Countries can consider a range of actions; for example, they can:

    - Seek community engagement in all stages of planning, design and implementation;

    - Strengthen legitimacy and support for traditional management institutions;

    - Use gender-disaggregated data for planning, monitoring and evaluation;

    - Seek out appropriate protocols including free, prior and informed consent for engaging with indigenous peoples and local communities;

    - Select appraisal and assessment tools appropriate for local contexts to identify options;

    - Consider innovating financing models, including public–private partnerships and blended finance;

    - Raise public awareness of the importance of forests and grasslands to adaptation;

    - Consider catchment-level planning and landscape approaches;

    - Enhance synergies and facilitate multiple benefits by setting up cross-sectoral and institutional coordination mechanisms, such as for focal points of climate, land and biodiversity related conventions.

CHAPTER 1

INTRODUCTION AND BACKGROUND

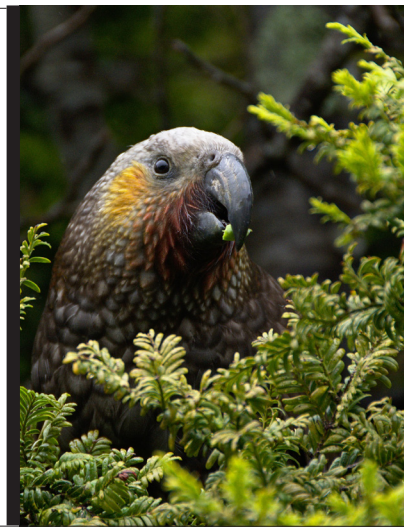
1.1 Introduction

The Paris Agreement, the Strategic Plan for Biodiversity 2011–2020, the Sustainable Development Goals and the Sendai Framework for Disaster Risk Reduction[5] underscore the role nature can play in addressing humanity's most pressing problems. Actions that help conserve, restore or sustainably make use of biodiversity and ecosystems can provide adaptation benefits while also contributing to multiple facets of sustainable development. These include climate change mitigation, disaster risk reduction, and the maintenance of essential ecosystem services. Forest and grassland ecosystems provide floodwater retention and slope stabilization and serve as windbreaks, while also providing food, fodder and innumerable recreational and cultural services. In recognition of these critical services to humanity, ecosystem-based approaches to enhancing resilience to global change have taken root in recent years and have featured in policy frameworks, programmes and pilot projects.

5 See table 1 for a list of policies and frameworks encompassing EbA, Eco-DRR, NbS and related strategies.

Adaptation strategies include the conservation or restoration of ecosystems providing critical services, engineered or built infrastructure, or governance and policy instruments, among others. Increasingly, policymakers are favouring integrated strategies, such as nature-based flood defence.

Actions that help conserve, restore or sustainably make use of biodiversity and ecosystems can provide adaptation benefits while also contributing to multiple facets of sustainable development. These include climate change mitigation, disaster risk reduction, and the maintenance of essential ecosystem services.



Some agricultural practices can also be considered as examples of mixed strategies: local irrigation schemes, the planting of drought-tolerant or resilient seed varieties and resilient water infrastructure with upgraded embankments combine engineered and nature-based measures.

While adaptation can be planned, some societies, including rural communities and groups of people practising traditional livelihoods, have been continually adapting to change.

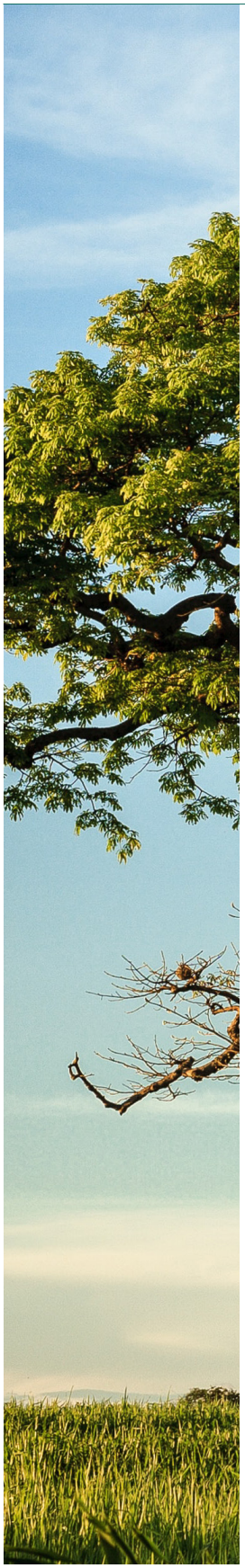
Support for integrating ecosystem-based approaches into broader strategies for enhancing resilience to global change, which may include use of the adaptation options mentioned above, is increasing. EbA and Eco-DRR are defined by the Convention on Biological Diversity (CBD)[6] as the use of biodiversity and ecosystem services as part of an overall adaptation strategy to help people adapt to the adverse effects of climate change and reduce disaster risk, through the sustainable management, conservation and restoration of ecosystems.[7] The concepts underpinning ecosystem-based approaches have contributed to the development of the umbrella concept of NbS and catalysed the idea that nature contributes directly to sustainable development beyond societal adaptation. Some examples of EbA with respect to forest and grassland systems include ecosystem restoration and conservation, agroforestry, sustainable livestock management, sustainable land management and vegetated windbreaks.

Related approaches include community-based adaptation, building with nature, green infrastructure, climate-smart agriculture and integrated water resources management. In practice, the terms EbA, Eco-DRR and NbS are often used interchangeably, and sometimes incorporate hybrid solutions. Despite differences in terminology, there is a growing movement towards integrating the sustainable management, conservation and restoration of biodiversity and ecosystems within an overall strategy to enhance the resilience of people and nature to global change.

6 SCBD 2019 (EbA Guidelines).

7 SCBD 2019 (EbA Guidelines).

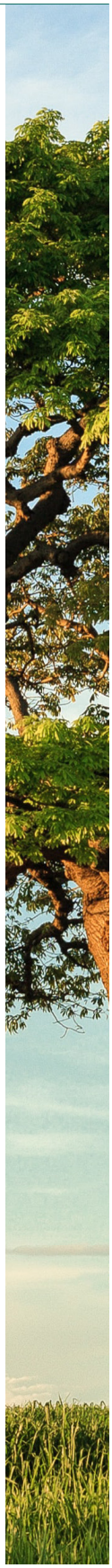
THE PROBLEM



While evidence is mounting for the efficacy and cost-effectiveness of integrating ecosystems into adaptation, and such adaptation strategies are gaining prominence, hard adaptation options (also referred to as engineered or technology-based options) are still among the most common approaches to reducing the risk of climate change impacts and disasters. More than half of all countries, including over 90 per cent of the least developed countries (LDCs), recognize the importance of protecting nature for adaptation planning and include elements of NbS in the adaptation components of their NDCs, but these goals are only described broadly, and many do not include measurable targets.[8]

Multiple challenges exist for implementation of EbA, including lack of available evidence on the effectiveness of approaches, inadequate financing and lack of appropriate governance arrangements.[9] Trade-offs between adaptation and other societal goals, such as mitigation and the maintenance of livelihoods, also arise and need full consideration. For example, the large-scale implementation of mitigation measures such as bioenergy with carbon capture and storage requires large areas of land and has the potential to deplete biodiversity, compete with food production and drive deforestation. At the same time, climate change and other human pressures are driving the loss of biodiversity and impairment of ecosystem functioning in forest and grassland ecosystems, impacting their ability to provide societal adaptation services while also creating potentially novel systems.

Such challenges and complexities are explored in this paper and analysed through a compilation of 16 case studies, backed by evidence from the literature and other sources of information, namely national adaptation plans (NAPs), NDCs and recent global biodiversity and climate change assessment reports. Examples of best practices and actions to address challenges and knowledge gaps are also presented, with contributions from the expert group on biodiversity and adaptation.



8 UNEP 2021.

9 Seddon et al. 2020.

1.2 Mandate and objectives

This scoping paper has been prepared in response to the Subsidiary Body for Scientific and Technological Advice (SBSTA) mandate to prioritize the thematic area of forests and grasslands under the Nairobi work programme on impacts, vulnerability and adaptation to climate change (NWP). In addition, the Adaptation Committee (AC) invited the NWP to address the linkages between biodiversity and climate change adaptation at the 14th NWP Focal Point Forum, scheduled to be held in conjunction with the twenty-sixth session of the Conference of the Parties (COP 26).

The NWP is the first stakeholder engagement mechanism created under the Convention. It serves as a technical bridge between Parties, constituted bodies and other stakeholders, enabling them to share and disseminate knowledge and experience on adaptation. The NWP mandates inform the adaptation needs of Parties; support the formulation and implementation of national adaptation plans (NAPs); and support the biodiversity and climate change related work of other constituted bodies, including the Least Developed Countries Expert Group (LEG) and the Standing Committee on Finance (SCF).

Scoping paper objectives

This paper is intended for Parties to the UNFCCC and non-State actors. Its purpose is to stimulate discussion and translate knowledge into action with a view to integrating the biodiversity and ecosystems of forests and grasslands into adaptation strategies. The scope of the paper includes the identification of adaptation knowledge gaps at the local, subnational, national, regional and global level.

The findings from this paper serve as an input to the 14th NWP Focal Point Forum, to be held in conjunction with COP 26. The Forum provides an interactive space for Parties, NWP partner organizations and thematic experts to exchange views and insights on thematic areas, knowledge gaps and action needed at different levels.

The secretariat collaborated with an expert group on biodiversity and adaptation to:

- Review the role of biodiversity and ecosystems in adaptation strategies, including community-based, ecosystem-based and hybrid approaches;
- Identify knowledge gaps and needs regarding the integration of biodiversity and ecosystems into adaptation. To align with the mandate of the NWP, this work focuses on forest and grassland ecosystems. The analysis draws on examples from different countries and regions, including the LDCs, small island developing States and African countries;
- Discuss approaches and strategies for addressing knowledge gaps, including discussion of good practices (through case studies) of where and how biodiversity has been integrated into adaptation strategies at various scales.

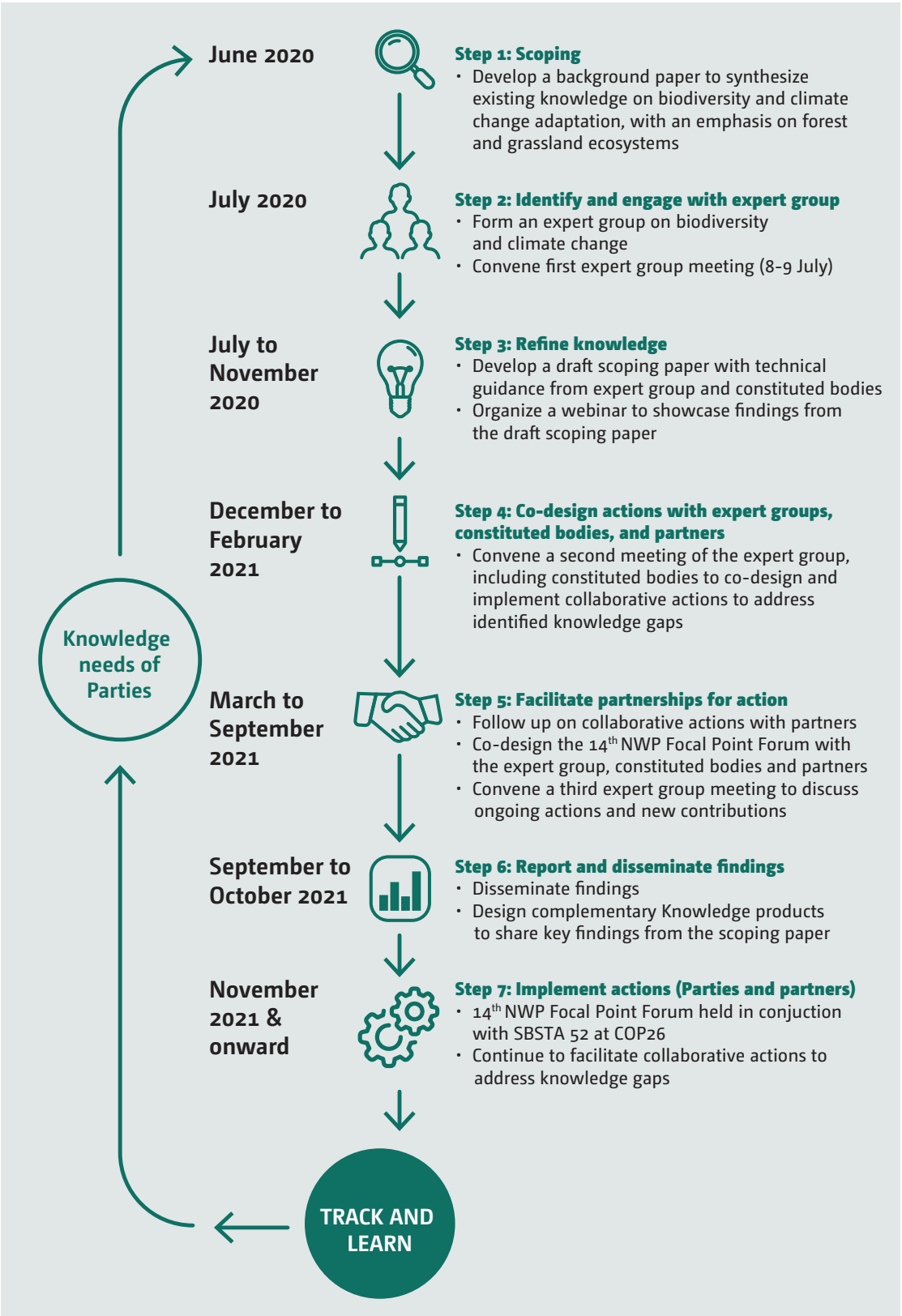
1.3 Knowledge to action

Under the NWP's knowledge-to-action approach, collaborative partnerships drive activities that produce relevant knowledge products and catalyse action in response to identified knowledge needs under relevant topics and thematic areas. Building on previous experience and existing resources, the NWP follows a stepwise approach to turn knowledge into action (figure 1).

As the initial step in its knowledge-to-action process, in July 2020 the secretariat convened an expert group on biodiversity and adaptation comprising policymakers, practitioners and researchers representing diverse organizations and institutions (see annex I for a list of group members and their affiliations). The expert group provided inputs to this scoping paper and the case studies and will continue to collaborate with each other and the secretariat in designing the NWP Focal Point Forum as well as co-designing actions related to refining and closing adaptation knowledge gaps beyond the Forum. At an initial virtual meeting, members of the group discussed challenges, knowledge gaps, needs and actions regarding adaptation in forest and grassland ecosystems.

For this scoping paper, knowledge gaps were synthesized on the basis of the discussions at the expert group meeting and subsequent online exchanges among members, and by reviewing national reports submitted as part of the UNFCCC process as well as the relevant literature. Online exchanges were also conducted between the expert group and the broader community, namely with a practice group set up within the Friends of EbA (FEBA) network under the IUCN Commission on Ecosystem Management.

Figure 1: The Nairobi work programme's knowledge-to-action workflow for the thematic area of biodiversity and adaptation

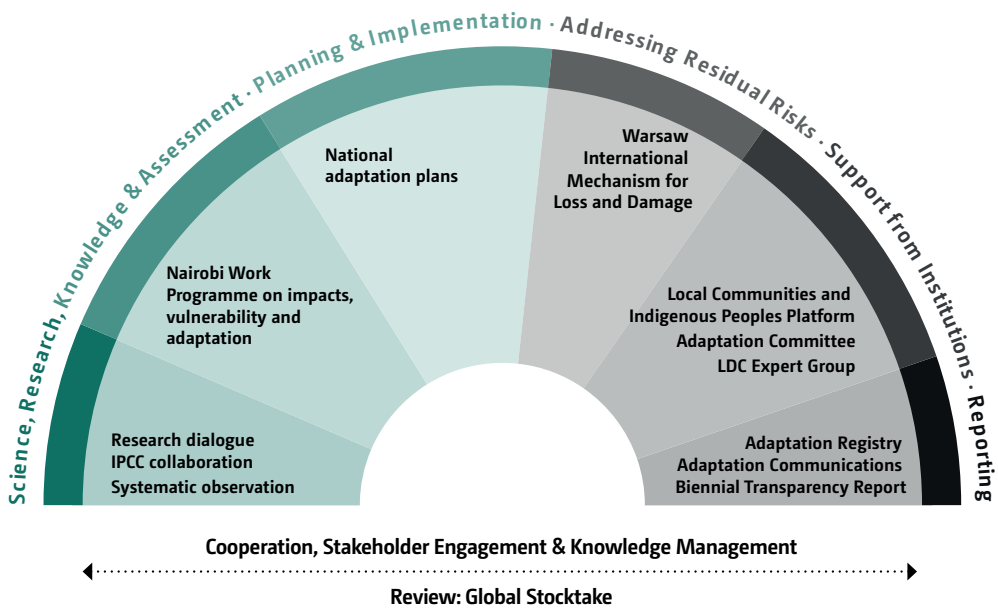


1.4 Global Agendas Supporting Biodiversity, Ecosystems and Adaptation

As countries face increasing risks to the health and livelihoods of their populations, and to the environment, the urgency of adaptation actions has become clear. In response to the rising prominence of the adaptation agenda, a network of adaptation-related institutions, bodies and mechanisms has formed under the UNFCCC through which Parties can find support (figure 2).

Article 2 of the UNFCCC states that "The ultimate objective of this Convention...is to achieve... stabilization of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system. Such a level should be achieved within a time frame sufficient to allow ecosystems to adapt naturally to climate change, to ensure that food production is not threatened and to enable economic development to proceed in a sustainable manner".

Figure 2: Support for adaptation under the UNFCCC



Source: UNFCCC, 2019

The Cancun Adaptation Framework aims to enhance action on adaptation, reducing vulnerability and building resilience in developing country Parties. Under the Framework, the aim of NAPs is to reduce vulnerability to the impacts of climate change by building adaptive capacity and resilience, and integrate climate change adaptation into policies, programmes and activities within all relevant sectors and across scales.

The main elements of the NAP process are laying the groundwork and addressing gaps; preparatory elements, including identifying and appraising adaptation options; implementation strategies; and reporting, monitoring and review.

EbA is one of several approaches in the NAP Technical Guidelines[10] for conducting vulnerability and risk assessments. These assessments can aid in prioritizing measures, such as conservation or restoration, to maintain ecosystem health and functioning. Countries have progressed on this front by including in their NAPs EbA strategies[11] such as creating seed banks to preserve duplicate samples of a variety of plant seeds; developing and cultivating stress-tolerant crops and livestock breeds; restoring ecological systems through rainwater harvesting, sustainable agriculture, soil regeneration and agroforestry; using information and communication technologies in climate change adaptation; and establishing specific issues such as biodiversity and tourism as the pillars for their national adaptation strategies.

Article 2 of the Paris Agreement recognizes protecting the integrity of ecosystems and biodiversity for both climate change mitigation and adaptation actions, laying out principles for considering the crucial role of ecosystems. It calls for integrating adaptation into relevant environmental policies and actions, where appropriate, as well as for building resilience of ecosystems through sustainable management of natural resources. Multiple elements of the Paris Agreement emphasize the resilience of communities and ecosystems as central to adaptation (box 1).

Under the Paris Agreement, Parties are requested to communicate every five years, in documents known as NDCs, their post-2020 actions to reduce national emissions and adapt to the impacts of climate change. The latest NDC synthesis report[12] analyses 48 first and updated NDCs, 39 of which have an adaptation component, and which refer to food security and productivity and to terrestrial and wetland ecosystems as the top two adaptation priorities (figure 3). Most adaptation components describe adaptation efforts to protect terrestrial ecosystems and forests, with Parties aiming to increase protected areas and connectivity, enhance urban biodiversity and implement sustainable forest management and reforestation. Examples of adaptation strategies outlined in NDCs[13] that integrate ecosystems include establishing biodiversity corridors, enhancing species conservation, regenerating 40 per cent of degraded forests and rangelands, increasing forest coverage to 42 per cent of land area, allocating 2,000 hectares of land to nature-based enterprises and allocating 30 per cent of land to agroforestry by 2025. Countries also reported that an ecosystem-based or community-based approach could maximize synergies between adaptation and mitigation.

10 NAP Technical Guidelines, Least Developed Countries Expert Group 2012. See https://unfccc.int/files/adaptation/cancun_adaptation_framework/application/pdf/naptechguidelines_eng_high__res.pdf.

11 See the progress in the process to formulate and implement national adaptation plans (FCCC/SBI/2019/INF.15).

12 See FCCC/PA/CMA/2021/2.

13 Seddon et al. 2016; UNFCCC 2021.

BOX 1 BIODIVERSITY AND ECOSYSTEMS IN THE PARIS AGREEMENT

Preamble

Parties note the importance of **ensuring the integrity of all ecosystems, including oceans, and the protection of biodiversity**, recognized by some cultures as Mother Earth.

Article 5, paragraph 2

Parties are encouraged to take action to implement and support . . . for: policy approaches and positive incentives for activities relating to reducing emissions from deforestation and forest degradation, and t**he role of conservation, sustainable management of forests and enhancement of forest carbon stocks** in developing countries; and alternative policy approaches, such as joint mitigation and adaptation approaches for **the integral and sustainable management of forests**, while reaffirming the importance of incentivizing, as appropriate, non-carbon benefits associated with such approaches.

Article 7, paragraph 1

Parties . . . establish the global goal on adaptation of enhancing adaptive capacity, **strengthening resilience** and reducing vulnerability to climate change . . .

Article 7, paragraph 2

Parties recognize that adaptation is a global challenge faced by all . . . and makes a contribution to the long-term global response to climate change to **protect people, livelihoods, and ecosystems . . .**

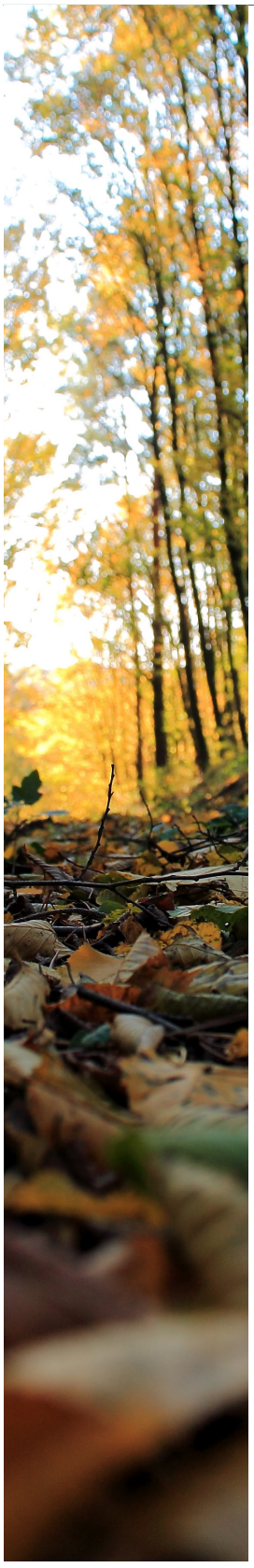
Article 7, paragraph 5

Parties acknowledge that adaptation action should follow a **country-driven, gender-responsive, participatory and fully transparent approach, taking into consideration vulnerable groups, communities and ecosystems**, and should be based on and guided by the best available science and, as appropriate, **traditional knowledge, knowledge of indigenous peoples and local knowledge systems,** with a view to integrating adaptation into relevant socioeconomic and environmental policies and actions, where appropriate.

Article 8, paragraph 4

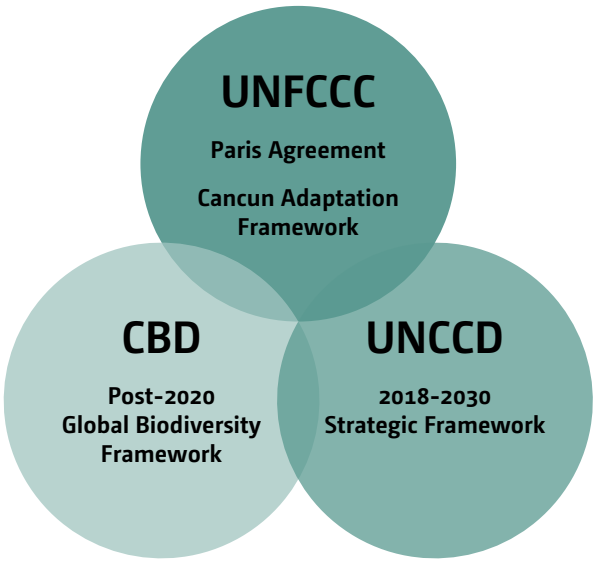
Areas of cooperation and facilitation to enhance understanding, action and support [under the Warsaw International Mechanism for Loss and Damage] may include . . . resilience of **communities, livelihoods and ecosystems.**

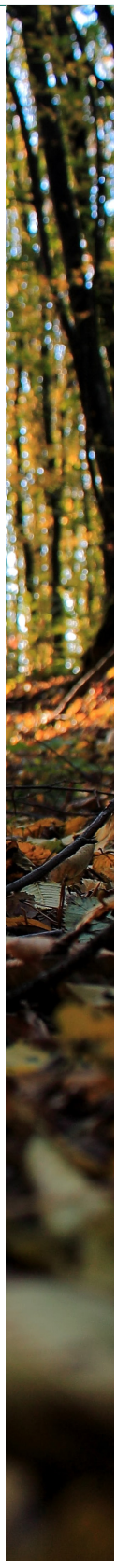
SYNERGIES UNDER THE RIO CONVENTIONS AND THE SUSTAINABLE DEVELOPMENT GOALS

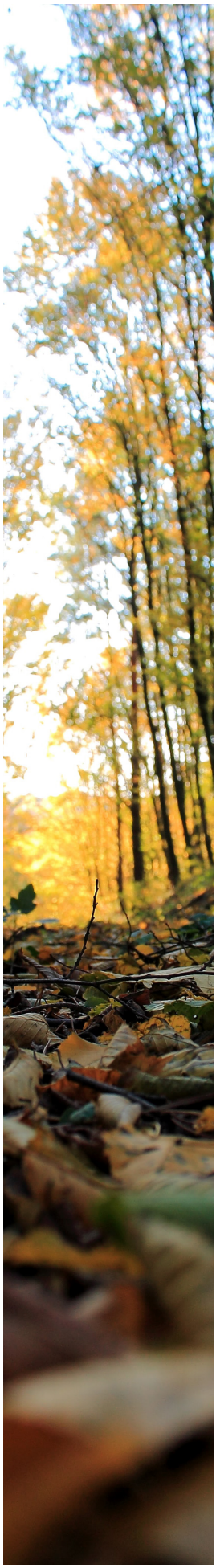


The concepts of biodiversity conservation and sustainable use and sustainable land management for achieving resilience to global change underpin the sister Rio Conventions of the UNFCCC. Parties to the CBD will adopt the post-2020 Global Biodiversity Framework in 2022 as the successor to the Strategic Plan for Biodiversity 2011–2020 in order to achieve the 2050 vision of "living in harmony with nature". The United Nations Convention to Combat Desertification (UNCCD) 2018–2030 Strategic Framework recognizes the important services provided by ecosystems, especially dryland ecosystems, for drought mitigation and the prevention of desertification. By adopting the Land Degradation Neutrality target under this Framework, Parties have agreed that the amount of healthy and productive land should stay stable from 2030, thus enhancing land resilience to climate change and halting biodiversity loss linked to ecosystem degradation. Implementation of the Rio Conventions in a coherent and synergistic manner has the potential to yield multiple benefits for many facets of sustainable development, including climate change mitigation and adaptation; biodiversity conservation and sustainable use; and sustainable land management and enhanced livelihoods (figure 3).

Figure 3: Potential synergies for sustainable development by implementing the Rio Conventions



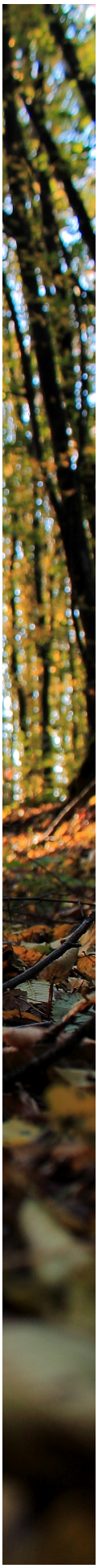




Through the Collaborative Partnership on Forests,[14] the secretariats of the Rio Conventions collaborate with other relevant organizations to promote the long-term sustainable management of forests. The Rio Convention bodies also partner with various organizations,[15] to strengthen the capacities of countries to combat forest biodiversity loss, desertification and land degradation, to reduce emissions from land use and land-use change and to support adaptation through maintaining ecosystem services and providing livelihood options.[16] The GEF strategy on sustainable forest management is based on the principle that forest projects can and should contribute to several objectives of the Rio Conventions simultaneously.

The Joint Liaison Group[17] of the secretariats of the CBD, the UNCCD and the UNFCCC is a mechanism for coordination among the three Rio Conventions. The Group facilitates the sharing and exchange of information, supports collaboration among national focal points for each Convention and explores options for further cooperation. One example of a joint outreach activity is the Rio Conventions Pavilion, a platform convened at the conferences of the Parties of the three Conventions for raising awareness of and sharing information about the latest practices and outcomes on the co-benefits that can be realized through the implementation of the Rio Conventions.

Biodiversity and ecosystems are also threaded throughout various UNFCCC programmes and initiatives and various agreements at the global and regional level – a list of these can be found in annex II.



14 See https://www.un.org/esa/forests/collaborative-partnership-on-forests/index.html.

15 This includes the Food and Agriculture Organization of the United Nations (FAO), the Global Environment Facility (GEF), the International Tropical Timber Organization, the United Nations Development Programme (UNDP), the United Nations Environment Programme (UNEP), the World Bank and United Nations Forum on Forests.

16 For more details on the Rio Conventions 2012, Action on Forests, see https://unfccc.int/resource/docs/publications/rio_20_forests_brochure.pdf.

17 See https://unfccc.int/about-us/about-the-secretariat/the-joint-liaison-group.

CHAPTER 2

UNDERSTANDING THE ROLE OF FOREST AND GRASSLAND BIODIVERSITY AND ECOSYSTEMS IN ADAPTATION

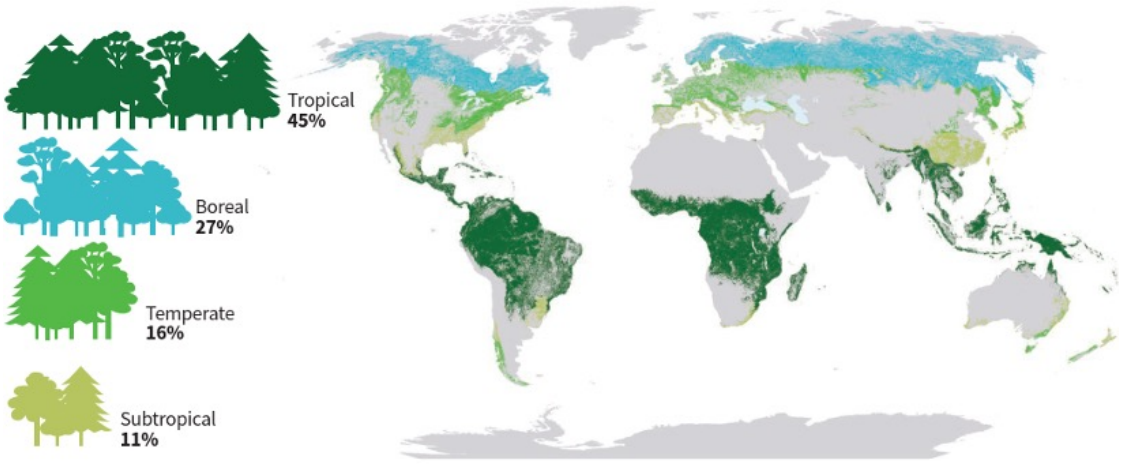
2.1 Contribution of forests and grasslands to adaptation and sustainable development

Forests[18] cover 4 billion hectares on Earth, or nearly a third of all land (figure 4). Forests support a wide range of services to humanity, from provisioning to regulatory (e.g. water filtration, temperature regulation) to cultural ecosystem services. Worldwide, 186 million hectares of forest are allocated for social services such as recreation, tourism, and the conservation of cultural and spiritual sites.[19]

18 Countries define forests differently. CBD and FAO refer to forests as natural forests and forest plantations, defined as land with a tree canopy cover of more than 10% and an area of more than 0.5 hectares. Forests are determined by both the presence of trees and the absence of other predominant land uses.

19 FAO 2020.

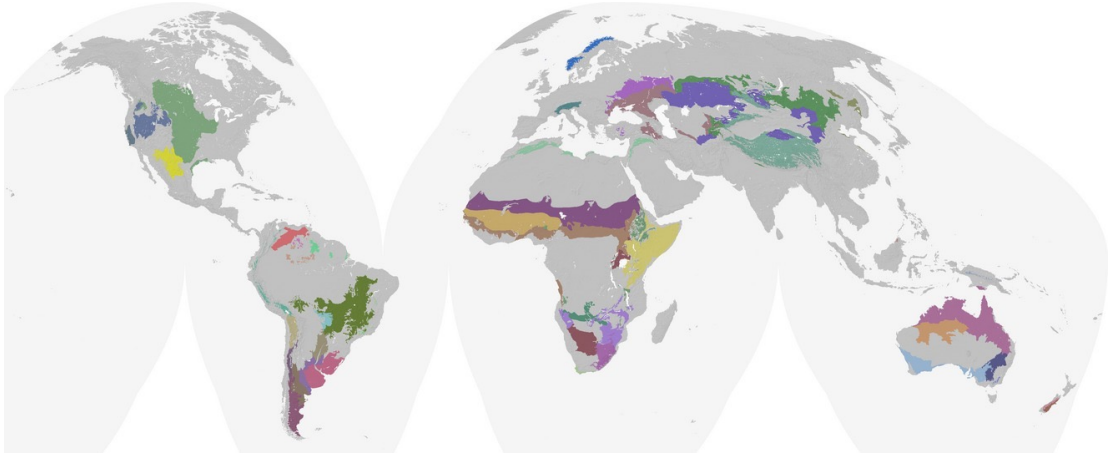
Figure 4: Proportion and distribution of global forest area by climatic domain, 2020



Source: FAO 2020, adapted from United Nations World map, 202.

Grasslands and rangelands occur naturally on all continents except Antarctica (figure 5). They occupy nearly half of the world's ice-free land and provide multiple services for people, including forage for livestock and native herbivores, habitat for native flora and fauna, provisioning ecosystem services (such as water and mineral resources) and reserves for recreation and nature conservation.[20] Natural grasslands are areas mainly created by processes related to the climate, fire and wildlife grazing (and they may also be used by livestock). Semi-natural grasslands are the product of human management, requiring maintenance by livestock grazing or hay-cutting, and will normally be encroached on by shrubs or trees if left unmanaged.[21]

Figure 5: The global extent of grasslands and distribution mapping of grassland types.



International Vegetation Classification (IVC) matched with terrestrial ecoregions of the world. 49 IVC divisions are displayed; 16 other IVC divisions are unmapped due to scale.

Source: Dixon et al. 2014.

20 Cobon et al. 2018.
21 Bengtsson et al. 2019.

Together, forests and grasslands provide innumerable services to people. Forest, water and energy cycle interactions provide the foundation for achieving forest-based adaptation and mitigation goals.[22] Forest conservation actions can provide refuges and migration corridors for species that are adapting to changing climate patterns or responding to sudden climate events; enable societal adaptation to climate events while reducing vulnerability to floods, droughts and other weather-induced problems; and reduce the costs of climate-related negative impacts.[23] Intact forest ecosystems play an important role in maintaining natural disease dynamics in wildlife communities and reducing the probability of contact and pathogen transmission among humans, livestock and wildlife.[24] Natural and semi-natural grasslands provide agricultural services in addition to ecosystem services such as water supply and flow regulation, carbon storage, erosion control, climate mitigation, pollination and cultural ecosystem services.[25] The numerous adaptation services provided by grasslands include buffering from climate extremes, landscape connectivity, erosion control, shade and resilient fodder production.[26]

Biodiversity underpins the ecosystem processes and functions that provide critical services to society, including climate change adaptation and disaster risk reduction (see box 2).[27] For example, biodiversity promotes ecosystem performance and resistance to insect pests and diseases. The loss of biodiversity, which is attributable to many drivers, including climate change, alters ecosystem functioning across temporal and spatial scales, reducing ecological integrity and the corresponding capacity of ecosystems to provide ecosystem services.[28] Key ecosystem services and functions that are affected by habitat degradation and fragmentation include pollination, seed dispersal, pest control, nutrient cycling, decomposition, preservation of water quality and prevention of soil erosion.[29] Through complex functional relationships and competition as well as seed-dispersal dynamics, the loss of biodiversity erodes the carbon storage capacity of forests.[30] Field experiments demonstrate that the loss of biodiversity in grasslands threatens ecosystem functioning and sustainability.[31] Models show that biodiversity is linked to the stability of grassland ecosystems against environmental change, but biodiversity also has direct effects on the quantity and quality of grassland productivity.[32]

2.2 Vulnerabilities of forests and grasslands to climate change and land-use change

However vast, forest and grassland biomes face critical threats from multiple drivers of change, reducing their potential to deliver adaptation services. The first Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES)[33] global assessment report on biodiversity and ecosystem services emphasizes that nature and its vital contributions to people, which together embody biodiversity and ecosystem functions and services, are deteriorating worldwide. Climate change is affecting forest ecosystem health owing to the increased frequency, severity and duration of extreme weather events such as heatwaves and droughts;[34] the

22 Morecraft et al. 2019.
23 Mansourian, Belokurov and Stephenson 2009.
24 Marco et al. 2020.
25 Bengtsson et al. 2019.
26 Lavorel et al. 2019.
27 Cardinale et al. 2012.
28 Isbell et al. 2017; Perrings et al. 2010.
29 Watson et al. 2018.
30 See http://www.cpfweb.org/73947/en/.
31 Tilman et al. 1996.
32 Van Oijen et al. 2018.
33 IPBES 2019.
34 Allen et al. 2010.

BOX 2 DEFINITIONS OF BIODIVERSITY AND ECOSYSTEMS IN ADAPTATION

Biodiversity means the variability among living organisms from all sources including, inter alia, terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part; this includes diversity within species, between species and of ecosystems (Article 2 of the CBD).

Ecosystem means the dynamic complex of plant, animal and micro-organism communities and their non-living environment interacting as a functional unit (Article 2 of the CBD). Ecosystems are shaped by people, and all people depend on the capacity of ecosystems to deliver essential ecosystem services. Thus, people and ecosystems are interdependent social-ecological systems (Elmqvist et al. 2010).

Ecosystem functioning refers to the flow of energy and materials through the biotic and abiotic components of an ecosystem. It includes many processes such as biomass production, trophic transfer through plants and animals, nutrient cycling, water dynamics and heat transfer (IPBES glossary).

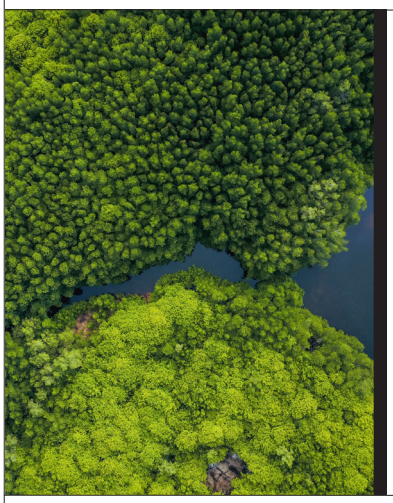
Biodiversity underpins ecosystem functioning, and in turn, the provisioning of **ecosystem services**, including the services that contribute to enhancing resilience of the social-ecological system and reducing the risk of climate change impacts and disasters (Cardinale et al. 2012). Biodiversity plays an important role in promoting resilience in ecosystem functioning under environmental perturbations (Oliver et al 2015).

The Fifth Assessment Report of the Intergovernmental Panel on Climate Change (IPCC) notes that **successful adaptation will depend on our ability to allow and facilitate natural systems to adjust to a changing climate, thus maintaining the ecosystem services on which all life depends** (IPCC 2014).

expanding ranges in warmer temperatures of pests and diseases; and the increased vulnerability to fire due to longer fire seasons and drought.[35] The combination of pressures can be deadly to ecosystems; for example, drought and heat can together bring forests past the tipping point for die-off.[36] Globally, in 2015, about 98 million hectares of forest were affected by fire, representing approximately 4 per cent of total forest area, with two-thirds of the affected area being in Africa and South America.[37] And globally, 40 million hectares of forests, mainly temperate and boreal, have been affected by insects, diseases and severe weather events.[38]

Across the globe, plant diversity is in serious decline, with the number of documented plant extinctions comprising twice the number of extinctions of mammals, birds and amphibians combined. An assessment of a sample of thousands of species representing the taxonomic and

35 IPCC 2019.
36 Verbesselt et al. 2016.
37 FAO 2020.
38 See https://unfccc.int/about-us/about-the-secretariat/the-joint-liaison-group.



Actions to conserve, restore or sustainably use biodiversity and ecosystems can provide adaptation benefits while also contributing to multiple facets of sustainable development. These include climate change mitigation, enhancement of livelihoods and maintenance of essential ecosystem services.

geographical breadth of global plant diversity showed that one in five plant species (22 per cent) is threatened with extinction, with most of the threatened species being in the tropics.[39] The IPBES assessment report found that 1 million plant and animal species are threatened with extinction as a result of anthropogenic activities.

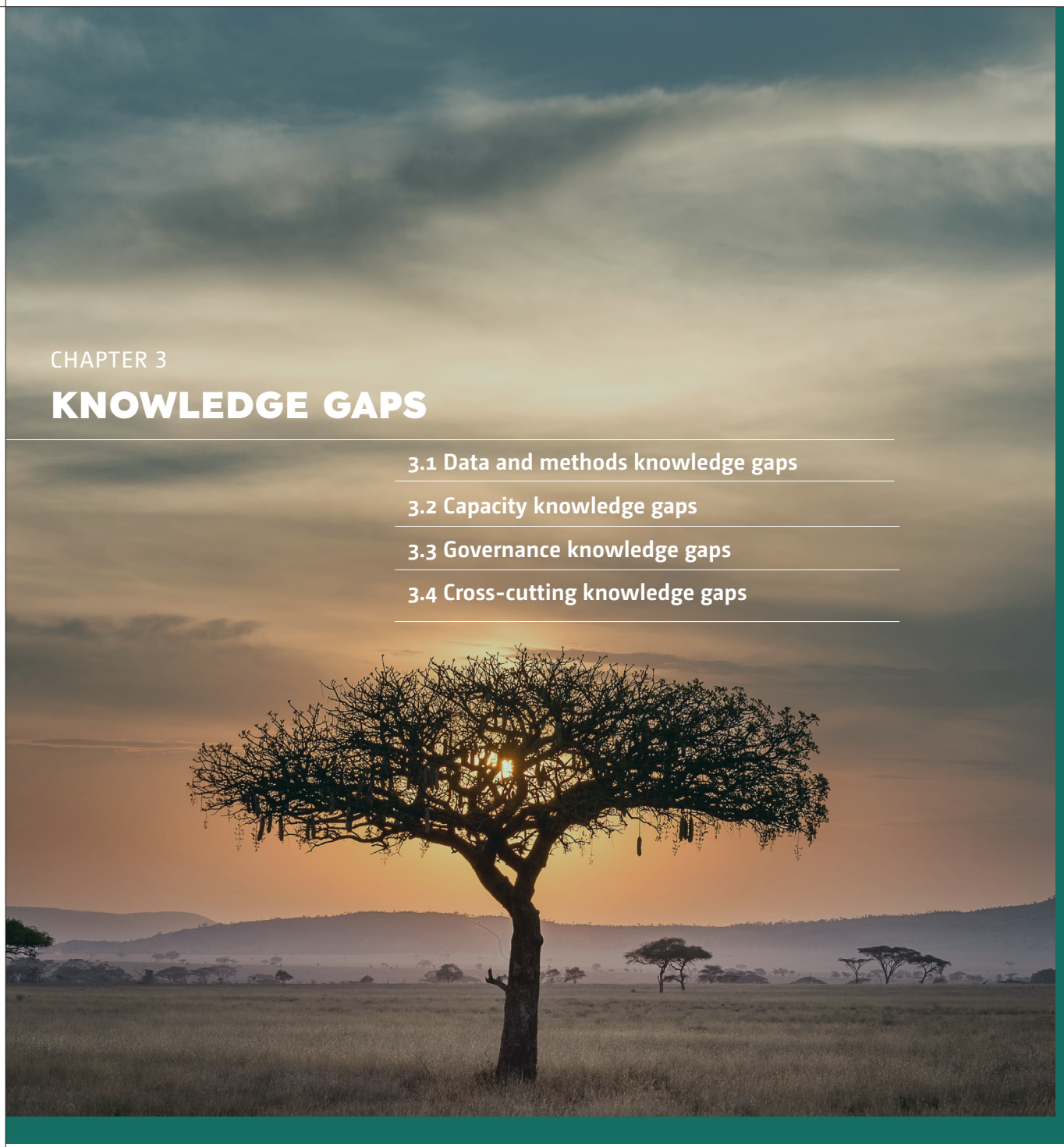
While climate change is currently a key driver of species extinction and is predicted to remain as such in the future, other drivers of change include land-use change, the spread of invasive alien species and zoonoses, and resource overexploitation, all of which lead to widespread fragmentation and degradation of forest and grassland habitats. Land-use change includes deforestation and the conversion of valuable carbon-storing peatlands to oil palm and fast-growing tree plantations. By 2050, scenario projections forecast a 50 per cent reduction in terrestrial biodiversity caused by destructive agricultural and forestry activities.[40]

Models forecast a major decline in mammal habitats, particularly in Africa and South America.[41] In grasslands, climate change, including warming and changes in precipitation, together with land-use change, including overgrazing, are driving dramatic shifts in ecosystem diversity, structure and functioning, leading to loss of productivity and carrying capacity for livestock.[42]

The consequences of ecosystem degradation extend to human health. For example, the haze generated by burning to clear land results in premature deaths. The COVID-19 pandemic is a stark reminder of the crucial role that intact forests play in maintaining natural disease dynamics and preventing the transmission of pathogens among humans, wildlife and livestock.[43]

Before the pandemic, scientists had established that human encroachment in natural areas is associated with the risk of human exposure to infectious diseases including dengue fever, Ebola virus disease, hantavirus, malaria yellow fever and Zika virus disease.[44] In an era of global change, with the intertwined impacts of climate change, land-use change and pandemics, prioritizing the protection and restoration of ecosystems will be a critical strategy not only for adaptation and mitigation, but also for risk reduction in terms of human health.

39 WWF 2020.
40 Kok et al. 2018.
41 Baisero et al. 2020.
42 Li et al. 2018; Wilcox et al. 2015; Ma et al. 2017.
43 UNEP and International Livestock Research Institute 2020.
44 Watson et al. 2018.



CHAPTER 3

KNOWLEDGE GAPS

This chapter discusses knowledge gaps and needs in integrating biodiversity and ecosystems into adaptation strategies. Knowledge gaps are interpreted broadly and encompass lack of information and data, lack of information and data in needed formats, and lack of specific tools or awareness of tools for processing information and data. Broader challenges related to making use of knowledge are also discussed.

Knowledge gaps were determined by first reviewing relevant peer-reviewed and grey literature on biodiversity and adaptation in grasslands and forests, including national reports submitted as part of the UNFCCC process and recent assessment reports by IPBES and the IPCC covering biodiversity, ecosystem services and climate change, with a focus on land. The knowledge gaps were then discussed with the expert group on biodiversity and adaptation (see section 1.3) in a virtual meeting and through subsequent online exchange and collaboration. Case studies were solicited from the expert group on biodiversity and adaptation (described in section 5).

3.1 Data and methods knowledge gaps

Constraints to adaptation

The planning and implementation of adaptation actions can be constrained by a range of biophysical, institutional, financial, social and cultural factors. For example, higher rates of global change may reduce the effectiveness of some adaptation options or result in them attracting a higher cost. If tipping points in biomes are exceeded such that adaptation of natural systems is constrained, severe adverse consequences are predicted to result.[45] In regions where livelihoods are dependent on ecosystem goods and services, adaptation may be constrained by population growth and development, leading to ecological degradation. There are also physical constraints to adaptation, such as soil conditions or land-use change, which affect how forests and plants shift their ranges in response to climate change. Adaptation success also depends on how quickly institutions can respond to climate change challenges and implement effective response strategies.[46]

In addition to constraints, there are limits to adaptation arising from the interaction of climate change processes with biophysical and socioeconomic constraints. Insights have been gained on tipping points, key vulnerabilities and planetary boundaries; however, empirical evidence on the quantification of dynamics around these thresholds is lacking.[47]

Interacting drivers of change

Drivers of change are factors that, directly or indirectly, cause changes in social-ecological systems. Multiple drivers of change affect forest and grasslands – both direct drivers, such as clear-cutting, and indirect drivers, such as nutrient enrichment from agricultural activities. Ecosystems can only support adaptation if they continue to function under a changing climate, thus it is important to analyse potential vulnerabilities of NbS to climate change impacts and interactions between drivers. Uncertainties are associated with localized climate change impacts and population responses to multiple interacting impacts and adaptation strategies.[48] In order to design effective adaptation strategies and avoid maladaptation, it is critical to better understand the long-term interaction of drivers and uncertainties of impacts, and how these uncertainties affect adaptive capacity. Investments are needed for long-term research, data management and exchange (particularly in transboundary contexts), the application of social and environmental trade-offs, and monitoring and evaluation systems for tracking the effectiveness of adaptation strategies.

Other knowledge gaps identified in national reports and by the expert group on biodiversity and adaptation include:

- Understanding of the linkages between ecosystem status or condition and community resilience;
- Understanding of how landscape and ecosystem functioning underpins adaptation services, delineating the role of provisioning and non-provisioning ecosystem services;
- Understanding of the role of conservation and restoration measures in mitigation and adaptation;
- Understanding of specific ecosystems and cultural landscapes, including dry tropical forests, temperate and subalpine forests, rangelands and grasslands of the Himalayas, savannahs and oases.

Social-ecological systems

Understanding the target social-ecological system for an adaptation action is a necessary first step in its implementation. Challenges relate to accepted methodologies

45 IPCC 2014.
46 Van Oijen et al. 2018.
47 Klein et al. 2014.
48 Phillips-Mao et al. 2016.

for incorporating diverse values, cultures and knowledge systems – including traditional knowledge, knowledge of indigenous peoples and local knowledge – into design and implementation of actions. Understanding social-ecological systems and assessing vulnerabilities across geopolitical boundaries can be complex, and few successful precedents exist upon which to draw for learning and for application to transboundary adaptation initiatives. Vulnerabilities and risks can be difficult to assess when accounting for system shocks and crises, such as the COVID-19 pandemic, which compound existing adaptation challenges. Vulnerabilities and risks can be difficult to assess when accounting for system shocks and crises, such as the COVID-19 pandemic, which compound existing adaptation challenges.

Changing values and traditions pose a challenge to implementing adaptation strategies in the Hindu Kush Himalayas, given the lack of interest by the younger generation in traditional land use and stewardship, and their perception that local products are not organic or healthy (case study 10).

Identification, prioritization and appraisal of adaptation options

Engineers and financiers have tended to opt for well-known adaptation measures such as infrastructure, for example sea walls to safeguard against storm surges and sea level rise. Even now, much disaster risk recovery funding is directed to infrastructure. Without piloting NbS at sufficient scale, building a good knowledge base for these solutions will be difficult. Securing robust evidence of their impacts and potential maladaptation over time is a major challenge.

A strong scientific evidence base, particularly quantitative socioeconomic assessments and economic cost–benefit analyses, is needed for ecosystem-based approaches. Comprehensively valuing the full range of these approaches' social, economic and environmental benefits over time is challenging and requires capacity; thus, benefits are often undervalued. For example, methodologies for estimating blue carbon are far behind those for estimating in land forest-based carbon, so investment in mangrove forests for their carbon sequestration value is lagging.

Measuring return on investment in adapting to drought in pastoral lands in Isiolo County, Kenya, has been challenging. Direct benefits are difficult to quantify, in part owing to the mobility of pastoralists, and the broader economic benefits of ecosystem services and pastoral production systems are even more challenging to quantify, resulting in their true value being underestimated (case study 1).

Interdisciplinary adaptation strategies

The design and development of transdisciplinary adaptation strategies, which require the engagement of stakeholders, ecologists, planners, engineers and architects, is relatively new. The field currently suffers from a lack of experience, particularly in integrating biodiversity and ecosystems into existing grey adaptation interventions. Challenges include connecting actors, such as engineers, architects, ecologists, development agencies, civil society organizations and decision makers, and using common terminology. Lack of communication and lack of capacity for coordination can lead to the duplication of effort.

Designing adaptation strategies to be context-specific, decentralized and transformative is an ongoing and evolving challenge.

3.2 Capacity-related knowledge gaps

Monitoring and evaluation

Effective monitoring and evaluation of adaptation outcomes is essential to learn from best practices and reduce uncertainties about effectiveness and long-term impacts. Evaluating the progress and effectiveness of adaptation measures is hampered by a lack of long-term monitoring mechanisms and institutions, including long-term research stations, such as for mountainous and high-elevation grasslands and rangelands. There is also

a lack of clearinghouse mechanisms and open access to data, limiting empirical research. Capturing perceptions can be useful in assessing effectiveness and doing so provides important information not accessible to quantitative methods; however, limits to perception analyses should be accounted for, and the capture of perceptions must be carefully designed so as to avoid biases.[49] *The Guidebook for Monitoring and Evaluating Ecosystem-based Adaptation Interventions*[50] is an example of a tool for addressing this gap; it aims to provide guidance on establishing a baseline upon which to standardize approaches for monitoring and evaluation.

Scaling up of initiatives

While there are many examples of successful bottom-up, locally developed adaptation strategies, such as those included in this paper, scaling them up can be a challenge. For example, farmer-managed natural regeneration for landscape restoration has been implemented in the Maradi and Zinder regions in the Niger, but it can be difficult to determine where similar approaches can be implemented and where it may be necessary to combine restoration with other techniques. To scale up such initiatives, research into functional ecology in different contexts is needed, as is increasing the capacity to conduct socioeconomic assessments.[51] Lessons learned from the case studies also in the paper reveal that stakeholders perceive a lack of understanding of ecosystem-based approaches as one impediment to their widespread implementation.[52]

Financing and investment

Knowledge gaps hinder the scaling up of innovative finance mechanisms. A wide range of adaptation strategies have been backed by innovative pilot financing mechanisms, including through community enterprises, microfinance and public-private partnerships.

In response to recurrent droughts and floods in arid grasslands in Uganda and Kenya, an innovative community conservation fund was set up to support the restoration of catchments while providing sustainable livelihood packages to beneficiaries, spurring an increase in small business initiatives by communities, with many resulting in net environmental benefits (case study 3).

Challenges include delineating who receives access to available funding and the responsibilities for long-term maintenance; coping with the short-term nature of project cycles; prioritizing sustainable investments that respect human rights in vulnerable communities or areas; and mobilizing private sector investment.

While there is a need to scale up innovative mechanisms that deliver both biodiversity gains and sustainable livelihoods for long-term benefits, some, such as public-private partnerships, already exist. For example, the InsuResilience Global Partnership for Climate and Disaster Risk Finance and Insurance was launched by the Group of 7 countries in 2017, supported by the Vulnerable Twenty Group, with the aim of executing more timely and reliable post-disaster response and better preparing for climate and disaster risks using risk finance and insurance.

Currently, the partnership supports 25 programmes in 78 countries with the help of its implementing partners. Programmes include the development of regional sovereign risk pools, such as African Risk Capacity and the Pacific Catastrophe Risk Assessment and Financing Initiative.

At the community level, community forest enterprises (micro, small or medium-sized enterprises that are forest-based or forest landscape based) hold promise for being scaled up; for example, small-scale producers of teak wood, coffee, cocoa, honey, bamboo and rattan; sedge grass weavers; and ecotourism providers.

49 Reid et al. 2019.
50 GIZ, UNEP-WCMC and FEBA 2020. See https://www.adaptationcommunity.net/download/ME-Guidebook_EbA.pdf.
51 Chomba et al. 2020.
52 Li et al. 2018; Wilcox et al. 2015; Ma et al. 2017.

Community forest enterprises can help secure rights, access and benefits for local communities; protect forests from fire, landslides and floods; reduce overgrazing, unsustainable harvesting and illegal cutting; secure and diversify livelihood sources for communities; reduce deforestation and forest degradation; and increase the resilience of the forest ecosystem and of biodiversity.

Sufficient evidence of the cost-effectiveness of EbA is currently lacking, hampering the uptake of such approaches across sectors. Related challenges include establishing accepted methodologies for valuing ecosystem services, including the recognition of non-monetary ecosystem service values, and understanding the ways in which long-term finance can aid in achieving adaptation, mitigation, livelihood, biodiversity and other benefits.

3.3 Governance knowledge gaps

Governance in the context of adaptation involves the collective efforts of multiple societal actors to address issues associated with the impacts of climate change, including the creation of institutions and rules, and the selection of normative principles to guide problem solving and institution-building.[53] Key challenges associated with adaptation governance knowledge gaps include governing at multiple scales, given that climate change impacts occur at various scales and ecosystem governance occurs within a complex web of stakeholders operating at different levels; governing across different sectors; and governing under uncertainties regarding the sensitivity of the climate system, regional climate change impacts and the consequences for social-ecological systems.[54]

Challenges that have been encountered in implementing adaptation measures in South Africa include lack of local government authority to implement adaptation measures, inadequate policy support at the provincial level, insufficient cross-sectoral collaboration at all levels, knowledge gaps, funding shortages, low-capacity levels, weak institutional effectiveness and high levels of poverty (case study 2). Power and trust issues pose potential barriers to adaptation implementation, as observed when implementing community-based watershed management training and EbA in Myanmar (case study 7).

The need for a holistic approach to governance to pursue multiple objectives is increasingly being recognized. For example, in the United Kingdom of Great Britain and Northern Ireland, the Climate and Ecological Emergency Bill has been tabled in Parliament, and the Government is setting aside millions of pounds sterling for NbS work. Governments and government institutions tend to be restricted to their sectoral silos, but NbS can be a prime opportunity for achieving broad public benefits.

Transboundary governance

Adaptation interventions may be hampered when conservation and development approaches do not consider the sensitivity and fragility of complex social-ecological systems. Mechanisms for the effective transdisciplinary governance of adaptation strategies are needed, including large-scale, landscape-level planning that integrates ecosystems across political boundaries. For example, adaptation strategies to respond to vulnerabilities in the tundra, alpine and montane forest ecosystems of Bhutan, India and Nepal are multidimensional and complex, and include consideration of geopolitical sensitivities, poverty, inequality, malnutrition and land-use change (case study 9).

Knowledge needs regarding governance challenges include:

- Developing mechanisms for regional and subregional cooperation and transboundary and multi-stakeholder collaboration;
- Integrating ecosystem-based approaches and NbS into sectoral policies beyond

53 Huitema et al. 2016.
54 SCBD 2019.

the environment, including planning, zoning, infrastructure and disaster risk management;

- Breaking siloed approaches across sectors and creating enabling conditions for the interaction of policymakers and decision makers;
- Integrating and safeguarding biodiversity in NDCs and long-term research and management strategies, including protecting indigenous and local knowledge; developing national implementation mechanisms for international agreements, given that many governments ratify agreements without putting in place implementation mechanisms;
- Defining criteria for going beyond incremental adaptation and achieving transformational adaptation;
- Integrating ecosystem-based approaches into NAPs and NDCs;
- Scaling up ecosystem-based approaches from pilot projects or individual actions to large-scale, integrated interventions at the landscape level, and addressing associated governance needs;
- Moving from adaptation diagnoses to implementation, including through the Lima Adaptation Knowledge Initiative under the UNFCCC.[55]

Trade-offs

Synergies among adaptation, mitigation and biodiversity are often assumed, but caution must be applied to avoid downplaying trade-offs, including livelihood resilience, for local people. There is a need to critically assess the assumptions underlying synergies using empirical research. For example, case studies of forest conservation in the Congo Basin found that perceived trade-offs for local communities included:

- Proximity of forests providing easier access to resources versus threat to livelihoods due to crop raiding by herbivores when pastures are not maintained, increased exposure to wildlife, and killing of livestock;
- Abundant forest resources due to conservation efforts versus availability of land for farming;
- Conservation restrictions preserving ecosystem integrity versus rights of local communities to access resources that may strengthen resilience;
- Strengthened forest management due to external intervention versus local power and control over forest resources.[56]

An analysis of EbA case studies for this paper found that other kinds of trade-offs had been encountered, including trade-offs between different land uses, different population groups, upstream and downstream areas, and competing uses in connected ecosystems.[57] There is a need to develop scientific and policy frameworks that navigate trade-offs, explicitly listing existing trade-offs at the local, national and international level and underlining clear strategies for maximizing synergies.

Trade-offs between social groups also have a gendered dimension. Research in drylands shows that ecosystem-based strategies adopted by women and men are being determined by gender norms and ethnic and class relations. By and large, men are often driven to adopting coping strategies that are not based on ecosystems, such as outmigration for employment purposes, as viable adaptation strategies. Such migration of men poses new challenges for women and increases their vulnerability, as forest-related traditionally male activities are added to their workload. Women have developed their own adaptation strategies based on forest resources (e.g. charcoal production) to adapt to recurrent droughts. But women are hindered in utilizing the

55 For more details on the LAKI, see https://unfccc.int/topics/adaptation-and-resilience/workstreams/nairobi-work-programme-nwp/the-lima-adaptation-knowledge-initiative.

56 Few, Martin and Gross-Camp, 2017.

57 Reid et al. 2019.

potential of ecosystem-based approaches owing to social norms and restrictions, insecure access to natural resources, lack of knowledge and financial resources, and limited market opportunities.[58]

Participatory approaches

Research and practice suggest that effective adaptation is based on the needs and self-identified problems of communities at the front lines of climate change. Meaningful, effective participation of all stakeholders, including indigenous peoples and local communities, is needed in adaptation planning. Women in particular are key observers of climate change given that much of their traditional livelihood roles in communities worldwide depend on animal and plant health and the availability of water and plant species, which are impacted by climate change. However, the development of inclusive approaches may be hampered by limited methodologies or lack of capacity for bottom-up community participation in adaptation strategies.

Participatory approaches can be scaled up and capacity enhanced for such approaches, including through co-design of strategies, use of participatory scenario planning tools, co-production of knowledge and via assessments.

The Bishnupur community forest user group in Nepal assessed the sources of climate vulnerability in the Sarlahi district and collectively identified and implemented NbS and alternative livelihood options. The community chose to expand tree cover to protect and restore the environment and cultivate beehives in order to generate income from honey, as these approaches were perceived as most appropriate for their needs and benefited women in particular (case study 6).

Land tenure

Another specific challenge that can hinder climate change actions relates to land tenure, including tenure of community, private, industry and government-owned forest areas. The IPCC Special Report on Climate Change and Land underscores that insecure land tenure affects the ability of people, communities and organizations to make decisions regarding land that can advance adaptation and mitigation objectives.[59] Two key NbS, avoiding deforestation and promoting reforestation, are limited by the fact that clear land tenure is lacking in many tropical forest areas.[60]

As a result of the limited recognition of customary access to land and land ownership, the vulnerability of communities can increase while adaptive capacity can decrease. For example, pastoralism can be an effective adaptation response to drought and food insecurity, but large areas are needed to allow grassland recovery and livestock to be moved to land with more favourable conditions. In Kenya, the privatization of small parcels of land prevents traditional management of large communal areas.[61] Implementing appropriate land policies, such as those that involve recognition of customary tenure, community mapping, redistribution, decentralization, co-management, and regulation of rental markets, can provide some flexibility for adaptation and mitigation options.[62]

Other governance challenges include the failure of governments to prioritize adaptation or support for NbS, and the provision of limited support by governments to the devolution of governance and to the securing of rights of indigenous peoples. EbA and NbS are also hampered by adverse incentives for extractive activities such as mining, deforestation and intensive agriculture.

58 Djoudi and Brockhaus 2011.
59 IPCC SRCCL 2018.
60 Wolosin and Harris 2018.
61 Reid and Orindi 2018.
62 IPCC 2019.

3.4 Cross-cutting knowledge gaps

Knowledge of indigenous peoples and local communities

The critical importance of traditional knowledge, the knowledge of indigenous peoples and local knowledge systems is often recognized; however, the challenge of ensuring that the planning and implementation of adaptation initiatives are informed or driven by these diverse knowledge systems remains. This knowledge must be considered as part of a nested knowledge system integrating information, practices and worldviews that cover local natural resource management, governance, social norms, spiritual beliefs and experience of marginalization.[63] Traditional knowledge thus encompasses much more than data to supplement scientific knowledge.

Challenges to integrating traditional knowledge into adaptation planning include power asymmetries between local communities and mainstream thought and scholarship on development and climate change;[64] the loss of traditional knowledge because of development, educational systems, urbanization, language loss and migration;[65] the adverse impacts of climate change; and a culture favouring hard engineering solutions to climate risks that are based on scientific assessments, leading to underutilization of traditional knowledge in adaptation.[66] Valorization and protection of traditional knowledge, the knowledge of indigenous peoples and local knowledge systems are thus crucial to building resilience in communities.

Gender and climate change adaptation

Lessons learned from the case studies show that it is crucial to recognize that social differentiation is a determinant of vulnerability. Change affects people differently according to their cultural, economic, environmental and social context.

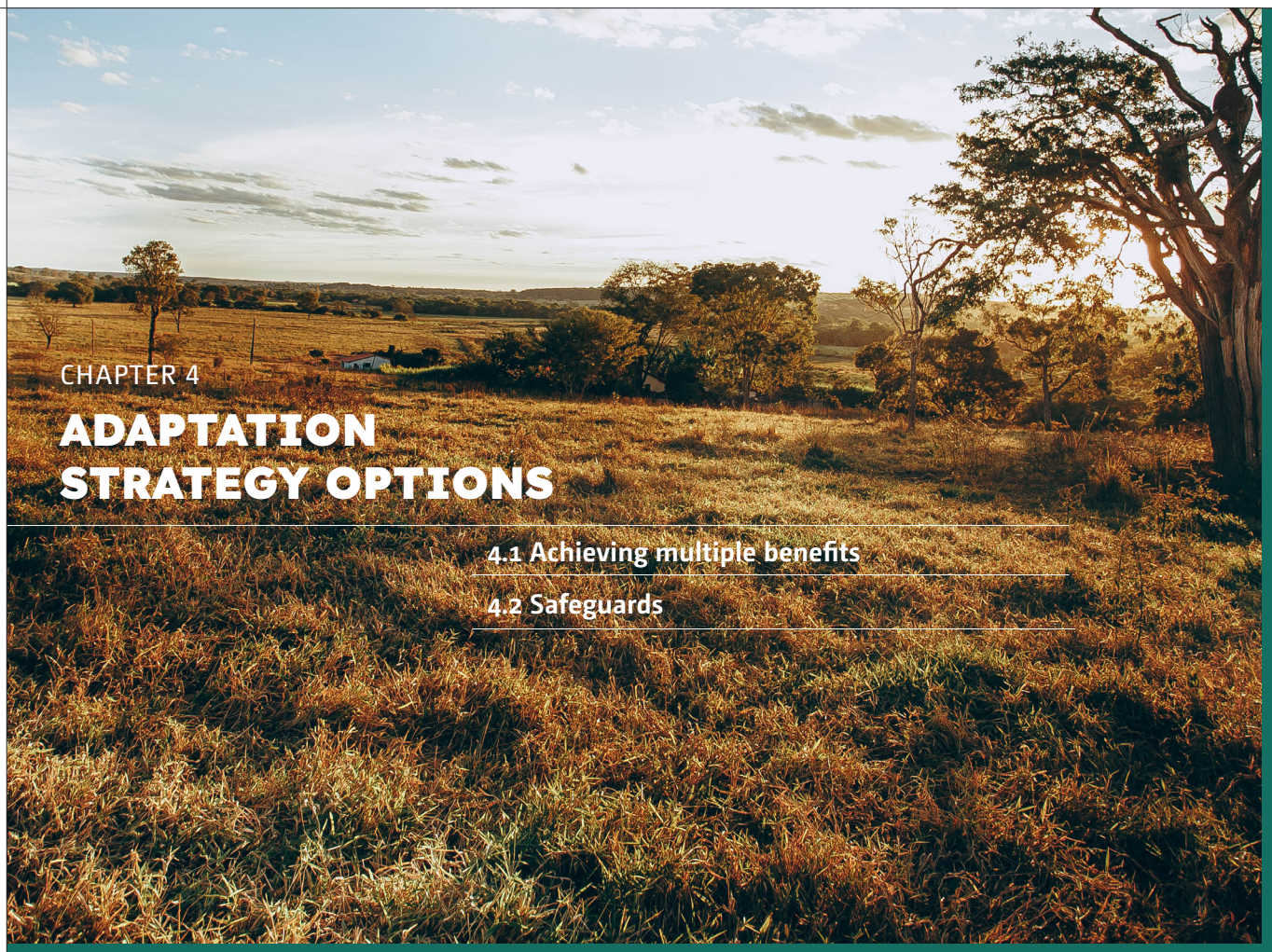
The capacity to respond and adapt to change is shaped by power relations affecting access to resources and information as well as the availability of options. Gender-specific data and guidelines for NbS and EbA initiatives that include baselines and gender assessments beyond simple sex-disaggregated data so as to account for both tangible and intangible gender dimensions – including intersecting categories of, for example, ethnicity, class and age – are needed to address the gender gaps at the interface of gender, biodiversity and climate change.

Gender considerations are crucial as EbA strategies are built around existing gender roles, responsibilities and restrictions. Gender-related restrictions and social norms hinder women from realizing the potential of NbS. The challenges women face include insecure land tenure, limited access to natural resources, insufficient knowledge and lack of financial resources. The restricted power of women to influence decision-making at the household and community level as well as limited market opportunities for women are additional factors.

EbA and NbS need to address the root causes of vulnerability to avoid exacerbating rather than reducing existing injustices while leaving challenges of climate change unaddressed.

Gender-specific data and guidelines for NbS and EbA initiatives that include baselines and gender assessments beyond simple sex-disaggregated data so as to account for both tangible and intangible gender dimensions – including intersecting categories of, for example, ethnicity, class and age – are needed to address the gender gaps at the interface of gender, biodiversity and climate change.[67]

63 Nalau et al. 2018.
64 Diver 2017.
65 McCarter et al. 2014.
66 Nalau et al. 2018.
67 Djoudi et al. 2016.



CHAPTER 4

ADAPTATION STRATEGY OPTIONS

Given the critical importance of forest and grassland biodiversity and ecosystems to society, and the impacts of climate change and land-use change on these vast biomes, it is critical to integrate measures to conserve and restore ecosystems into adaptation strategies. The fifth Global Biodiversity Outlook of the CBD[68] identifies halting and ultimately reversing biodiversity loss, limiting climate change and improving human capacity to adapt to it, and improving food security as the pathways to a sustainable future.

Consequently, addressing climate change in ways that limit global temperature rise without imposing unintended additional pressures on biodiversity or society is crucial. A multitude of options exist for adaptation, ranging from traditional hard infrastructure to green or ecosystem-based approaches and to community-based or hybrid solutions. Research into the social and environmental impacts of integrating forest and grassland ecosystems into adaptation planning and implementation is ongoing, but case studies in the peer-reviewed literature already contain critical reflections on effectiveness, lessons learned, and policy recommendations related to doing so.

Table 1 presents examples of adaptation strategies implemented in forest and grassland ecosystems in different regions, with notes on their effectiveness and outcomes. The actions include management of dry forests, diversification of livelihoods in community forests, proactive fodder management in diverse grassland mosaics, and establishment of wildlife conservancies to sustainably manage grasslands and rangelands. Further examples of adaptation strategies are discussed in section 5, which contains case studies prepared by the expert group on biodiversity and adaptation (see section 1.3).

68 SCBD 2020.

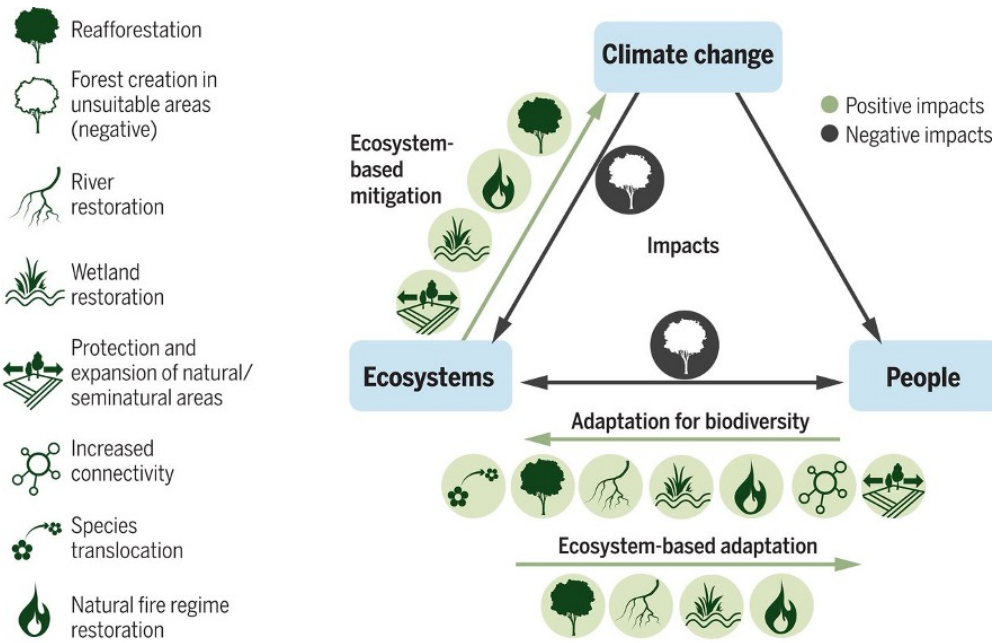
Table 1: Ecosystem-based adaptation in forest and grassland ecosystems

LOCATION	VULNERABILITY OR IMPACT ADDRESSED	ADAPTATION STRATEGY OR OUTCOMES
Ethiopia dry forests[i]	Drought reducing livelihoods	Dry forest income has become a crucial livelihood strategy in response to frequent droughts in the study area; hence, it is important to improve the **management of dry forests** for livelihood enhancement while also securing their long-term ecological functions.
China, forests adjacent to crops in South China[ii]	Drought affecting crop productivity	**Natural forests** (not plantations) near villages provide protection for rice crops against drought by enhancing the availability of water for irrigation.
Nepal, community forests[iii]	Extreme events affecting food security and livelihoods	**Community forests** can provide multiple benefits for adaptation, mitigation and social capital livelihoods, including food supplements, but the trade-off for mitigation may be a reduction in the food supplement capacity of forests due to a reduction in vegetation diversity.
France, Alpine grasslands[iv]	Extreme events affecting livelihoods	A **landscape mosaic of biodiverse grassland types** can maintain agricultural production and tourism and facilitate income diversification. For example, proactive fodder management enhances soil water retention in fertilized hay meadows on terraces, carbon storage and water quality.
Kenya, grasslands and rangelands[v]	Drought affecting pastoral livelihoods	The establishment of **wildlife conservancies in support of the sustainable management of grasslands and rangelands**, through partnerships between Maasai landowners and commercial tourism operators, enhances adaptation, wildlife tourism and pastoral livelihoods. Payment for ecosystem services was found to buffer households from fluctuating livestock income, but also generates synergies and/or trade-offs depending on land-use restrictions.
Peru, Andean-Amazon foothills, tropical forest[vi]	Land-use change, drought and flooding affecting food security	**The Amarakaeri Communal Reserve was created by 10 indigenous communities** to conserve their ancestral territory and the multitude of services it provides, such as food, shelter, medicine and water. The community harvested chestnuts as an alternative to forest-clearing, serving to diversify sources of income and protect natural resources, and providing a means to enhance social organization for land planning.
Burkina Faso, savannah woodlands[vii]	Recurrent droughts and gendered vulnerabilities	Women in central Burkina Faso are responsible for their household's food security in the lean season. In villages where forest resources were still available, **women selling firewood from the savannah woodlands** were about four times more likely to curb the food insecurity of their households by using income generated from forest resources to purchase cereals during the lean season, confirming the important safety net and gendered role of forests in adaptation.

[i] Amanuel et al. 2019.
[ii] Wang, Huang and Chen 2019.
[iii] Pandey et al. 2016.
[iv] Lavorel et al. 2019.
[v] Osano et al. 2013.
[vi] Beltran-Toloso et al. 2020; PANORAMA Solutions database.
[vii] Koffi, Djoudi and Gautier 2017.

Integrated strategies incorporating ecosystems can yield benefits not only for these ecosystems but also for local communities and for climate change adaptation and mitigation. However, negative impacts may arise and are to be avoided – these include afforestation in unsuitable areas (as opposed to afforestation in areas that support forest ecosystems) and impacts on the resources and livelihoods of indigenous peoples and local communities. Figure 6 shows the relationships between adaptation for biodiversity, EbA for people and ecosystem-based mitigation. Successful ecosystem-based responses to climate change depend on an integrated approach to ensure that synergistic effects are maximized and harms are avoided.[69]

Figure 6: Role of natural and semi-natural ecosystems in climate change mitigation and adaptation



Source: Morecroft et al. 2019.

4.1 Achieving multiple benefits

Recent global assessment reports on biodiversity, land and climate change not only emphasize the importance of integrating ecosystems into adaptation strategies, but also highlight that such strategies can help achieve multiple benefits. According to the IPCC Special Report on Climate Change and Land,[70] reducing deforestation and forest degradation represents one of the most effective and robust options for climate change mitigation, offering large mitigation benefits globally without risking trade-offs in solving other major challenges.[71] The IPCC report[72] on extreme events reiterates the need to invest in ecosystems, sustainable land management, and ecosystem restoration and management as strategies for adapting to climate extremes. Restoring 350 million hectares

69 Morecroft et al. 2019.

70 IPCC 2019.

71 As 13 per cent of total human-induced carbon dioxide emissions are mainly due to deforestation and peatland degradation, there is a high mitigation potential from improved land management – close to one third of total global emissions, and total gross emissions from the land sector.

72 IPCC 2012.

of forests by 2030 has the potential to generate economic benefits from watershed protection and to improve crop yields and forest products, while sequestering one to three gigatonnes of carbon dioxide equivalent per year.[73]

Improving forest and grassland management yields benefits for mitigation and adaptation while assisting in preventing desertification and land degradation and increasing food security.

Preserving and restoring forests, grasslands and peatlands, and other measures that do not require land-use change, provide "almost exclusively positive impacts on sustainable development, such as reducing poverty and hunger and enhancing health, clean water and sanitation."[74] In the same vein, the recent IPBES Global Assessment Report on Biodiversity and Ecosystem Services[75] emphasizes that sustainable actions and pathways include prioritizing land-based adaptation and mitigation measures that do not have negative impacts on biodiversity, such as reducing deforestation, restoring land and ecosystems, improving the management of agricultural systems and preventing the degradation of wetlands and peatlands.

The IPBES report, like the IPCC Special Report on Climate Change and Land, underscores that the conservation, restoration and sustainable use of nature through efforts fostering transformative change can result in the achievement of multiple sustainability goals. The cost-effectiveness of NbS has been described as leading to a "triple dividend" of economic gains from (1) growth associated with increasing food and water security and increasing tourism and recreation value, (2) avoided losses from protecting communities and infrastructure from climate change impacts and (3) social and environmental benefits from improved human health and habitats.[76]

The Dasgupta Review, an independent global review of the economics of biodiversity, has headline messages that emphasize the strong economic rationale for protecting and conserving ecosystems in the face of significant risk and uncertainty about the consequences of degrading ecosystems. This includes expanding and improving the management of protected areas and investing in NbS to address biodiversity loss and significantly contribute to climate change mitigation and adaptation with wider economic benefits, including job creation.[77]

The IPCC and IPBES reports, among others, recognizing that the knowledge of indigenous peoples and local communities contributes to biodiversity and ecosystems, emphasize the importance of securing land tenure for these communities.

Indigenous and community lands are a globally important carbon sink, holding at least 22 per cent of the carbon stored in tropical and subtropical forests and at least 17 per cent of the total carbon (including soil carbon) stored in forests. There is considerable potential for more carbon to be stored on degraded indigenous and community lands if they are secured, better protected and restored,[78] and appropriate safeguards are put in place, for example to protect livelihoods and prevent displacement.

4.2 Safeguards

In practice, it can be difficult to avoid trade-offs in implementing adaptation initiatives, including NbS. Trade-offs occur when ecosystem management enhances one or more ecosystem services at the expense of another,[79] or when one policy outcome is favoured at the expense of another. A focus on mitigation objectives alone risks perverse outcomes, for example for biodiversity or adaptation, that increase

73 See the Global Commission on Adaptation.
74 IPCC 2019.
75 IPBES 2019.
76 See the Global Commission on Adaptation.
77 Dasgupta 2021.
78 Rights and Resources Institute 2018.
79 Rodríguez et al. 2006.

rather than reduce vulnerability to climate change impacts.[80] Trade-offs are further discussed in section 3.3 in the context of knowledge gaps.

Adaptation strategies should be implemented with careful consideration of their trade-offs, such as between different ecosystem services, or between communities situated upstream or downstream from a particular adaptation intervention. See also section 3.4 on the consideration of trade-offs as a cross-cutting considerations to integrate into the planning and design of adaptation strategies to avoid maladaptation and harm to communities, biodiversity and ecosystems.

The guidelines for EbA and Eco-DRR adopted by Parties to the CBD provide a useful reference point when considering various safeguards during planning and implementation of adaptation strategies (table 2). While the safeguards refer to ecosystem-based approaches in Table 2, they are important to apply to any adaptation strategy.

Safeguards should be considered for mitigation strategies as well. Under the REDD+ framework,[81] biodiversity conservation is one of the seven safeguards that should be promoted and supported by Parties to the UNFCCC.[82] Parties have agreed to develop a safeguard information system on how they address and respect safeguards.

80 Morecraft et al. 2019.
81 See Decision 1/CP.16, para. 70.
82 See https://redd.unfccc.int/fact-sheets/safeguards.html.

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Table 2: Safeguards for effective planning and implementation of ecosystem-based approaches

Applying environmental impact assessments and robust monitoring and evaluation	1. EbA and Eco-DRR should be subject, as appropriate, to environmental impact assessments, including social and cultural assessments (referring to the Akwé: Kon guidelines), at the earliest stage of project design, and subject to robust monitoring and evaluation systems.
Preventing transfer of risks and impacts	2. EbA and Eco-DRR should not result in adverse impacts on biodiversity or people, nor result in the displacement of risks or impacts from one area or group to another.
Preventing harm to biodiversity, ecosystems and ecosystem services Using resources sustainably	3. EbA and Eco-DRR, including disaster response, recovery and reconstruction measures, should not result in the degradation of natural habitat, loss of biodiversity or the introduction of invasive species, nor create or exacerbate vulnerabilities to future disasters. 4. EbA and Eco-DRR should promote and enhance biodiversity and ecosystem services, including through rehabilitation/restoration and conservation measures as part of post-disaster needs assessment and recovery and reconstruction plans.
Using resources sustainably	5. EbA and Eco-DRR should not result in unsustainable resource use nor enhance the drivers of climate change and disaster risks, and should strive to maximize international and national standards for maximizing energy efficiency and minimize material resource use.
Promoting full, effective and inclusive participation	6. EbA and Eco-DRR should ensure full and effective participation of indigenous peoples and local communities, women, minorities and the most vulnerable, including the provisioning of adequate opportunities for informed involvement.
Ensuring fair and equitable access to benefits	7. EbA and Eco-DRR should promote fair and equitable access to benefits and not exacerbate existing inequities, particularly with respect to marginalized or vulnerable groups. EbA and Eco-DRR interventions should meet national labour standards, protecting participants against exploitative practices, discrimination and work that is hazardous to well-being.
Ensuring transparent governance and access to information	8. EbA and Eco-DRR should promote transparent governance by supporting rights to access to information, providing all stakeholders and rights holders, particularly indigenous peoples and local communities, with information in a timely manner, and supporting the further collection and dissemination of knowledge.
Respecting human rights including rights of indigenous peoples and local communities	9. EbA and Eco-DRR measures respect human rights, including rights of indigenous peoples and local communities, women and men, and including access to and use of physical and cultural heritage.

Source: SCBD 2019.

CHAPTER 5

LESSONS LEARNED FROM CASE STUDIES

This section outlines case studies and other examples from the literature to illustrate how actions can be integrated to address the knowledge gaps identified in this paper. The case studies encompass a variety of adaptation approaches, including community-based and nature-based approaches, diversification of livelihoods and enhancement of access to global climate finance. A snapshot of the case studies is provided in table 3, while the case studies are described in full in annex IV.

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Table 3: Snapshot of featured case studies

REGION, COUNTRY AND ECOSYSTEM	RISK, IMPACT OR VULNERABILITY	ADAPTATION STRATEGIES AND INITIATIVES
Africa: Kenya Isiolo County Arid grasslands	Drought and increases in water scarcity during the dry season, leading to difficulty in planning grazing	**Case study 1:** Preparing county governments to access global climate finance *ADA Consortium, Kenyan National Drought Management Authority*
Africa: South Africa Northern Cape Province Rangelands and wetlands	Hotter and drier periods, and more intense storms, floods and droughts, with impacts on farming livelihoods	**Case study 2:** Rehabilitation of critical rangeland and wetland ecosystems in the Succulent Karoo *Conservation South Africa*
Africa: Uganda and Kenya Arid grasslands	Recurrent droughts, floods and resource-use conflicts in drylands	**Case study 3:** Building drought resilience through land and water management *Government authorities*
Latin America: Peru Nor Yauyos-Cochas Landscape Reserve Andean Puna grasslands	Droughts, frosts and intense rainfall impacting livestock-dependent communities	**Case study 4:** Combining green and grey infrastructure to restore water flow to native grasslands and pastures *Instituto de Montaña, IUCN and partners*
Latin America: Paraguay and Brazil Paraná watershed Tropical forest	Deforestation altering peak flow of the Paraná River, and climate change causing higher risk of floods	**Case study 5:** Large-scale forest restoration and protection on private land *Itaipu Binacional, local governments and international funders*
Asia: Nepal Bishnupur community forest Mixed tropical forest	Loss and degradation of forests resulting from severe flooding, forest fires and invasive species, affecting livelihoods and water security	**Case study 6:** Community forest user group driven EbA, expansion of tree cover and cultivation of beehives *Bishnupur women community forest user group, RECOFTC*
South-East Asia: Myanmar Shan State Temperate forest	Deforestation, forest degradation, soil erosion and forest fires	**Case study 7:** Community-based watershed management training, soil erosion control and introduction of improved cookstoves *Myanmar Institute for Integrated Development, Government bodies, Pa'O self-administrative zone leading body and ICIMOD*
South Asia: Bhutan Barshong Gewog Montane grasslands and forests	Deforestation, soil fertility decline, overharvesting, haphazard infrastructure development, biodiversity loss and depletion of water resources	**Case study 8:** Sustainable land management activities (organic farming, beekeeping, supply of tree saplings to farmers) and market linkages for village produce, i.e. connecting suppliers to buyers *Collaborating Government Ministry, Tsirang Dzongkhag District Administration and ICIMOD*
Asia: Afghanistan, Bangladesh, Bhutan, China, India, Myanmar, Nepal and Pakistan Montane grasslands and forests, tundra and pasture	Warming, forest degradation, biodiversity loss, and vegetation shifting to higher altitudes and colonizing rangelands	**Case study 9:** Protecting the Himalayan rangeland through transboundary cooperation, diversifying livelihoods, enhancing ecosystem resilience and strengthening governance and institutions *Collaborating country governments, ICIMOD and research centres*

South Asia: Bhutan, India and Nepal Mount Kangchenjunga Tundra and alpine and montane forests	Political instability, rapid development and climate change affecting pastoral practices	**Case study 10:** Conservation and development strategy and regional cooperation framework on rangeland management, genetic exchange of yak and diversification of yak-based products *Collaborating country governments and ICIMOD*
Asia: Cambodia Montane forests	Erratic rainfall, floods and droughts leading to erosion, crop failures and damaged infrastructure, and illegal logging in protected forests	**Case study 11:** Reforestation with multi-use native species, patrols to halt illegal logging, home garden creation, supply of pumps for wells and rain harvesting tankers, and implementation of early warning systems *Government of Cambodia and UNEP*
Africa: Gambia Evergreen and semideciduous forests, savannah woodlands and mangroves	Flooding, erratic rainfall and intensified droughts and floods, and reduction in crop yields driving unsustainable exploitation of forest resources	**Case study 12:** Living in protected areas of Gambia: ecosystem rehabilitation, sustainable businesses, home gardens and sectoral policies *Government of the Gambia and UNEP*
Africa: Sudan Grasslands, rangelands, forests and riparian zones	Erratic rainfall, rising temperatures, drought, declining crop productivity, land degradation and loss of livestock	**Case study 13:** Regenerating rangelands; establishing community-managed tree nurseries, farms and shelter belts; providing training on livelihoods; and implementing revolving funds *Government bodies and Federal Ministries of Republic of Sudan and UNEP*
Africa: United Republic of Tanzania Mangroves	Sea level rise, coastal erosion, degradation of coral and mangrove habitats, and unsustainable use of natural resources	**Case study 14:** Building and upgrading sea walls, relocating aquifers to protect them from rising seas and restoring mangrove forests for flood protection *Government of the United Republic of Tanzania and UNEP*
West Africa: Burkina Faso Central Dry forests and savannah woodlands	Gendered impacts of: recurrent droughts, deforestation and forest degradation, loss of biodiversity, and food insecurity	**Case study 15:** Forest landscape restoration in Burkina Faso. Shea, wild raisins, tamarind and African locust bean for food and fuelwood, and fodder during lean season *Tiipaalga NGO and CIFOR*
South Asia: Sri Lanka Mangroves	Coastal erosion, floods and storm surges	**Case study 16:** Blue-Green Protectors: participatory and multi-actor partnerships for decision-making to conserve forest ecosystems and address climate risks of vulnerable communities *SLYCAN Trust and bodies of the Government of Sri Lanka*

5.1 Lessons learned: data and methods knowledge gaps

Integrating different adaptation approaches into an overall strategy

Effective adaptation strategies that respond to a community's vulnerability and risks often combine a suite of interventions, including community- and ecosystem-based approaches, livelihood diversification and innovative financing mechanisms.

- In the Nor Yauyos-Cochas Landscape Reserve, Peru, adaptation approaches integrated participatory approaches to address climate change in the grasslands of the Andes. The approaches included the following measures: strengthening community organizations and institutions; strengthening local capacities and knowledge; and combining green and grey infrastructure to restore water flow to native grasslands and pastures and improve livestock and pastureland management (case study 4).

- Community-based watershed management was implemented in the temperate forests of Shan State, Myanmar. The planting of 36,000 native seedlings will help the area adapt to the impacts of deforestation, forest degradation, soil erosion and increased risk of forest fires. This approach was complemented by the introduction of improved cookstoves and bio briquettes to improve household energy use and protect the forest from overextraction of firewood (case study 7).

- In the Hindu Kush Himalayas, adaptation to climate change impacts, such as flash floods, affecting water resources and land-use change, including forest degradation, focuses on ecosystem-based approaches, including the restoration of critical rangeland and forest ecosystems. Other measures have included developing conservation corridors to connect fragmented forest habitats and protected areas; establishing regional programme steering committees to promote institutional cooperation; and improving the value chain in niche mountain products and services such as Allo (nettle plant) handloom products, large cardamom, yak-based products and tourism, which have contributed to food security and local economic development (case study 9).

- To manage flood risks in the Gambia, 10,400 hectares of degraded forests, savannah and mangroves will be rehabilitated, and 3,000 hectares of farmland restored. Enrichment planting is being used both on farms and in natural ecosystems. Multipurpose plant species chosen for their provisioning value (wood, fuel, fruit, honey, medicine and fibre) and climate resilience are being used for the large-scale restoration effort, which will also strengthen adaptation by reducing soil erosion and increasing groundwater supplies through greater ground infiltration capacity. Other EbA interventions are establishing ecologically sustainable businesses; creating home gardens to diversify food and income sources; and developing four sectoral policies (on transhumance, migration, agriculture and energy) that integrate adaptation actions into their annual plans with explicit budget and monitoring structures (case study 11).

- In Cambodia, various EbA practices have been implemented in five protected community areas: reforesting natural land to regulate soil water flow, conducting patrols to halt illegal logging, establishing home gardens with irrigation to diversify sources of food and income, and developing early warning climate systems. Over 450,000 fruit trees were distributed to 1,900 families. Also, rice harvests have greatly improved at project sites through using climate forecasting to inform planting schedules, thus reducing the impacts of drought and heat stress, and by distributing drought-tolerant rice varieties appropriate to the local ecosystems. Households in the five areas were also trained to improve rice storage techniques (case study 13).

Interdisciplinary and transboundary approaches

- In the grasslands of Isiolo County, Kenya, effective rangeland management requires authorities to exercise jurisdiction over large areas, but administrative boundaries and the imposition of different tenure and land-use systems can disrupt pastoralist mobility and the ability to manage stock effectively. Catchment-level planning is important to ensuring pastoralist access to water in this dry area. The continued provision of ecosystem services from the rangelands for pastoralism thus requires landscape-level management approaches (case study 1).

- Local and national agencies are receptive to scaling up adaptation interventions if tangible results can be demonstrated and even more so when communities advocate the benefits of such interventions and seek clear, focused support. This has been the case in Bhutan. Participatory planning, co-development of solution packages, demonstration on farmers' fields, and joint monitoring and feedback mechanisms on project progress have led to the incorporation of project recommendations and planning policies at the local and national level (case study 8).

- In the Hindu Kush Himalayas, a transboundary adaptation programme followed a progressive evolutionary pathway of rigorous interdisciplinary research, participatory planning across scales, local to global, and multi-stakeholder consultation. Countries agreed to cooperate on the regional programme for three years (2012–2015), thereby committing to achieving regional conservation and development outcomes. They initiated the feasibility assessment process, and developed and agreed on the Conservation and Development Strategy and Regional Cooperation Framework for implementing the programme. Yak herding was identified as a key component for regional cooperation (case study 9).

5.2 Lessons learned: capacity knowledge gaps

Scaling up financing and investment

Livelihood diversification has been the focus of sustainable financing of adaptation interventions, and in some cases has resulted in the scaling up of investment.

- In Uganda and Kenya, livelihood diversification has been supported through piloting the Community Environment Conservation Fund, an innovative mechanism that supports the restoration of catchments while providing sustainable livelihood packages to beneficiaries. The Fund saw an increase in investments in small business initiatives by communities, with most enterprises having a positive effect on environmental protection, conservation and restoration. The Fund's strategy relied on county-level structures and allocations from the county and national budget (case study 3).

- In South Africa, adaptation has been supported by funding from government public works and social protection programmes for job creation, which have enabled operation of adaptation actions at scale and independence from short-term, location-specific donor-funded approaches (case study 2).

- The community forest enterprise involving honey production from beehives ("Trees and Bees") in Bishnupur, Nepal, resulted in increased financing for similar initiatives under the Green Climate Fund (GCF). For example, the Chure Rehabilitation Project has replicated the "Trees and Bees" approach in a number of areas in the foothills of Chure, including in the nearby Pragatishil community forest. The Bishnupur community forest user group is also sharing knowledge with other such groups to facilitate replication (case study 6).

- In Bhutan, lessons learned from implementing sustainable land management practices include integrating livelihood diversification

into the response to climate change adaptation and introducing quick-gain activities. These activities are based on the comparative advantages of the location and emerging market opportunities for building the resilience of rural households. The targeted messaging of "safe for consumption vegetable production" and "stall-fed goat farming" was used as an entry point to gain community participation in the project and ensure it could achieve its wider objective of resilience-building through sustainable land and water management (case study 8).

- Some countries have been working to direct more financial resources to climate change. For example, the Government of Nepal has increased financial resources for addressing climate change and has also determined that 80% of adaptation funding must go to local-level initiatives.[83]

- In some case studies, incentives, such as those focused on livelihoods, have been used to cover the lag time before ecosystem service-related benefits from EbA measures emerge or to strengthen community support for an EbA initiative.

- In the Gambia, 166 natural resource-based businesses have been established; these will stimulate economic activities for poor communities while creating investments in ecosystem services. A total of USD 11.3 million will be raised from taxes and licensing fees over 20 years for the National Forest Fund. The project aims to create 11,550 jobs in climate-resilient livelihoods. Moreover, demonstrations will be given to local communities to create home gardens of herbs, shrubs and trees. The diversity of plant species in these gardens will ensure continual agricultural productivity throughout the year, offsetting extreme weather impacts (case study 11).

- In four localities on the western side of the White Nile River in the Sudan, smallholders and pastoralists lack the earnings and capital to make their livelihoods resilient to climate shocks. Communities have been trained to adopt alternative climate-resilient livelihoods and provided with the technology and funding to do so. This includes training for 1,600 women in 'backyard gardening' to diversify their sources of income. Furthermore, a revolving funds scheme available to 480 people is being established to support the purchase of physical inputs to adaptation actions, including animal feed supplements, drought-tolerant crop species seeds and solar pumps for wells (case study 12).

- In Cambodia, sustainable alternative livelihood strategies, including chicken-raising, cricket-raising and ecotourism, have been adopted by over 500 households so far. Training has been given in households and schools on creating vegetable home gardens, which diversify families' agricultural produce – 337 hectares have been established. In community-protected areas such as Ngon, this initiative is helping more than 6,000 people to supplement often dwindling incomes with rain-fed crops and to build sustainable local economies for generations to come (case study 13).

- In Sri Lanka, an action that contributes to scaling up investment for conservation efforts provides an example of merged finance: it includes financial support from the private sector (Mitsubishi Corporation), the public sector and community service organizations (Drowning Islands and the SLYCAN Trust) (case study 16).

- Awareness-raising and capacity-building activities in Bhutan, including engaging various government departments, non-governmental organizations (NGOs), private enterprises and journalists in efforts to sustain conservation approaches (case study 8).

- A training programme on forest management enhanced the capacity

83 Reid et al. 2019.

of forest officials to develop forest management plan (2016–2025) and led to the development of a forest fire risk assessment map for Shan State, Myanmar (case study 7).

- Working with local organizations and strengthening local planning processes is important for facilitating effective EbA implementation. In some instances, this has meant creating new institutions, such as formalized collective governance bodies, local committees for risk reduction and local climate change planning committees. In others, appropriate institutions existed before the EbA intervention that have played a role in EbA implementation including community assemblies, community natural resource management groups, savings and credit groups and women's groups.[84]

- Knowledge generation and sharing has facilitated EbA implementation, as shown in several case studies. For example, participatory plant breeding was the foundation of EbA in China and Peru, and farmer-to-farmer meetings and exchanges were important in Uganda, Senegal, Burkina Faso and China. Furthermore, combining local and scientific knowledge was often perceived as facilitating EbA implementation. For example, participatory plant breeding in China involved local research in collaboration with scientific institutes, such as the Maize Research Institute of the Guangxi Academy of Agricultural Sciences and the Yunnan Academy of Agricultural Science.[85]

4.3 Lessons learned: governance knowledge gaps

Participatory approaches

Participatory approaches and stakeholder engagement throughout adaptation planning and implementation were seen as critical to successful adaptation in many case studies. A suite of innovative participatory tools, such as local economy resilience assessments, participatory 3D modelling, and collaborative design of monitoring and evaluation, were applied in the case studies and had positive impacts.

- In Isiolo County, Kenya, community involvement and participation was actively sought throughout all stages of design and implementation of adaptation strategies, and was formalized in management structures and decision-making processes. This allowed local people to retain control of responses to their development and adaptation priorities. Participatory livelihood and local economy resilience assessments helped identify possible investments (case study 1).

- In the Lower Tana River catchment in Uganda and the Aswa Agago catchment in Kenya, the involvement of all stakeholders and community groups in project activities, for example in developing environmental and natural resource management plans and resource maps, promoted a strong sense of ownership of the activities. In turn, this built a sustainable mechanism that secured gains beyond the project locations and lifespans (case study 3).

- In Nepal, a community forest user group developed its own monitoring mechanism and promoted participatory monitoring activities, such as public auditing. This helped to ensure transparency as well as improve the programme and increase the participation of vulnerable groups (case study 6).

- In Myanmar, micro plans and 3D modelling helped communities to initiate, plan and manage their forest, water and other natural resources (case study 7).

- In the Hindu Kush Himalayas, bringing all stakeholders on board from the initiation of a project resulted in rigorous planning and helped identify needs-based issues, challenges and

84 Reid et al. 2019.
85 IPCC 2019.

opportunities. Planning was conducted in an integrated manner and at the landscape level in order to identify common issues requiring regional cooperation for both biodiversity and human well-being (case study 10). In the above-mentioned and other case studies, genuine participatory approaches to working with local organizations helped foster a sense of ownership and contributed to the long-term effectiveness of adaptation strategies.[86]

- In Sudan, community-managed tree nurseries support the planting of climate-resilient species, and 2,000 community farms (4 hectares each) are being developed using climate-resilient land management practices, drought-tolerant fruits and vegetables, and integrated pest management. The initiative includes training for 1,600 women on 'backyard gardening' to diversify their sources of income (case study 12).

- In Cambodia, local patrol groups participated in implementing EbA, namely, during the planting of more than a quarter of a million trees. In addition, local community members at the project site are paid a salary to look after a tree nursery. The project has eased people's reliance on rain-fed agriculture and diversified diets by setting up households and schools with the training and supplies needed to create home gardens and wells for year-round irrigation and to raise chickens. Sustainable alternative livelihood strategies, including chicken-raising, cricket-raising and ecotourism, have been adopted by over 500 households so far (case study 13).

- In the United Republic of Tanzania, stakeholders were engaged in planning on-the-ground activities, including site selection, environmental impact assessment and awareness-raising for these activities. A network of 87 community groups were established in the project areas to manage mangrove sites. Some community members were employed as casual labourers to construct infrastructure (e.g. sea walls, boreholes and rainwater harvesting systems). After project activities were completed, communities continued to participate in infrastructure and mangrove management. For example, in Bagamoyo, each borehole is managed by a water user committee or association, and in Zanzibar, Pangani and Rufiji, planted mangroves continue to be managed by the relevant district councils in collaboration with community mangrove planting associations or beach management units. Academic and research institutions were engaged in capacity-building and project technical support as consultants. Students from the University participated as interns in all project areas, and master's students participated by undertaking research in the project areas. FORUMCC, an NGO network partner, helped to raise awareness of climate change in communities and create community-based organization networks on climate change (case study 14).

Gender-responsive strategies, and consideration of local knowledge and youth empowerment

- Several of the case studies described how integrating traditional knowledge, the knowledge of indigenous peoples and local knowledge systems within the range of participatory processes helped build adaptive capacity – in part because adaptation knowledge was tailored to the needs and norms of the end users of that knowledge.

- Supporting customary range management institutions (dedhas) was an integral function of the Isiolo County Climate Change Fund in Kenya, which aimed to prepare county governments to access global climate finance to support adaptation and climate-resilient development. By supporting traditional management institutions, local knowledge was also prioritized.

86 Reid et al. 2019.

The strong level of participation throughout the process was central to building local resilience, but it required facilitation and capacity-building to ensure success (case study 1).

- In Nepal, communities selected adaptation measures on the basis of their traditional knowledge and available resources, such as planting native species (Dalbergia sissoo and Acacia catechu) in riverbanks and controlling grazing and fire (case study 6).
- In Myanmar, a cross-learning visit of the national Forest Department to the community helped promote gender-responsive community forestry (case study 7).
- In Bhutan, to evaluate the effectiveness of adaptation, gender-disaggregated quasi-experimental design was used for a baseline and an end-line study focusing on target households and a control group of non-beneficiaries (case study 8).
- In Sri Lanka, youth engagement helped build community ownership. Youth shared experience on the conservation of mangrove forest ecosystems through the Global Youth Forum on Climate Change (case study 16).

Institutional support

- A number of social, institutional and political factors have supported the implementation of the Isiolo County Climate Change Fund in Kenya. Local institutions are now strong, empowered and heavily engaged in adaptation planning. Achieving this result has required considerable initial investment, and legitimizing and supporting local institutions in this way has meant communities are now in control of designing and supporting initiatives to meet their development and adaptation needs. County-level support for addressing climate change and supporting Fund processes is apparent. Governance and coordination is strong at the county level. At the national level, Kenya has several policies and institutions that support climate change planning. A national commitment to local involvement and decision-making has also provided opportunities to enhance community participation in decision-making and support community land ownership, both of which are cornerstones of the Fund's effectiveness (case study 1).
- In South Africa, several policy and institutional factors have supported EbA implementation at the local, provincial and national level, most notably local government capacity, a supportive national and provincial legislative and policy environment, and opportunities for integrating EbA into expanded public works programmes. These programmes provide great potential for scaling up EbA implementation and moving away from stand-alone EbA projects with limited and location-specific impacts. Mainstreaming is also occurring as EbA is incorporated into various national policymaking and planning processes. Tools and guidance have been developed to support this process (case study 2).
- In Peru, implementing a suite of EbA and hybrid initiatives effectively strengthened the governance and management of natural resources by empowering formal and customary governance structures and platforms that promote learning, knowledge-sharing and capacity-building for adaptation (case study 3).
- Implementing climate change adaptation initiatives through community forest user groups is an appropriate strategy to ensure their sustainability. In Nepal, such user groups achieved sustainability by collaborating with local authorities and integrating climate change adaptation into local development plans and programmes (case study 6).
- Government prioritization of EbA and climate change at the national, provincial and regional level supports EbA implementation. Many countries have established national-level bodies

dedicated to addressing climate change, such as Chile's Climate Change Office under its Ministry of the Environment. Climate change policies are also emerging in many countries, at the national and subnational level, and can promote EbA. For example, South Africa has developed policies and a legislative framework for environmental governance, which provide clear support for EbA.[87]

- In many of the case studies, local government bylaws and institutions supported EbA implementation. This was partly because local government structures are usually responsible for implementing activities related to environmental protection, disaster risk reduction, service delivery, job creation and poverty alleviation, often working together across departments, which ensures the cross-sectoral collaboration needed for EbA. Where this level of local government capacity exists, it can support EbA implementation well. Capacity at higher levels is also important; for example, in South Africa, stakeholders see the Department of Environmental Affairs as a strong supporter of EbA, which has helped with implementing and scaling up initiatives throughout the country.
- Policies unrelated to climate change that facilitate EbA – particularly those supporting decentralization – can be critical for success. Other important policies include those that recognize indigenous land rights and protect traditional knowledge, as seen in Peru, and protect and manage forests and watersheds in Paraguay and Brazil.
- Constitutional and legal frameworks allow county- and local-level institutions to plan for adaptation and channel funding accordingly. For example, the 2011 National Framework for Local Adaptation Plans for Action in Nepal has resulted in the delivery of adaptation services to the most climate-vulnerable areas and people. In the Gambia, land-use plans are being developed to support transhumance corridors and prevent human–wildlife conflicts.

87 Reid et al. 2019.

CHAPTER 6

PARTNERSHIPS AND ACTIONS

6.1 Actions for Governments

Governments can consider a range of actions to close knowledge gaps. Options based on the synthesis of existing knowledge and analysis of gaps and lessons learned follow.

Data and methods

- Systematically collect data on a range of adaptation options, including ecosystem-based approaches, that provide multiple benefits for other goals, including conserving biodiversity and sustaining livelihoods, with appropriate consideration of social and environmental safeguards.
- Use gender-disaggregated data for planning, monitoring and evaluation.
- Seek appropriate protocols for engaging with indigenous peoples and local communities on planning, implementation, and monitoring and evaluation.
- Select appraisal and assessment tools appropriate to local contexts to identify options, including participatory livelihood and local economy resilience assessments to identify possible investments.
- Form partnerships with academic and research institutions, and involve youth, non-profit organizations and associations in addressing local knowledge gaps.
- Improve the quality and enhance the availability of scientific data on forests and grasslands, including social science data (on norms, perceptions, behaviours, institutional and management practices).

Capacity

- Involve communities, including community forest user groups, in developing participatory monitoring schemes, such as public auditing, to enhance transparency and improve participation.
- Complement donor-funded projects with relevant funds from government public works, social protection programmes or other funds to increase the longevity of adaptation approaches.
- Consider innovative financing models, such as revolving funds schemes to support the purchase of physical inputs to adaptation (such as seeds for drought-tolerant crops), public-private partnerships and blended finance.
- Engage with different government departments, NGOs, private sector enterprises and the media to communicate with local communities in order to enhance transparency and ownership.
- Seek alliances with individuals and organizations that can champion adaptation support and implementation, and set appropriate adaptation trends that foster uptake of adaptation policy.
- Increase public awareness of the importance of forests and grasslands to adaptation and sustainable development, and foster norms of stewardship to build adaptive capacity.

Governance

- Assess needs of stakeholders expected to take up new adaptive practices, including norms, current behaviours, reference networks and expectations (i.e. what stakeholders think is the right way to manage forests and grasslands and related issues). Use this information to design adaptation interventions and promote uptake of the desired intervention.
- Seek community involvement and participation in all stages of planning, design and implementation of adaptation strategies in order to enhance local ownership and the relevance and legitimacy of efforts.
- Strengthen legitimacy and support for traditional management institutions, such as for customary range management, so as to prioritize local knowledge and foster norms of nature stewardship for adaptation.
- Empower formal and customary governance structures and platforms that promote learning, knowledge-sharing and capacity-building for adaptation.
- Implement cross-learning visits across sectors and organizations to promote gender-responsive adaptation strategies.
- Engage youth to build community ownership of adaptation strategies, for example by promoting the sharing of experience through sustained and repeated global youth forums.
- Seek cooperation with local governments responsible for implementing activities related to environmental protection, disaster risk reduction, service delivery, job creation and poverty alleviation to promote cross-sectoral collaboration.
- Consider catchment-level planning and management for transboundary adaptation, including implementing a landscape approach and setting up cross-jurisdictional steering committees to promote cooperation on adaptation and other development goals.
- Set up committees for coordination among focal points of climate-, land- and biodiversity-related conventions, ministerial departments, agencies and other stakeholders to enhance synergies.

6.2 Resources and knowledge dissemination for governments

Examples of additional resources and ongoing initiatives, including under the UNFCCC, applicable to forest and grassland ecosystems can also be found in annex III.

UNFCCC and other United Nations agencies

- The Adaptation Committee has compiled a list of regional centres and networks working on adaptation. The regional centres it supports include organizations that work on the thematic area of biodiversity and ecosystems, such as the Lake Chad Basin Commission, the Lake Chad Sustainable Development Support Program and the Southern African Science Service Centre for Climate Change and Adaptive Land Management.

- The Adaptation Knowledge Portal, operated by the NWP, aims to provide access to information and knowledge on climate change adaptation, building on global contributions of policymakers, practitioners and researchers. It also provides a platform to share the latest news and resources on adaptation under the UNFCCC process.

- The climate change/biodiversity expert working group established by IPBES and IPCC works on the interlinkages between climate change and biodiversity conservation and was formally included in the IPBES Programme of Work adopted in 2019.

- The Global Adaptation Network, led by UNEP, which serves as its secretariat, is a global platform for knowledge-sharing on climate adaptation, established in 2010 to help the world build resilience to climate change by spreading adaptation knowledge and best practices. Through regional nodes, such as the Asia Pacific Adaptation Network, REGATTA in Latin America and the Caribbean, and the West Asia Regional Network on Climate Change, as well as through global partnerships, the Network provides a worldwide platform for distributing and exchanging climate change adaptation knowledge through a range of means.

Non-governmental organizations

- AdaptationCommunity.net provides information on applying approaches, methods and tools that facilitate the planning and implementation of adaptation action.

- The EbA tools navigator is a comprehensive compilation of tools relevant to all aspects of planning and implementing EbA developed by the International Institute for Environment and Development, the International Union for Conservation of Nature and UNEP-World Conservation Monitoring Centre.

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ANNEX I: EXPERT GROUP ON BIODIVERSITY

Name of expert	NWP partner organization	Location
Loreen Katiyo	Global Water Partnership (GWP) South Africa	South Africa
Ronnakorn Triraganon	The Center for People and Forests (RECOFTC)	Thailand
Kathrin Ludwig	Adelphi	Germany
Ali Raza Rizvi Emily Goodwin	The International Union for Conservation of Nature (IUCN)	United States
Therese Mundita S. Lim James Santiago Carlo M. Carlos	ASEAN Centre for Biodiversity	Philippines
Nakul Chettri	ICIMOD	Nepal
Alexander Shestakov	The Convention on Biological Diversity (CBD)	Canada
Amanda Rycerz	Acclimatise	United States
Hindou Oumar Balkisou Buba	Association des Femmes Peules Autochtones du Tchad (AFPAT)	Cameroon
David Bennell	World Business Council for Sustainable Development	United States
Houria Djoudi	Centre for International Forestry Research (CIFOR)	Indonesia
Jusper Omwega	National Environment Management Authority (NEMA)	Kenya
Jesse DeMaria-Kinney	PlanAdapt	Switzerland
Hans Schutten	Wetlands International	The Netherlands
Michele Poletto Suyeon Yang	The United Nations Environment Programme (UNEP)	Kenya
Margarita Caso	Instituto Nacional de Ecologia y Cambio Climatico, Mexico (INECC)	Mexico
Mandy Barnett	The South African National Biodiversity Institute (SANBI)	South Africa
Alisher Mirzabaev	Centre for Development Research (ZEF), University of Bonn	Germany
Michael Weisberg	University of Pennsylvania	United States
Matthias De Beenhouwer	WeForest	Zambia
Josef Settele	Helmholtz Centre for Environmental Research (UFZ). Nominated IPBES expert	Germany
Viviana Figueroa	Indigenous Women's Biodiversity Network (IWBN)	United States
Hannah Reid	International Institute for Environment and Development (IIED)	United Kingdom
Fabrice Renaud	University of Glasgow	United Kingdom
Mathias Bertram Ulrich Kindermann	The Deutsche Gesellschaft für Internationale Zusammenarbeit GmbH (GIZ)	Germany

ANNEX II: BIODIVERSITY AND ADAPTATION IN GLOBAL AGENDAS

Ecosystems and biodiversity are threaded throughout various programmes and initiatives of the UNFCCC. These include:

Nairobi work programme (NWP)

Under the NWP, numerous knowledge products have been produced with key partners on the theme of ecosystems and adaptation. The NWP, in collaboration with members of Friends of EbA (a partnership under the IUCN Commission on Ecosystem Management), prepared a synthesis report on adaptation planning, implementation and evaluation addressing ecosystems and areas such as water resources.[88]

Lima Adaptation Knowledge Initiative (LAKI)

The LAKI is an adaptation knowledge-sharing initiative to build evidence based on the effectiveness and understanding of good adaptation practice and its gaps.[89] LAKI is a collaboration between the UNFCCC secretariat, involving NWP and UNEP through its Global Adaptation Network. Priority-setting workshops are convened with multi-stakeholder expert groups to identify, categorize and prioritize climate change adaptation knowledge gaps for specific subregions and sectors/themes.

Global and subregional partners then work to catalyse activities to bridge these knowledge gaps. In its pilot phase, the LAKI identified a total of 85 priority adaptation knowledge gaps across six subregions: Andean, West Asia/Gulf Cooperation Council, North Africa, Southern Africa, Indian Ocean islands and Hindu Kush Himalayas, Pacific small island developing States and Hindu Kush Himalayas.

The Least Developed Countries Expert Group (LEG)

The LEG provides technical guidance and advice on strengthening considerations regarding vulnerable groups, communities and ecosystems within the LDCs.[90] Under the LEG, Parties engage with NWP partner organizations to implement NAP-related activities and provide support to the LDCs, including a joint session at the 2019 NAP Expo on strengthening considerations regarding vulnerable groups, communities and ecosystems.

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Local Communities and Indigenous Peoples Platform (LCIPP)

The 2019 LCIPP workshop of the Facilitative Working Group emphasized the significant repository of knowledge of indigenous peoples and local knowledge systems that can contribute to environmental decision-making in an integrative manner, including being directly involved in decision-making processes with respect to the rights and

88 UNFCCC 2017. See https://unfccc.int/sites/default/files/resource/docs/2017/sbsta/eng/03.pdf.

89 For further details of the LAKI, see https://www4.unfccc.int/sites/nwpstaging/Pages/laki.aspx.

90 UNFCCC (LEG) 2018. See Considerations regarding vulnerable groups, communities and ecosystems in the context of the national adaptation plans.

91 UNFCCC (LEG) 2018. See Considerations regarding vulnerable groups, communities and ecosystems in the context of the national adaptation plans.

obligations associated with access to and preservation of biodiversity.

Standing Committee on Finance (SCF)

The SCF assists the Conference of Parties in relation to the financial mechanism of the Convention. The SCF launched a public call for inputs from interested stakeholders to the next SCF Forum focused on financing NbS as a driver of NDCs and NAPs.[92] The SCF Forums connect constituted bodies under the UNFCCC with public and private actors involved in climate finance issues at the global, regional and national level.

Paris Committee on Capacity-building (PCCB)

The PCCB addresses current and emerging gaps and needs in implementing and further enhancing capacity-building in developing countries. Through the #RecoverBetterTogether project, members of the PCCB Network shared stories and examples of their work in blogs, short videos and social media posts to showcase their contributions to a fair and green COVID-19 pandemic recovery.

Warsaw Framework for REDD+

The Warsaw Framework for REDD+ is an internationally agreed approach to guide activities in the forest sector that reduce emissions from deforestation and forest degradation, as well as the sustainable management of forests and the conservation and enhancement of forest carbon stocks in developing countries. It aims for the implementation of activities by national governments to reduce human pressure on forests that result in greenhouse gas emissions at the national level, but as an interim measure also recognizes subnational implementation.

Since the adoption of the Warsaw Framework, 50 developing countries have submitted a REDD+ forest reference level or forest reference emission level for technical assessment under the UNFCCC, covering more than 70 per cent of the total forest area in developing countries. Fifteen countries have submitted a summary of information on how safeguards are being addressed and respected. Thirteen countries have submitted REDD+ results for technical analysis (as at October 2020). In total, these results amount to more than 8.5 billion tonnes of carbon dioxide equivalent emission reductions, mainly achieved by reducing emissions from deforestation.

REDD+ activities have the potential for benefiting biodiversity conservation. Additionally, the USD 500 million pilot programme for REDD+ result-based payments under the GCF provides an additional 2.5 per cent to the final payment when the activities contribute to non-carbon benefits, including biodiversity conservation. The ability of countries to monitor and report on their forest resources has improved through their participation in REDD+, enabling more informed decision-making and thus more effective management, including protection and restoration of forest ecosystems.

92 See Co-facilitators' note on the next Forum of the Standing Committee on Finance.

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Table 3: The 2030 Agenda for Sustainable Development

Adopted by all United Nations Member States in 2015. The table includes numerous Sustainable Development Goals related to biodiversity and ecosystems:

SDG 1: End poverty in all its forms everywhere	Build the resilience of the poor and those in vulnerable situations and reduce their exposure and vulnerability to climate-related extreme events and other economic, social and environmental shocks and disasters.
SDG 2: End hunger, achieve food security and improved nutrition and promote sustainable agriculture	Ensure sustainable food production systems and implement resilient agricultural practices that increase productivity and production, that help maintain ecosystems, that strengthen capacity for adaptation to climate change, extreme weather, drought, flooding and other disasters and that progressively improve land and soil quality.
SDG 3: Ensure healthy lives and well-being for all at all ages	Strengthen the capacity of all countries, in particular developing countries, for early warning, risk reduction and management of national and global health risks.
SDG 6: Ensure access to water and sanitation for all	Achieve universal and equitable access to safe and affordable drinking water for all. Implement integrated water resources management at all levels, including through transboundary cooperation as appropriate. Protect and restore water-related ecosystems, including mountains, forests, wetlands, rivers, aquifers and lakes.
SDG 11: Make cities inclusive, safe, resilient, and sustainable	Substantially increase the number of cities and human settlements adopting and implementing integrated policies and plans towards inclusion, resource efficiency, mitigation and adaptation to climate change, resilience to disasters, and develop and implement, in line with the Sendai Framework.
SDG 13: Take urgent action to combat climate change and its impacts	Strengthen resilience and adaptive capacity to climate-related hazards and natural disasters in all countries. Integrate climate change measures into national policies, strategies and planning.
SDG 14: Conserve and sustainably use the oceans, seas and marine resources	Sustainably manage and protect marine and coastal ecosystems to avoid significant adverse impacts, including by strengthening their resilience, and take action for their restoration in order to achieve healthy and productive oceans.
SDG 15: Sustainably manage forests, combat desertification, halt and reverse land degradation, halt biodiversity loss	Ensure the conservation, restoration and sustainable use of terrestrial and inland freshwater ecosystems and their services, in particular forests, wetlands, mountains and drylands, in line with obligations under international agreements.

In recent years, support for integrating biodiversity and ecosystems into adaptation and risk reduction strategies has increased and has been embedded in other major agreements and promoted in the international policy arena at international, national and local scales (Table 4).

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Table 4: Highlights of support for nature-based solutions in the international policy sphere across scales

Framework	Policy instrument	Description
CBD Strategic Plan for Biodiversity to be succeeded by the post-2020 Global Biodiversity Framework	Strategic Goal B Reduce direct pressures on biodiversity and promote sustainable use	Target 5: Rate of loss of all natural habitats halved. Target 7: Areas under agriculture, aquaculture and forestry are managed sustainably including biodiversity conservation. Target 10: Multiple anthropogenic pressures on coral reefs and other vulnerable ecosystems impacted by climate change or ocean acidification are minimized to maintain integrity and functioning.
	Strategic Goal C Improve status of biodiversity by safeguarding ecosystems, species and genetic diversity	Target 11: Protected areas – terrestrial, inland water, coastal and marine water landscapes and seascapes. Target 13: Genetic diversity of cultivated plants and farmed and domesticated animals and of wild relatives, including other socioeconomically as well as culturally valuable species, is maintained.
	Strategic Goal D Enhance the benefits to all from biodiversity and ecosystem services	Target 14: Ecosystems that provide essential services including water and that contribute to health livelihoods and well-being are restored and safeguarded. Target 15: Ecosystem resilience and contribution of biodiversity to carbon stocks enhanced, including restoration of degraded ecosystems, mitigation, adaptation and desertification.
CBD Decisions	VI/22	Promotion of biodiversity in forests to enhance their capacity to adapt to climate change, and for climate change mitigation and adaptation measures.
	X/33	Implementation of ecosystem-based approaches for adaptation, including sustainable management, conservation and restoration of ecosystems.
	XII/19	Reaffirming the need for enhanced support and cooperation to promote ecosystem restoration efforts of developing countries, noting that not enough progress has been made to reduce habitat loss and to promote ecosystem restoration.
	XII/20	Calls on governments and other relevant organizations to promote EbA and Eco-DRR approaches and integrate these into their respective policies and programmes on biodiversity and climate change and disaster risk reduction, recognizing that while biodiversity and ecosystems are vulnerable to climate change, the conservation and sustainable use of biodiversity and restoration of ecosystems can play a significant role in climate change mitigation and adaptation, combating desertification and disaster risk reduction.
	XIII/5	Adoption of the short-term action plan on ecosystem restoration to promote restoration of degraded natural and seminatural ecosystems, including in urban environments, as a contribution to reversing the loss of biodiversity, recovering connectivity, improving ecosystem resilience, enhancing the provision of ecosystem services, mitigating and adapting to the effects of climate change, combating desertification and land degradation, and improving human well-being while reducing environmental risks and scarcities.

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Framework	Policy instrument	Description
	XIV/5	Adoption of the voluntary guidelines for the design and effective implementation of ecosystem-based approaches to climate change adaptation and disaster risk reduction.
CBD Articles	Article 6	Urges Parties and other governments to use revised and updated National Biodiversity Strategies and Action Plans (NBSAPs) as instruments for the integration of biodiversity targets into national development and poverty reduction policies and strategies, economic sectors and spatial planning processes (decision X/2). Parties were also invited to integrate ecosystem-based approaches for adaptation into relevant strategies, including adaptation strategies and plans, national action plans to combat desertification, NBSAPs, poverty reduction strategies, disaster risk reduction strategies and sustainable land management strategies (decision X/33).
Sendai framework	Prioritizes ecosystem-based approaches to build resilience and reduce disaster risk	Outlines seven global targets to be achieved over the next 15 years, prioritizing "ecosystem-based approaches…to build resilience and reduce disaster risk". Priority Action 1: The role of ecosystems will need to be taken into account in disaster risk assessments. Priority Action 2: Strengthening risk governance. Priority Action 3: Strengthen investments in disaster resilience.
Global Platform for Disaster Risk Reduction 2017	Cancun High-Level Communique	Emphasizes the close nexus between climate change and water-related hazards and disasters and highlights integrated water resources management as an effective instrument for enhancing resilience and serving both disaster risk reduction and climate change adaptation goals, in addition to investments in resilient infrastructure, including green infrastructure and housing. All countries, provinces and cities are urged to make integrated flood and drought management central to their planning and management processes.
World Humanitarian Summit		Commits the UN Member States to fulfilling core responsibilities of humanitarian aid and disaster risk preparedness, including building community resilience.
UN Habitat	New Urban Agenda	Contains three transformative commitments: leaving no one behind and fighting against poverty; urban prosperity and opportunities for all; and ecological and resilient cities and human settlements.
Ramsar Convention on Resolutions	Resolution XII.13 on Wetlands and Disaster Risk Reduction	Encourages Parties to integrate wetland-based disaster risk management and climate change adaptation into development policies and planning at all levels of government, including in vulnerability analysis, poverty reduction strategies and natural resource management plans (including land-use and water-use) and sectors, and in multi-sector policies and plans.
	Resolution VIII.35 The impact of natural disasters, particularly drought, on ecosystems	Encourages Parties with Ramsar sites affected by drought or other natural disasters to use the mechanisms and benefits of the Montreux Record by placing such sites that are in need of priority conservation action on the Record and, as appropriate, seeking national and international assistance to support their conservation action.

Framework	Policy instrument	Description
Edinburgh Declaration		Subnational governments, cities and local authorities will build on efforts to deliver transformative actions by considering the overall value of nature and integrating it into subnational, city and local planning, management and governance instruments; mainstreaming biodiversity across public, private and business sectors to achieve greater environmental, societal and economic resilience; strengthening capacity-building in order to implement NbS and green and blue infrastructure, particularly through ecosystem-based approaches and as a contribution to a green recovery from COVID-19.
Ten Essentials for Making Cities Resilient		Safeguard natural buffers to enhance the protective functions offered by natural ecosystems. It is encouraged to consider natural buffers in the rural hinterland of the city and the wider region, and to build regional resilience through transboundary cooperation with other municipalities.
Guidelines for Just Transition		Recommends supporting public works and employment programmes, including initiatives linking poverty eradication and ecosystem protection, as well as those for workers affected by the transition to environmentally sustainable economies, including climate change, who have been laid off due to structural or technological change.

ANNEX III: RELEVANT INITIATIVES

This annex builds on section 6.2. Examples of initiatives noted below are applicable to forest and grassland ecosystems that seek to mainstream nature in governance and policy instruments, enhance regional and international cooperation, and shift governance and financing to better value nature. This list is non-exhaustive; a more comprehensive list can be found on the Nature-based Solutions Contributions Platform (UNEP) and in the forums and platforms mentioned.

Programmes and Policy

The UN Decade on Ecosystem Restoration 2021-2030 was declared by the UN General Assembly, led by the UNEP and FAO, with the aim of massively scaling up the restoration of degraded and destroyed ecosystems as a proven measure to fight the climate crisis and enhance food security, water supply and biodiversity.

The different initiatives outlined below, support the implementation of the Warsaw Framework for REDD+:

The UN-REDD Programme 2020-2030, is a partnership involving FAO, UNEP and UNDP to support more than 65countries to realize their full potential for emission reductions and removals through halting and reversing deforestation and forest degradation;

REDD+ experiences are being shared by Parties and relevant stakeholders via the UNFCCC REDD+ WebPlatform, which also contains all background information and documents, and the Lima Information Hub for REDD+, which offers information on the implementation of REDD+ and results-based payments; A wide range of capacity-building tools for REDD+ implementation has been developed by the Forest Carbon Partnership Facility and the UN-REDD Programme.

Restoration Initiatives

The Bonn Challenge aims to restore 350 million hectares (an area roughly the size of India) of degraded ecosystems by 2030. Currently 57 countries, subnational governments and private organizations have committed to bring over 170 million hectares under restoration. This endeavour builds on regional efforts, such as the **Initiative 20x20** in Latin America, which aims to restore 20 million hectares of degraded land by 2020, and **the AFR100 African Forest Landscape Restoration Initiative**, which aims to bring 100 million hectares of degraded land under restoration by 2030.

The Sustainable Growth, Livelihoods and Ecosystem Restoration Initiative, known as the Billion Trees Tsunami, is being implemented in Pakistan. It is a major effort to restore ecosystems and support reforestation.

The Great Green Wall Initiative aims to restore Africa's degraded landscapes and transform millions of lives in one of the world's poorest regions, the Sahel. Once complete, the Wall will be the largest living structure on the planet: 8,000 kilometres stretching across the entire width of the continent. Launched in 2007 by the African Union, the initiative brings together African countries and international partners, under the leadership of the African Union Commission and the Pan-African Agency of the Great Green Wall.

Partnerships and Advocacy

Friends of EbA (FEBA) is a global collaborative network of 80+ agencies and organizations involved in EbA working jointly to share experiences and knowledge, improve the implementation of EbA-related activities on the ground, and exert

a stronger and more strategic learning and policy influence on EbA. FEBA works to synthesize this multi-stakeholder knowledge on EbA; disseminate this knowledge by convening the global EbA community around high-level events, technical workshops, and expert working groups; and raise awareness and understanding of EbA in adaptation planning processes and multilateral policy frameworks.

The Central African Forest Initiative (CAFI) aims to support governments in the region as they implement reforms and enhance investments to address such challenges as poverty, food insecurity and climate change.

The Global Campaign for Nature, led by Costa Rica together with partner countries, including the Bahamas, the Democratic Republic of Congo, Gabon, Guyana, Guatemala, Liberia and Suriname as well as different organizations and foundations, is providing public support to the growing movement for nature and the global **New Deal for People and Nature**.

The Natural Climate Solutions Alliance seeks to mobilize the resources needed for NbS to contribute fully to delivery of the Paris Agreement and the Sustainable Development Goals. The resources would be used to address the most pressing environmental and social challenges, prevent biodiversity and forest loss, promote sustainable water management and create sustainable community livelihoods.

ANNEX IV: CASE STUDIES

Case Study 1: Supporting Counties in Kenya to Mainstream Climate Change in Development and Access Climate Finance, Kenya: The Isiolo County Climate Change Fund

Brief description

The Adaptation Consortium aims to prepare county governments to access global climate finance to support adaptation and climate-resilient development. It mainstreams mechanisms that allow communities to prioritize investments in public goods that build their climate resilience.

Details

Location: Isiolo County, Kenya

Type of adaptation: Social

Scale: Subnational, National

Ecosystem/Landscape: Grasslands - succulent karoo

Funding Sources: Bi-/Multilateral donor, State-led

Implementing agencies and partners: Ada Consortium, Kenyan National Drought Management Authority

Climate vulnerability

Drought increases water scarcity during the dry season. 65% of Isiolo County is classified as 'very arid' and 30% as 'arid', so securing reliable water resources is a major challenge. Climate change and climate variability in the drylands causes variations in rainfall and is the main driver of ecological change.

Timeline

2013 and 2016.
Anticipated lifetime: Ongoing

Lessons learned and best practices

- Community participation is fundamental throughout the design and implementation, and formalized in management structures and decision-making processes. Participatory livelihood and local economy resilience assessments helped to identify potential investments.
- Supporting Ward Climate Change Planning Committees' customary range management institutions (dedhas) is an integral part of the Isiolo County Climate Change Fund (ICCCF) and local knowledge is also prioritized.
- Effective rangeland management requires jurisdiction over large areas, but administrative boundaries and the imposition of different tenure and land-use systems can disrupt pastoralist mobility and livestock management. Catchment-level planning is therefore important to ensure pastoralist access to water in this dry area, which also requires landscape-level management approaches.
- Measuring returns on investment is difficult because people are highly mobile and many benefits are difficult to quantify. Pastoral production systems have historically been undervalued as a land-use choice.
- Key challenges include the historical mismanagement of water and grazing resources; poor coordination and communication by the central planning systems and a disconnect between communities and formal governance systems; limited capacity to track the impact of adaptation interventions at the county level; and difficulty securing county-level government support and multi-sectoral coordination.

- A national commitment to devolution has also provided opportunities to enhance community participation in decision-making and support community land ownership, both of which are cornerstones of ICCCF effectiveness. Several social, institutional and political organizations have supported ICCCF implementation in Isiolo.

Impact

- ICCCF investments have helped build local resilience to climate change while providing a number of co-benefits that promote well-being of people in poor and marginalized households.
- Pastoralists and agro-pastoralists particularly benefit, which is important as livestock is the dominant economic sector in Isiolo County and supports the majority of the population. Women benefit no less than men.
- ICCCF disbursements have supported projects that have improved ecosystem resilience and services provision. Investments in traditional rangeland governance and management systems slow land deterioration and have led to rangeland regeneration.
- Having a strong financial rationale makes ICCCF investments cost effective for both community and external investors. The investments in strengthening *dedha* in four Isiolo wards over the 2014 long dry season, resulted in a ratio of 402:1 of local community benefits to ICCCF investment. The ratio of benefits for local and non-local community members was 1,635:1.
- *Dedha* members contributed their own money to *dedhas* management, and the ratio of returns on their investment was high.
- The costs of establishing the ICCCF was 28% greater than the total value of the investments delivered by the first round of disbursements, but these costs are likely to drop dramatically in subsequent rounds.
- The ICCCF running costs compare favourably with similar mechanisms and indicate that no other land uses would provide better returns. Effectiveness was evaluated using a methodology described in Reid et al. 2018 and Reid et al. 2017.

Costs and benefits

- A wide range of social co-benefits included: improved local natural resource management, conflict resolution, community cohesion, employment opportunities, enhanced natural resource management skills, improved diets and improved health. Trade-offs in terms of who benefitted, where and when these social co-benefits materialised appear to be minimal.
- Broader economic benefits emerging from ICCCF investments in Isiolo included: insurance for disasters, option value, income substitution for reduced expenditure, capital for investment and access to credit.
- Economic benefits are likely to last for a long time. Possible financial trade-offs included losses suffered by neighbouring communities with reduced access to water, and by extension pasture.

Stakeholder participation methodology

- Local knowledge of climate, water management and rangeland management was supported by the ICCCF, most notably through the traditional elders system (*dedha*), which are the repository for much of this knowledge.
- Formalized opportunities for community involvement in ICCCF management and decision-making also ensured that community participation was central to ICCCF establishment and decision-making processes, including building capacity of *dedhas*.

- Initial community consultations in Isiolo verified community and government support for the ICCCF approach and led to a series of workshops with community and government participants in 2011 to design the institutional structure of the devolved finance mechanism.

Link

https://www.iied.org/eba-evidence-policy-kenya

Summary of the case study

Case study 2: Climate-Resilient Livestock Production on Communal Lands, South Africa

Brief description

EbA involving rehabilitation of critical rangeland and wetland ecosystems in the Succulent Karoo, South Africa.

Details

Location: Namakwa District Municipality in the Northern Cape Province of South Africa

Scale: Municipal

Ecosystem/Landscape: Grasslands - succulent karoo

Type of adaptation: Social, Institutional

Funding Sources: Bi-/Multilateral donor, State-led

Implementing agencies and partners: Conservation South Africa

Climate Vulnerability

As a result of climate change, the Namakwa District Municipality will become hotter and drier, with more intense storms, floods and droughts. Households living in the Leliefontein communal area rely on livestock farming as one of their main sources of livelihood. However, due to the aridity of the area, farming is on the margins of economic viability, with large areas of land needed to sustain few animals.

Timeline

Initial EbA project 2011-2015, with ongoing follow-up work since 2016

Lessons learned and best practices

- Project activities built on local knowledge adopted a range of participatory processes, which helped build adaptive capacity.
- Few social trade-offs were observed, but because of the slow nature of rangeland restoration, the associated gains in resilience took time to accrue. Similarly, while few trade-offs in terms of ecosystem service provision were observed, ecosystem-related benefits from rangeland restoration took several years to emerge.
- It may also be that semi-arid Succulent Karoo ecosystems have thresholds relating to overgrazing or climate change, which if crossed could lead to irreversible change.
- A number of policy and institutional barriers influenced the implementation of effective EbA initiatives at local, provincial and national levels. Most notably the lack of local government authority to implement EbA, inadequate policy support at the provincial level, insufficient cross-sectoral collaboration at all levels, knowledge gaps, funding shortages, low-capacity levels, weak institutional effectiveness and high levels of poverty.
- A number of policy and institutional opportunities also supported EbA implementation at various levels, most notably local government capacity, a supportive national and provincial legislative and policy environment, and opportunities for integrating EbA into expanded public works programmes.

These programmes have provided great potential for scaling up EbA implementation and moved away from stand-alone EbA projects with limited and locale-specific impacts. Mainstreaming has also been occurring as EbA is incorporated into various national policymaking and planning processes in South Africa. Tools and guidance have been developed to support this process.

Impact

- Communities maintained or improved their adaptive capacity or resilience, and reduced their vulnerability, in the face of climate change. The initiatives benefitted vulnerable groups, especially those relying on pastoralism for their livelihoods.
- The EbA initiatives also restored, maintained or enhanced the capacity of ecosystems to continue to produce services for local communities, and allowed ecosystems to better withstand climate change impacts and other stressors.
- EbA rangeland restoration was not financially viable from the perspective of landowners. EbA approaches (rangeland and wetland restoration) were also considerably more expensive than other adaptation options.
- Effectiveness was evaluated using methodology described in Reid et al. 2018, Reid et al 2017 involving assessing effectiveness for human societies, ecosystem, and financial and economic effectiveness.

Costs and benefits

- Numerous social co-benefits emerged from the EbA initiatives, and few costs.
- Despite the lack of financial viability for the landowner, EbA options provided broader economic benefits such as job creation, and provided a strong economic case for wider application using government funding channelled through South Africa's expanded public works programmes.

Stakeholder participatory methodology

Project activities involved extensive engagement with local farmers, surrounding communities, civil society stakeholders, and local and district-level government officials to guide and inform the development of a range of adaptation options, including EbA. This process was interactive and collaborative, with project staff acting as facilitators to engage the community and other stakeholders through workshops, peer learning exchanges in the field, regular stakeholder meetings and the co-design of project activities. The project also incorporated local/indigenous knowledge and practices.

Assessing effectiveness involved interviewing a range of project stakeholders.

Link

https://www.iied.org/eba-evidence-policy-south-africa

Summary of the case study

Case study 3: Building Drought Resilience through Land and Water Management

Brief description

The project aimed at building the resilience of dryland communities within river catchments in Uganda and Kenya. The areas are arid and semi-arid in nature, with communities facing multiple challenges related to droughts, floods and resource-use conflicts that hinder development and livelihood well-being.

Details

Location: Aswa Agago Basin in Uganda and Lower Tana River Basin in Kenya

Scale: Subnational

Type of adaptation: Social, institutional

Ecosystem/landscape: Grasslands

Funding sources: Bi/multi-lateral donor, State-led

Implementing agencies and partners: Kenya: Water Resources Authority, County Governments of Garissa and Tana River, and National Government Agencies and Ministries operating at the local level.

Uganda: Upper Nile Water Management Zone, Directorate of Water Resource Management and the District Local Governments

Climate vulnerability

Community vulnerability to recurrent droughts, floods and resource-use conflicts in drylands

Timeline

The first phase of the project was implemented from 2012 to 2014. Second phase was from 2015 to 2018, project implemented

The project is now in its third phase, *Resilience for People and Landscapes Programme*. It will scale up gains in building resilience of communities to climate disasters, improving governance and management of natural resources while securing the livelihoods of the communities.

Lessons learned and best practices

- The project supported action learning and lessons learned events, enabling learning and modification of approaches to fine-tune workplans. Action learning supported the practical transfer of skills and knowledge through peer-based learning with a focus on governance, landscape restoration and livelihood improvement.
- Involved stakeholders and different groups in the community promoted a strong sense of ownership of project activities. This included their involvement in the development of environment and natural resource management plans and resource maps. This has built a sustainable mechanism that has secured the gains beyond the project location and lifespan.
- Livelihood diversification was supported through piloting the Community Environment Conservation Fund (CECF), an innovative mechanism that supports restoration of catchments while providing sustainable livelihood packages to beneficiaries. The CECF saw an increase in investments in small business initiatives by communities, with most enterprises having a positive effect on environmental protection, conservation and restoration.
- The project effectively strengthened the governance and management of natural resources by empowering formal and customary governance structures and platforms that promoted learning, knowledge-sharing and capacity-building for sustainable landscapes.

Impact

- The project used the adaptive capacity approach, where the communities were closely involved in the design and development of adaptation measures ranging from livelihood diversification, interfacing formal governance structures with customary institutions to the adoption of climate-resilient financing for sustained ecosystem restoration.
- The adaptation strategy was closely linked to the IUCN Resilience Framework, which has four main pillars: (a) diversity of the economy, (b) livelihoods and nature, (c) sustainable infrastructure and technology and (d) self-organization and learning.
- The project indicators included number of: (a) livelihood diversification activities supported through CECF implementation, (b) water infrastructures that enhance utilization

and access for sustainable domestic use, (c) environment and natural resource management plans developed, (d) resource maps developed, (e) capacity-building workshops held, (f) local level policies and legislation developed on natural resource management, and (g) action learning events held. The strategy was evaluated against the four resilience framework pillars for the respective project result areas.

Costs and benefits

- The project successfully strengthened the resilience of over 150,000 people though the development of eight micro-catchment management plans, which supported the restoration of over 168 kilometres of degraded river banks and 400 hectares of degraded landscapes.
- In Uganda most of the wetlands in the project area experienced notable levels of restoration, with additional impacts of increased water and pasture for livestock. The project built two sub-surface dams and 127 water sources with functional water resources users' associations and committees. The water sources have provided clean and safe water to over 40,000 people within the project landscapes.
- Alternative livelihood strategies under the CECF supported over 30,000 community members the majority of which were women and youth.
- The involvement of women in action-learning events ensured that women were properly represented in the documentation and dissemination of best practices and uptake of lessons from the project.

Stakeholder participatory methodology

A variety of approaches and methodologies were used for stakeholder engagement. This included participatory rangeland management and planning and participatory rural appraisal.

Link

https://www.iucn.org/regions/eastern-and-southern-africa/our-work/drylands-resilience-land-management/resilience-people-and-landscapes-programme-replap

Summary for the case study

Case Study 4: Nor Yauyos-Cochas Landscape Reserve, Peru

Brief description

Since 2013, four mountain EbA measures have been designed and are being implemented in the Nor Yauyos-Cochas Landscape Reserve through participatory processes.

These adaptation solutions combine traditional (indigenous), local knowledge with the latest science and comprise of three components: (1) strengthening community organizations and institutions, (2) strengthening local capacities and knowledge and (3) combining green and grey infrastructure to restore water flow to native grasslands/pastures and improve livestock and pastureland management – a key form of adaptation to climate change in the Andes. Working with conservationists, engineers and anthropologists, community members identified and designed the EbA measures according to their own needs and priorities, adapting ancestral and modern technologies to current social and environmental contexts and expected future climate.

Details

Location: Nor Yauyos-Cochas Landscape Reserve. Junín and Lima regions. Central Andes of Peru

Type of adaptation: Social

Ecosystem/Landscape: Grasslands - succulent karoo

Scale: Subnational, National

Funding Sources: Bi-/Multilateral donor, State-led

Implementing agencies and partners:

Instituto de Montaña, mountain.pe, IUCN

Campesino Communities of Miraflores, Canchayllo, Tanta and Tomas Nor Yauyos-Cochas Landscape Reserve

Regional Governments of Lima and Junín, National Service of Natural Protected Areas, Ministry of the Environment

Climate vulnerability

Glacial retreat, increasing temperatures, changes in rainfall patterns, extreme heat, drought, overgrazing, land degradation

Timeline

Mountain EbA measures were designed, implemented and monitored from 2013 to 2015 during the mountain EbA flagship program. From 2017 to 2020 the measures were consolidated and the monitoring system revised.
Anticipated lifetime: Ongoing

Lessons learned and best practices

- Participatory processes during the planning, implementing and monitoring phases, and recovering traditional knowledge are important strengths in generating community ownership and sustainability.
- Implementing a second project phase with objectives that consolidated EbA measures was a strength, and offered an opportunity to allocate more time and resources to processes that usually take more than two years.
- Communities' dynamics required different intervention efforts to reach success. One of the project's challenges was meeting the varied demands.
- Institutional approaches achieve different impacts when working with communities; building synergies to improve the community's livelihood is a challenge.

Impact

- The effectiveness of the strategy was evaluated in terms of: i) the strengthened capacity of the community organization to enhance pasturing standards for a sustainable and more equitable use of the grassland's common goods; ii) the ecosystem conservation status as a consequence of the grassland management; and iii) the strengthened ecosystem management capacities.
- Indicators for adaptation effectiveness are: i) pasture surface with improved coverage and condition; ii) the level of completion of the water and pasture management plan; and iii) technical capacities for pasture management and practices. Other adaptation capacity indicators like reachable technology, institutions and networking capacities, information and equity, among others are being analysed.

Costs and benefits

- Traditional cost–benefit analysis in Miraflores community show a benefit–cost rate of 1.44, with an intern return rate of 25%. After the measure more benefits were verified but still not evaluated in economic terms.
- Co-benefits include a decrease in pasture fires owing to the pasture irrigation practices and changes in the animal species owned by community members, prioritizing camelids with better fibre price that cause less damage to pastures, among others.

Stakeholder participatory methodology

- Participatory natural resource management includes local populations' perspectives in order to identify and implement solutions to people's problems in their own territories, increasing synergies between the local population's knowledge and capacities and scientific knowledge.

- A community committee was chosen and was responsible for working with the project during each project step: community assessment and the EbA measure design, sharing investments for the EbA measure implementation, and monitoring.
- Local authorities, women, elderly people, youth and different economic activities groups of representatives participated. Local and traditional knowledge was valued, and capacities with a scientific approach was strengthened.

Link

https://www.iied.org/eba-evidence-policy-peru

Summary of case study

Case Study 5: Watershed Forest Restoration to Support Functioning of the Itaipu Dam, Paraguay and Brazil

Brief description

Designing, implementing and financing NbS, including large-scale forest restoration and protection on company-owned land, and working with local people in the wider Paraná watershed to restore forests and improve soil management.

Details

Location: Paraná watershed, Brazil and Paraguay Central Andes of Peru

Type of adaptation: Social, Structural / physical,

Ecosystem/Landscape: Tropical forest

Scale: Municipal

Funding Sources: Bi-/Multilateral donor, State-led

Implementing agencies and partners: Itaipu Binacional, local governments, international funders

Climate vulnerability

Deforestation increasing the speed of water run-off into the Paraná river and its tributaries, altering peak flows; climate change causing higher risks of flood damage following more frequent and intense periods of heavy rainfall. Impacts include soil erosion and run off, drought and water scarcity.

Timeline

2003

Lessons learned and best practices

- A binational (i.e. transboundary) effort may be required for landscape-scale NbS.
- An enabling legal framework promotes private sector implementation of NbS.
- Understanding ecosystem services value helps promote NbS investment.
- NbS need to be implemented at an appropriate scale to prevent gains in some areas to be negated by losses elsewhere.
- The support of local communities and governments is important for large scale interventions.

Impact

- More than 25,000 people have benefited from increasing local capacity to manage protected forests, restore land, increase the biodiversity conservation and reduce water pollution by agrochemicals.
- Itaipu Binacional has worked with 55 indigenous communities and has 11 sub-projects associated with food security. It has also encouraged the production of yerba mate and honey to help generate income and support livelihoods.
- By working with local people, Itaipu Binacional can ensure that people who pay the short-term costs of forest restoration, for example by conserving

land instead of using it for agricultural production, also have a share in the benefits.

Costs and benefits

- Climate change mitigation through carbon sequestration
- Biodiversity conservation and enhancement
- Soil structure and fertility
- Supporting livelihoods of local farmers and communities
- Infrastructure development for local communities

Link

https://www.resilienceshift.org/case-study/itaipu-dam

Summary of the case study

Case Study 6: Trees and Bees, Nepal

Brief description

Since 2014, the Bishnupur community forest user group (CFUG) in Sarlahi district of Nepal has been implementing strategies to improve its resilience to climate change and natural disasters. These strategies aim to increase household income and reduce vulnerability through NbS that tackle flooding and riverbank cutting. The community assessed the sources of climate vulnerability, possible NbS and alternative livelihood options. The community chose to promote the expansion of tree cover both in and outside forests to protect and restore the environment. The community also focused on cultivating beehives and collecting honey as a way to support forest biodiversity and generate income, particularly for women.

Details

Location: Hariwan Municipality of Province 2 of Nepal.

Type of adaptation: Structural / physical, Social, Institutional

Ecosystem/Landscape: Forests– mixed tropical forest

Scale: Municipal

Funding Sources: Bi-/Multilateral donor, Grassroots – in kind

Implementing agencies and partners: Bishnupur women CFUG as the lead

RECOFTC – facilitation and capacity development of community forest user groups in designing and implementing adaptation interventions

Climate vulnerability

The area is losing forest owing to severe flooding; further degradation is occurring due to forest fires and an abundance of invasive species (e.g. Mikania micrantha and Eupotorium species). In addition, flooding in the area is threatening the lives and livelihoods of farmers, damaging property and washing away agricultural land. The area is also facing acute water problems and getting low returns from traditional livelihood activities (e.g. agriculture and livestock).

Timeline

2014, RECOFTC designed the project alongside local community members.

Project was completed in 2017.

Ongoing upscaling activities by the community with limited technical assistance from RECOFTC.

In addition, the municipality has taken over this initiative and has included beekeeping and riverbank stabilization in its local development plan.

Lessons learned and best practices

The project has gathered the following lessons learned:

- The Bishnupur CFUG is women-led, which demonstrates that women can play an effective role in natural resource management and in fighting climate change.
- As a community-based organization (CBO), CFUG coordinated with local authorities and integrated climate change adaptation into local development plans and programmes. This ensured the sustainability of the adaptation project.
- Communities select the adaptation measures based on their traditional knowledge and available resources, such as native species (Dalbergia sissoo and Acacia catechu) plantation along the riverbank with controlled grazing and fire. Implementing measures of their interest also increases their participation. NbS, blended with traditional practices, are socially, ecologically and economically sustainable.
- Restoration of degraded land can be linked with income-generating activities without harvesting forest products; beekeeping is one such example.
- The CFUG has its own monitoring mechanism and has promoted participatory monitoring activities such as public auditing. This helps to ensure transparency as well as improve the programme and participation of vulnerable groups.

Impact

The impact can be described through four broad indicators.

- Enhanced adaptive capacity: The adaptive capacity of the forest and local communities has been enhanced. Forest management based on CF operational plans and the rehabilitation of degraded land and riverbanks with native species has improved the forest conditions; bioengineering measures have protected agricultural land from floods, sustaining and improving productivity. Households are diversifying their income sources from beekeeping and agroforestry.
- Empowerment of the local community: The local community, including women and the extremely poor, have a greater understanding of climate impacts, sources of vulnerability and NbA strategies. This means that they can continue working by themselves and support their neighbours as they identify sources of vulnerability and appropriate adaptation measures.
- Institutionalization and sustainability: The implementation of adaptation measures through CBOs, such as CFUGs, has institutionalized this adaptation project, allowing activities to continue after the discontinuation of the external support. The CFUGs have continued to engage with local governments, relevant government agencies and other development organizations to access technical and financial support and design and implement adaptation strategies.
- The approach has influenced many larger donor-funded projects, including the GCF Chure Rehabilitation Project. This project has replicated the Trees and Bees approach in a number of areas in the foothills of Chure, including in the nearby Pragatishil community forest. The Bishnupur CFUG is also sharing knowledge with other CFUGs to facilitate replication.

Costs and benefits

The benefits of the programme have outweighed the costs.

- Local resources and materials were used for adaptation interventions to minimize the risk of disasters; this has minimized the overall cost of the project.
- Users participated in the design and implementation, which enhanced the efficiency of the project.
- The estimated value of direct benefits is $32,950 and the cost was $10,700.

- In addition to monetary benefits, the community gets the additional benefits of improved health resulting from a decrease in floods and flood-borne pathogens.

- For carbon storage and sequestration, it is estimated that a normal plantation forest sequesters 233.77 t C/ha in Nepal (ANSAB et al 2012). The estimated carbon stock enhanced in Bishnupur from the plantation of 3.8 ha degraded land is 888 t C/ha, which is equivalent to 3257 t CO_2; this equates to a carbon value of $16,285.

Stakeholder participation methodology

- Members of the Bishnupur CFUG are at the helm of the intervention. Women leaders of the CFUG, along with facilitators, led the process of assessing vulnerability and identifying adaptation measures.

- The CFUG engaged the poorest households throughout the process and supported them with seedlings and beehives as needed.

- Government organizations such as the Divisional Forest Office, the District Soil Conservation Office, the Regional Horticulture Development Centre, Lalbandi, and FECOFUN were requested to provide technical and financial assistance.

- In addition, Harion Municipality and RECOFTC provided technical and financial support to reduce climate change vulnerabilities of the communities.

Link

https://www.recoftc.org/

Summary of the case study

Case Study 7: Resilient Mountain Solutions: Strengthening Government–Community Connect to Improve Biodiversity and Ecosystem Restoration

Brief description

Myanmar hosts diverse ecosystems and habitats of various flora and fauna. However, owing to impacts of anthropogenic drivers and climate change these ecosystems are undergoing degradation and loss. ICIMOD initiated the Rural Livelihoods and Climate Change Adaptation in the Himalayas Project (Himalica) in 2013, focusing on cost-effective and sustainable catchment conservation measures involving multi-stakeholder participation. Long-term participatory land management strategies were initiated to restore degraded land and forest through community forest, afforestation and soil conservation measures in partnership with the Forest Department and the indigenous communities of Pa'O. Building on Himalica's effort, ICIMOD initiated the Resilient Mountain Solutions (RMS) initiative in 2018 to strengthen the government community connection in Myanmar.

ICIMOD, in collaboration with Shan State Forest Department, is preparing a geospatial-based "forest fire management plan" to enhance preparedness and reduce the forest fire risks using recent technologies, with the remote-sensing and GIS tools.

Details

Location: Shan State, Myanmar

Type of adaptation: Institutional

Ecosystem/Landscape: Temperate Forests–sub-tropical

Scale: Municipal, Subnational, National, Subregional

Funding Sources: Bi-/Multilateral donor

Implementing agencies and partners: International Centre for Integrated Mountain Development

Myanmar Institute for Integrated Development

Ministry of Natural Resources and Environmental Conservation, state and township forest offices

Pa'O Self-Administrative Zone Leading Body (indigenous communities)

Climate vulnerability

Deforestation, forest degradation, soil erosion and forest fires are some of the key issues affecting the biodiversity, forest ecosystems and water availability in Myanmar. Frequent forest fires negatively impact the health of the catchment that provides ecosystem services to the community and also adds sedimentation in the local ponds, decreasing the life of ponds, which are the main sources of water for domestic and animal use during dry season.

Timeline

T2015 (Himalica: Community forestry), Resilient Mountain Solutions

Ongoing 2022

Lessons learned and best practices

- Micro plans and 3D models help communities to initiate, plan and manage their forests, water and other natural resources.
- Several trainings for communities on forest nursery establishment, bamboo propagation and micro-catchment conservation effectively equip communities to grow their own seedlings for later transplantation to common and private forest areas.
- Afforestation and soil and water conservation measures applied in micro catchments help reduce soil erosion and improve the quantity and quality of water in ponds.
- Agroforestry activities support communities in conservation efforts and plantation of fruit trees on their farmland, which help increase their additional income in the long term.
- Promotion of improved cook stoves and bio briquette help reduce household energy use and protect forests from the over-extraction of firewood.
- Based on the learnings from Himalica, the RMS initiative carried out a vulnerability assessment and situation analysis of three villages in the indigenous communities in the Pa'O Self-Administered Zone. The findings helped to identify areas for the establishment of community forests. The key institutional challenge in the Pa'O Self-Administered Zone is a trust deficit between the community and the government. The initiative also focused on creating better linkages between the Shan Forest Department and the Pa'O Leading Body, thus strengthening the government–community connection to promote community forestry.
- A cross-learning visit by the Forestry Department of Myanmar, the Pa'O Leading Body and the community to Nepal helped them understand and promote gender-responsive community forestry in the Pa'O region of Myanmar.
- The training programme on forest management enhanced the capacity of forest officials for better planning and management and provided a scientific basis for revising the activities in the forest management plan (2016-2025) and developing a forest fire risk assessment map for Shan State.

Impacts

- Various government departments, NGOs, private sector entities and journalists who were involved in the project activities were connected with the communities. These communities continued to receive advisory services after the project ended to further sustain the conservation efforts.

- Demonstrated forest and catchment conservation measures helped improve biodiversity, reduce soil erosion, and improve water quality and quantity.
- Project activities were evaluated by government departments through regular site visits; strengths and weakness of the implementation approach and technical aspects were identified and corrected immediately after the field visits and evaluations.

Costs and benefits

- A systematic cost–benefit analysis was not done, but from the start of the project, low-cost conservation measures and the use of locally available material were emphasized.
- The main focus of the project is to enhance the capacity of women and men to produce required resources locally and to minimize their external dependency, for example, by establishing forest nurseries in each village and propagating bamboo in their respective catchments.
- The package of practices implemented in the forested catchment and farmland contributes to a reduction of soil erosion and biodiversity loss, and at the same time, helps improve the water quality and quantity and increase farm income.

Stakeholder participation and methodology

- Multiple stakeholders participated and contributed during the initiation and throughout implementation of the activities.
- Regular coordination efforts and updates on progress are shared with the Ministry of Natural Resources Environment Conservation and state- and township-level forests to facilitate uptake and long-term planning and management.
- The Shan State Forest department, Yezin University and NGOs are also engaged in facilitating trainings and providing planting materials.
- Communities, environmental journalists played an active role and there is an increased the participation of women in community forestry.
- The Pa'O Leading Body has appointed a focal person for RMS and all activities under RMS in the region are well coordinated.

Link

https://www.icimod.org/initiative/rms/

Summary of case study

Case Study 8: Sustainable land and water management for resilience building

Brief description

The overall objective of the project is to support the development of mountain rural livelihoods in the context of socioeconomic and climate change and the conservation of ecosystem assets and services. As part of adaptation and resilience building efforts, the project emphasised the sustainable management of land and water with due consideration of different resource management challenges. The target district has a lower general literacy rate, lower mean annual household income and higher unemployment rate than the national average.

The pilot interventions were designed based on the needs and priorities identified through a consultative process and community-led micro-planning. The beneficial effects of these interventions have been recognized by national and local government agencies and farmers' groups.

Details

Location: Barshong Gewog, Tsirang District, Bhutan

Type of adaptation: Institutional

Ecosystem/Landscape: Temperate Forests–sub-tropical

Scale: Municipal, Subnational, National, Subregional

Funding Sources: Bi-/Multilateral donor, State-led, Grassroots

Implementing agencies and partners: Ministry of Agriculture and Forest, Royal Government of Bhutan and Tsirang Dzongkhag District Administration

International Centre for Integrated Mountain Development, Kathmandu, Nepal

Timeline

2015 (Himalica: Community forestry), Resilient Mountain Solutions

Ongoing 2022

Lessons learned and best practices

Key takeaways of the project interventions are as follows:

- More income could provide options to respond to climate change adaptation; therefore, it is important to identify quick-gain activities based on the advantages of the location and emerging market opportunities for building rural household resilience. The production of vegetables safe for consumption and stall-fed goat farming are used as entry points to ensure community participation, with the aim of building resilience through sustainable land and water management.
- Ecosystem services can be well managed when communities identify livelihood benefits and outcomes from a resource management approach, which included: the plantation of fodder trees; shift from free-grazing to stall-fed goat farming; and other sustainable farming practices.
- Creation of incentives is a fundamental prerequisite for reducing the vulnerabilities of rural households, which includes improved access to services and capabilities (skills and knowledge) to manage resources.
- Active involvement and support of local line agencies is critical for ensuring the sustainability of the project's interventions.
- Demonstrating tangible results and benefits can incentivize local and national agencies the scaling-up. This needs to include benefits gained by communities. This has been the case in Bhutan. Participatory planning, co-development of solution packages, demonstrations on farmers' field and a joint monitoring and feedback mechanism on project progress led to twelfth 5-year plan of Bhutan both at the local and national level.

Impact

- An effectiveness analysis showed benefits to targeted actors and beneficiaries. The project applied a gender disaggregated, quasi-experimental design to assess baseline and end-line studies, focusing on target households and a control group (non-beneficiaries).
- More than 240 rural households in the pilot villages directly benefited from project interventions. According to the assessment of baseline and end-line surveys, the average income of beneficiary households has increased by Nu. 14142.8 [$229] from vegetable farming compared to non-beneficiary households, and in before-and-after scenarios, the average income of beneficiary households has increased by Nu. 42936.4 [$692] over the period of three years.
- The findings indicated substantial progress toward achievement of planned outcomes, and uptake of these results by *community members, local government and national agencies*. The project impacts were reported in the media.

Costs and benefits

- The climate-resilient agriculture (CRA) practices tested and demonstrated in Barshong have also been piloted in

Udayapur District, Nepal. A systematic assessment of the costs and benefits of these practices was carried out in Udayapur District.

- The results indicate that CRA generates multiple benefits compared to conventional agricultural practices. For instance, the benefit–cost ratio of CRA practice is 1.81 as compared to 1.02 for conventional farming. In addition, practicing CRA has changed the food habits of farmers, since the proportion of vegetables consumed in their regular meals has increased.

- Another study on biochar application reveals that the yields of a range of vegetables has increased markedly in plots treated with urine-biochar. The yield of fresh pea pods from plots treated with urine-biochar plus farmyard manure was more than twice that with nitrogen phosphorus potash only, and close to three times that with farmyard manure only (farmers' control). Similar results in terms of costs and benefits can be expected in Bhutan.

Stakeholder participation methodology

- ICIMOD implemented the project in coordination with national and local stakeholders. The project in Bhutan was coordinated by the Ministry of Agriculture and Forests at the central level and implemented by the Tsirang District Administration at local level.

- The project plans and activities were deliberated upon and endorsed by the Project Steering Committee, chaired by the Secretary of the Ministry of Agriculture and Forests, and accorded financial and administrative approval by the Dzongdag (district administrator).

- The local coordinator supports the implementation of activities with the livestock, forestry and agriculture sectors, in close consultation with the local government (gewog).

- The project involved community members, local elected representatives, entrepreneurs and private businesses at various stages to ensure local ownership over and functionality of interventions.

Link

https://www.icimod.org/initiative/himalica/

Summary of the case study

Case Study 9: Landscape Approach as Nature-based Solutions: A Balancing Act for Conservation and Development in the Hindu Kush Himalayas

Brief description

The Hindu Kush Himalayan region (HKH) region is an important repository of biological and cultural diversities and a source of varied ecosystems services. The International Centre for Integrated Mountain Development (ICIMOD), strengthens understanding of the dynamics of these fragile ecosystems and supports regional member countries through science-based integrated approaches.

The programme enhances resilience in the HKH region on: a) livelihood diversification and poverty alleviation; b) enhancing ecosystem resilience with special emphasis on rangeland, forests, freshwater and agro-ecosystems; c) strengthening governance and institutions; d) promoting long-term interdisciplinary research; and e) regional cooperation.

Details

Location: HKH region, which includes Afghanistan, Bangladesh, Bhutan, China, India, Myanmar, Nepal and Pakistan.

Type of adaptation: Structural/physical, Social

Scale: Municipal

Ecosystem/Landscape: Montane grasslands, Agricultural landscape, Temperate Forest, Montane

Funding Sources: Bi-/Multilateral donor, State-led

Implementing agencies and partners: Ministry of Agriculture and Forest, Royal Government of Bhutan, Thimphu, Bhutan

Kunming Institute of Botany, Chinese Academy of Sciences, China

Institute of Geographic Sciences and Natural Resources Research, Chinese Academy of Sciences, China

Ministry of Natural Resources and Environmental Conservation, Myanmar

Ministry of Forest and Environment, Government of Nepal, Kathmandu, Nepal

Govind Ballab Pant National Institute of Himalayan Environment, Almora, India

Climate vulnerability

The HKH region has been in spotlight for being one of the 36 "Global Biodiversity Hotspots" and "Crises Ecoregions" as well as a climate change hotspot. There are still knowledge gaps on the dynamics of the changing landscapes and climate and its interlinkages with people, mostly challenged by poverty.

Timeline

A long-term programme (2009-2036) with a 20-year time frame.

Four out of six of the identified landscapes are in the implementation phase.

Lessons learned and best practices

- The prevailing climate change trend shows increasing warming in the Himalayas and high-altitude areas with severe impacts on glaciers, the water source of 1.9 billion people.
- An integrated landscape approach, which considers social, ecological and environmental dimensions is a core aspect for regional cooperation. It also advocates NbS to address the emerging challenges, including climate change.
- Five broad approaches are used, namely: (i) ecosystem restoration and protection approaches; including protected area management. (ii) EbA, mitigation and disaster risk reduction; (iii) green infrastructure approaches; (iv) integrated resources management.
- The focus has been on capitalizing on niche mountain products for food and nutrient security and economic development; developing connectivity corridors and restoring critical ecosystems including rangeland and forests; institutional development; science-based decision-making; and providing a platform for policy dialogue and regional cooperation.
- Inclusive planning, both bottom-up and top-down dialogue, project ownership by stakeholders, and sustained programme interventions based on national and regional priorities are the basis of progress and success.
- Improving resilience in the HKH region is multidimensional and complex. The geopolitical sensitivity, differences in investment capacities for research and development, challenges to fighting poverty, inequality, food and nutrition insecurity, limited access to water and energy, along with degrading ecosystems, make regional cooperation important for improving resilience.

Impact

- Since the inception of the transboundary landscape programme in 2008, ICIMOD, has worked with its capable partnership network across the region to balance conservation and development, a main thrust of landscape management.
- The integrated and multidisciplinary framework has been instrumental for advancing resilience-building using NbS in the HKH region. The endorsement of

this framework by government agencies has been an important step in success for transboundary cooperation.

- The endorsement of regional documents developed through a consultative and participatory process has further legitimized the transboundary-level cooperation.

Costs and benefits

- The progress notes increased understanding of the dynamic of forests, rangelands, wetlands and agroecosystems in the identified landscapes.
- Collaboration, exchange of information, expertise and knowledge fulfils the common objective of conservation of biodiversity and enhancing the resilience capacity of the community as well as wildlife.
- Platforms have been created and made operational for policy-level dialogue with tangible outlook and planned interventions.

Stakeholder participation methodology

To implement the programme, three levels of engagement have been put into place. During the programme conception, formal consent and endorsement are received from government agencies. Once the approved, participatory planning with interdisciplinary experts, practitioners, implementing agencies and local communities are engaged. Implementation is initiated based on the strategic document prepared and approved by participating government agencies and through designated institutes and organizations.

Link

https://www.icimod.org/regional-programme/transboundary-landscapes/

Summary for the case study

Case Study 10: Protecting the Himalayan Icon of Rangeland through Transboundary Cooperation

Brief description

The Kangchenjunga Landscape Conservation and Development Initiative (KLCDI) is a transboundary initiative conceived to protect Mount Kangchenjunga, the world's third highest mountain. Specific areas of cooperation and intervention focus on yak rearing and the associated rangelands.

The culture and economy around yak rearing have connected people in adjacent parts of Bhutan, India and Nepal for centuries. The transboundary movement of herders among the highlands of the three countries is an age-old practice, important for the prosperity of herding communities and the vitality of their herds. However, evolving geopolitics, rapid development and climate change have affected pastoral practices by isolating herders and impacting traditional pastures. The programme has been focusing on: reviving a vanishing culture through rangeland management for better productivity of fodders; organizing festivals for awareness; genetic exchange of yak for population viability; diversifying yak-based products and market linkage; and linking yak and yak-herding communities with tourism for better income generation.

Details

Location: Kangchenjunga Landscape (Eastern Nepal, Sikkim and North Bengal, India and Western Bhutan)

Type of adaptation: Institutional

Scale: Municipal, Subnational, National, Subregional

Ecosystem/Landscape: Temperate Forests–sub-tropical

Funding Sources: Bi-/Multilateral donor, State-led, Individual/community-funded

Implementing agencies and partners: Ministry of Forest & Agriculture, Royal Government of Bhutan, Thimphu, Bhutan

Govind Ballab Pant National Institute of Himalayan Environment, Almora, India

Ministry of Forest and Environment, Government of Nepal, Kathmandu, Nepal

International Centre for Integrated Mountain Development, Kathmandu, Nepal

Research Centre for Applied Sciences and Technology, Kathmandu, Nepal

Timeline

January 2016

Implementing – end of first 5-year phase (2016–2020)

Lessons learned and best practices

The preparation phase during the inception, planning and implementation has been critical for the success of the work. This included:

- The KLCDI undertook initial rigorous interdisciplinary research, participatory planning across scales (local to global), multistakeholder consultation, as well as regional commitment for conservation and development outcomes that included the participating countries.
- A feasibility assessment process was undertaken, which was consolidated in a Conservation and Development Strategy and Regional Cooperation Framework (RCF). Yak was identified as one of the key components for regional cooperation.
- Following the endorsement by the respective governments, the implementation phase was initiated on five-year cycles between ICIMOD and the three States.
- During the implementation phase, a few areas of strategic focus were prioritized. First, the respective government agencies were sensitized on the state and urgency of interventions involving yak and its associated rangelands and age-old culture. This was followed by interactive dialogues among the policymakers, herders and the government.
- All stakeholders were onboard from day one of the project to ensure planning and understanding of the need-based issues, challenges and opportunities.
- It was important to have an integrated approach at landscape level and identify issues that need regional cooperation for biodiversity and human well-being.
- The limitations included: the younger generation were less interested in yak herding; products were not perceived as organic and healthy; and the area was considered less of a government priority given due to smaller population.
- ICIMOD has developed a long-term programme to revive this culture by strengthening networking, technology transfer and cross-learning opportunities as well as economic opportunities.

Impact

- The main objectives of the intervention were part of the larger landscape goal of sustaining ecosystem services and enhancing resilience. Yak has been one of the good success indicators.
- The programme enhanced rangeland productivity through the introduction of quality fodder plants in Bhutan; this was then scaled to the national level.
- The interventions on awareness-raising through festivals were also effective. So far, three festivals have been held in Nepal, two in Bhutan and the first one in Sikkim has been initiated but was delayed due to COVID-19.
- The programme convened key stakeholders from all eight countries of the Hindu Kush Himalayas and provided a platform for science, policy

and practices dialogue. Strengthening community institutions in Sikkim and the formation of national and regional networks for exchange of knowledge and good practices have been initiated.

- One of the major achievements is the transfer of yak bulls from Bhutan to Nepal and India (Sikkim) to revive the genetic exchange.
- Three major pillars of sustainability were evaluated - social, ecological and economic dimensions emphasizing social security of marginalized communities.
- With a focus on the rich tradition and culture, conservation interventions and rangeland heath for yak and its habitat, and finally linking it with product diversification and market for economic security, these interventions are seen as a resilience-building process for communities and the rangeland ecosystem.

Costs and benefits

- The Yak herding community live in one of the harshest environmental condition making their lives more exposure and sensitive. But they are still are the custodian of rangeland management, biodiversity conservation and international border patrolling.
- They also preserve the highland culture and safeguard the water tower of Asia made up of reservoirs of fresh water with snow, glaciers and permafrost.
- The economic opportunity is providing adaptive capacity and less exposure to vulnerability. With strong policy support and priority given by the governments, the benefits seem to be promising and sustainable.

Stakeholder participation methodology

The stakeholders were engaged at three levels:

Science – Academic institutions and professionals were involved through organizing seminars and literature reviews to understand the state of knowledge, gaps and potential areas for interventions.

Policy – Policymakers at the local, subnational and national levels were engaged in dialogue and cross-learning processes to understand the challenges and opportunities.

Practice – The ground-level practitioners, implementing agencies and local communities were made accountable for interventions on the ground.

Link

https://www.icimod.org/initiative/klcdi/

Summary of the case study

Case Study 11: Enhancing Climate Change Resilience of Rural Communities Living in Protected Areas of Cambodia

Brief description

The main approaches of the project are to reforest natural land to regulate soil waterflow; create patrols to halt illegal logging; establish 'home-gardens' with irrigation to diversify sources of food and income; supply pumping wells and rain harvesting tankers to boost the availability of water; and develop early warning climate systems to inform farmers' planting decisions.

Details

Location: 5 community protected areas, which are contained within 4 provinces: Siem Reap Province; Mondulkiri Province; Preah Vihear Province; and Kompong Thom Province

Type of adaptation: Structural / physical, Social, Institutional

Ecosystem/Landscape: Forests

Scale: Municipal, Subnational

Funding Sources: Bi-/Multilateral donor, State-led, Grassroots

Implementing agencies and partners: Implementing agency: Ministry of Environment, Government of Cambodia

Ministry of Agriculture, Forestry and Fisheries; Ministry of Water Resources and Meteorology; Ministry of Land Management, Urban Planning and Construction; Department of Research and Community Protected Area Development of the General Department of Administration for Nature Conservation and Protection

Project factsheet

Climate vulnerability

Climate change is producing erratic rainfall in Cambodia, where dry seasons are getting drier and wet seasons wetter, causing devastating floods and droughts. The effects include increased erosion on farms, crop failures from droughts and damaged infrastructure, which affects rural markets. Only 19.5% of cultivated land in Cambodia benefits from irrigation, so the agricultural sector is dependent on rainfall. To counter the fall in agricultural yields, communities rely on illegal logging in protected forests to supplement food and income, whether through fuelwood or charcoal. These decimated forests once provided both climate and soil water regulation in the agriculturally vital Mekong River Basin. With more than 80% of the population relying on agriculture for their livelihood, the risks are high.

Timeline

Post-project lifetime will be sustained as many of the project activities have been implemented by community members.

Lessons learned and best practices

Lessons learned regarding stakeholder participation:

- Listening and responding to local villagers regarding project design ideas goes a long way to reducing suspicion among local community members about the effectiveness of large, donor-funded projects. Their perception in some cases is that the money is not often used for the intended beneficiaries. The project management unit mitigated this challenge by spending more time in the field, coaching villagers on new techniques and giving justification and proof that the new ways will work. Through TV broadcasts, posters, radio, camping events, school visits and events at road rest areas, there has been active awareness-raising of climate change resilience practices.

Weakness in implementation and lessons learned:

- The project has faced challenges in motivating communities to start their own businesses, especially diversifying into new business areas (such as ecotourism). However, the establishment of the microfinancing schemes (a revolving loan from ACELDA Bank) in all five community protected areas (CPA) have proved a success. Within one CPA (Ronouk Khgneng CPA), 91 out of 95 families have joined the microfinancing MSG scheme. The scheme "snowballed" once families could see the benefits. This is deemed a powerful success given the social educational challenges faced by the project.
- A savings management team has also been selected among CPA committee members to help manage day-to-day revolving savings.

Impact

Innovative aspects of the project:

- Integrate an adaptation model to address drivers of climate change vulnerability.
- Support the sustainability of livelihoods and scaling through savings schemes, training on financial management and business plans.

- Awareness creation on climate change resilience practices at the constructed road rest areas.
- Focus on monitoring to support scaling, involving MSc students.

Indicators of adaptation effectiveness used:

- Economic assessment reports developed for the project, through a participatory approach with local communities, where relevant.
- Number of community members within the project protected areas, disaggregated by gender and trained on climate change and eco-agriculture.
- Number of intensified/diversified home gardens established at the target CPAs.
- Number, type and sector of policy revisions to address climate change risks.

Costs and benefits

- The forest restoration was carried out using multi-use native tree species that provide food, erosion control, timber, medicine and fruit. The project also planted trees alongside 2,200 hectares of rice paddies to reduce erosion and enhance soil productivity.
- Rice harvests were improved with drought-tolerant seeds (benefiting 872 families). The project set up households and schools with training to create home gardens of vegetables (benefiting 1,193 families).
- The project trained 500 households (~5 people per house) in sustainable income-generating strategies such as chicken-raising, cricket-raising, ecotourism and selling vegetables.
- Climate forecasts were used to inform and adjust planting schedules. The project aimed for a 20% decrease in the climate change vulnerability index at all project sites, covering a total population of 9,271 people.
- 80% of the 1,900 households in the project sites report an improvement in access to water. Rainwater harvesting tankers and pumping wells were built to improve water security.

Stakeholder participation methodology

The Project Steering Committee facilitated stakeholder engagement including government ministries, civil society, provincial, commune and district officers, and local agriculturalists, foresters and householders. It also involves commune council members in field activities, community committees and the Ministry of Environment throughout the project. The project connected with local beneficiaries in large part through its collaboration during the baseline assessment phase and interacted with local communities through its awareness-building and vulnerability assessment trainings activities, and so.

Link

https://www.unep.org/explore-topics/climate-change/what-we-do/climate-adaptation/ecosystem-based-adaptation/ecosystem-4

Summary of the case study

Case study 12: Large-scale Ecosystem-based Adaptation in the Gambia: Developing a climate-resilient, natural resource-based economy

Brief description

Through this project, 10,400 hectares of degraded forests, savannah and mangroves will be rehabilitated and 3,000 hectares of farmlands will be restored. The project aims to establish ecologically sustainable businesses; develop 'home-gardens' to diversify food and income sources; and integrate adaptation actions into sectoral policies. The project is funded by a grant from the GCF, along with contributions from the Gambian government.

Details

Location: The Lower River Region, Upper River Region, Central River Region North and Central River Region, South Gambia

Type of adaptation: Structural/physical, Social, Institutional

Ecosystem/Landscape: Grasslands, Forests, Mangroves

Scale: Municipal, Subnational, National

Funding Sources: Bi-/Multilateral donor GCF Grant

Implementing agencies and partners: Executing Entity – ministerial level: Ministry of Environment, Climate Change, Water, Forests and Wildlife

Executing Entity – departmental level: Departments of Forestry and Parks and Wildlife Management

PROJECT PARTNERS:

Ministry of Finance and Economic Affairs, Ministry of Agriculture, Social Development Fund, Gambia Chamber of Commerce and Industry, Department of Community Development, National Environment Agency

Project factsheet

Climate vulnerability

One-third of its total land area is below 10 metres above sea-level, and 10–20% of its land is seasonably or diurnally flooded, which makes the Gambian population of 2.1 million extremely vulnerable to climate change and rising seas. Climate projections point to more erratic rainfall, and droughts and floods have already been intensifying, causing crop yields to fall in many areas. The agricultural sector is threatened because it is heavily rain-dependent and employs 44% of the country's workforce, providing two-thirds of household income. Climate predictions for West Africa in 2020 suggest possible reductions of yields by 50% from rainfed agriculture. The risk is compounded because falling crop yields are forcing rural households to extract resources unsustainably from forest ecosystems, which degrades ecosystem services. Forest cover in Gambia has shrunk from 80% in the 1940s to around 42% in 2001.

Timeline

2017–2023

Ongoing

The project activities seek to support natural resource-based businesses, which can benefit the community in the long term. The project expects to raise $11.3 million over 20 years for the National Forest Fund from taxes and licensing fees.

Lessons learned and best practices

- The project engages communities in planning and designing activities for sustainable management of natural resources. This process will result in an analysis of the constraints, opportunities and commercial viability of all community-based businesses to be supported by the GCF project.
- The development of the EbA protocols during the project implementation phase will include an emphasis on integrating knowledge – including scientific and traditional knowledge.
- The design of the project's EbA interventions will be led by a technical team who will review and analyse information to make informed decisions.

Impact

- The project uses large-scale EbA to promote climate-resilient sustainable development: a) by restoring degraded forests and agricultural landscapes with climate-resilient plant species that provide goods for consumption or sale, and b) by facilitating the establishment of natural resource based businesses and management committees to manage the Gambian natural resource base in a sustainable manner.

- The economic value of the natural capital created by the GCF project's EbA investments will be the main incentive for communities to continue investing in the Gambia's natural resource base, rather than reverting to over-extraction of natural resources after the project has ended.
- Knowledge on implementing and monitoring large-scale EbA to support natural resource-based businesses will be generated and disseminated throughout the country, along with capacity development of the Government of the Gambia for large-scale implementation to mainstream EbA into policies, plans and processes.
- During the implementation phase an analyses of the potential EbA interventions are to be undertaken at each site to consider the cost-effectiveness and potential return on investment and ensure that all EbA interventions are implemented to detailed protocols for different landscapes. Local communities and regional extension officers will be trained in the implementation of EbA with opportunities to increase cost-effectiveness through capacity development, information and infrastructure.

Costs and benefits

- Increasing cash income of 11,550 households by at least $330 per year in a country where 60% of the population live below the overall poverty line.
- Rehabilitating 10,400 hectares of degraded forest, savannah and mangroves, and an additional 3,000 hectares of farmland.
- From 2017-2019, million mangrove propagules were planted, protecting coastal villages from storm surges and supporting habitat for fish species.
- Establishing 166 sustainable natural resource-based businesses with a cumulative gross cash return of $2.46 million.

Stakeholder participation methodology

The consultations in the project preparation involved multiple national, regional and local stakeholders from relevant ministries, departments, CBOs and NGOs (e.g., GCCI, SDF, FAO). Representatives were consulted to gather information on, inter alia, the baseline, project interventions and sites, implementation arrangements, sustainability, financing and potential risks.

Working group meetings were undertaken with CBOs and community members in four regions (Western, Lower River, Central River and Upper River). CBOs consulted during these working group meetings included Community Forestry Committees, Community Protected Area Committees, Village Development Committees and Women's Village Development Groups.

Link

https://www.unep.org/explore-topics/climate-change/what-we-do/climate-adaptation/ecosystem-based-adaptation/ecosystem-16

Summary of the case study

Case Study 13: Enhancing the Resilience of Communities Living in Climate Change Vulnerable Areas of the Sudan Using Ecosystem-Based Approaches to Adaptation

Brief description

The project is restoring degraded ecosystems such as rangelands, forests and riparian zones. The reforestation is prioritizing native species that generate multiple goods and services for local families, and that are resilient to climate change. The project is creating shelter belts on 10% of all cultivated areas in the project sites. A major component is to teach local communities how to adopt alternative climate-resilient livelihoods, and provide technology and funding to do so. The project is distributing gas cookstoves and sustainable building materials to reduce tree cutting. In arid areas, a family has been estimated to use about 52 trees per

year. A revolving funds scheme is being established to support the purchase of inputs for adaptation, including animal feed supplements, drought-tolerant seeds, and solar pumps for wells.

Details

Location: Four localities on the western side of the White Nile River in the Sudan

Type of adaptation: Structural/physical, Social, Institutional

Ecosystem/Landscape: Grasslands

Scale: Municipal, Subnational

Funding Sources: Bi-/Multilateral

Implementing agencies and partners: Higher Council on the Environment and Natural Resources, Republic of Sudan

National Ministry of Agriculture; National Ministry of Animal Resources; National Ministry of Gender; State Ministry of Agriculture; State Range and Pasture Administration; State Ministry of Animal Resources; White Nile State's Women's Union; Range and Pasture Administration; National Forest Corporation; UNDP; IFAD

Project factsheet
UNEP Sudan

Climate vulnerability

Climate impacts in the Nile state have impacted crop productivity, land degradation, grazing potential, resulting in loss of livestock and increased migration of people in search of jobs. The Sahara desert is advancing at a rate of about one mile a year, eliminating grazing land and waterholes. The ability to deal with the problem is inhibited by poverty and a rapidly growing population.

Timeline

The post-project lifetime will be as many of the project activities have been implemented by community members who have more ownership for sustaining the EbA activities even after project completion.

Lessons learned and best practices

Best Practices include:

- Empowering local communities to actively participate in decision making process during planning, implementation, management and upscaling of community-based EbA measures
- Establishment of community structures in 39 villages to manage, monitor and evaluate measures and build capacity of local community to implement climate resilient land management practices.
- Multi-disciplinary White Nile State technical committee has been trained to plan, implement, and upscale project activities in the Sudan to raise awareness and hold cross-sectoral dialogues across national agencies.

Weakness:

- Although stakeholder engagement has had tremendous benefits, reaching a consensus among diverse range of stakeholders is proving to be time-consuming, leading to delays in implementation.
- The project has faced implementation challenges due to a lack of institutional capacity and coordination for EbA.
- There have been conflicts between farmers and pastoralists due competition over natural resources brought about by non-transparent and unequitable land resource allocation. This risk has been mitigated by ensuring that participatory land-use planning is used.

Impact

Following outcome indicators are measured to assess the effectiveness:

- Percentage of targeted households that have adopted EbA measures that improve access to climate change resilient food/water sources for improved agricultural productivity.

- Percentage of targeted households that have adopted EbA measures to improve access to climate change resilient food / water sources and improved ecosystem services
- Number of lessons learned, demonstrations of intervention cost effectiveness and upscaling strategies on EbA integrated into the existing Cloud database.

Costs and benefits

- Regenerating 6600 hectares of rangeland with climate-resilient species, which will benefit 6800 households. Revolving funds will be set up for 480 people to purchase inputs for adaptation, like drought-tolerant seeds.
- Training 1600 women on 'backyard gardening' to diversify their sources of income. Development plans will be revised to mainstream gender-sensitive adaptation.
- Installing 200 rainwater harvesting pits on community farms, and building/ restoring 10 water reservoirs with wells, giving 3,200 people better water access.
- Planting 1,500 hectares of forests with climate-resilient trees, establishing community-led tree nurseries, and promoting alternative building materials and efficient cookstoves to reduce unsustainable tree felling.
- To reduce tree felling in the targeted localities, 3,150 households have been trained in the use of and supplied with improved cookstoves ('badhia') that burn biomass fuel in a cleaner and more efficient manner.
- 2,000 community farms (4 hectares each) are being developed with climate-resilient land management practices using drought-tolerant fruits and vegetables and integrated pest management.

Stakeholder participation methodology

- Extensive stakeholder engagement by various federal and White Nile State government agencies, private sector institutions, civil society organizations, multilateral development organizations and village development committees and subcommittees, among others.
- Stakeholder consultations have provided an opportunity to initiate efforts to spearhead integration of EbA across sectors, promote programmatic synergies at the State level, build partnerships, collaboration and networks with a diverse range of institutions and service providers that are playing a critical role during the planning and implementation of project activities.

Link

https://www.unep.org/explore-topics/climate-change/what-we-do/climate-adaptation/ecosystem-based-adaptation/ecosystem-12

Summary of the case study

Case Study 14: Developing Core Capacity to Address Adaptation to Climate Change in Productive Coastal Zones

Brief description

The approaches used by the project include building and upgrading seawalls, relocating aquifers from rising seas, and restoring mangrove forests to protect coastal communities from floods. Seawalls and groynes have been built along Tanzania's coast to stop the shores from eroding. The restoration was carried out using locally available, climate-resilient species. No-take zones were established with a goal of reducing deforestation by 40% in the restored sites. A network of 87 community groups was established in the project areas to manage the mangrove sites.

Details

Location: Four districts in Tanzania: Pangani, Bagamoyo, Rufiji and Zanzibar

Type of adaptation: Structural/physical, Social, Institutional

Ecosystem/Landscape: Grasslands, Forests, Mangroves

Scale: Municipal, Subnational, National

Funding Sources: Bi-/Multilateral donor

Implementing partners and agencies: Government of Tanzania Vice President's Office, Division of Environment

Rufiji, Pangani and Bagamoyo District Councils; Zanzibar Administration; University of Dar es Salaam and NGOs Network/ Consortium; Ministry of Water; Ministry of Works; Dar es Salaam City Council.

Project factsheet

Climate vulnerability

Tanzania's coasts face degraded natural ecosystems, damaged wells with saltwater and wrecked infrastructure due to sea level rise. The predicted increases in cyclones and sea level will also lead to coastal erosion and the submergence of small islands and human settlements. Studies have estimated sea-level rise in Tanzania will be between 0.5 and 1.4 feet by 2050, and the costs are projected to be $200 million per year, and in Dar es Salaam alone, $5.3 billion in public and private assets are at risk from flooding. The degradation of coral and mangrove habitats is further compounded by the unsustainable use of natural resources by local communities.

Time of initiation/ implementation

2012–2017 implemented

Ongoing

The post-project lifetime will be extended as the engagement of stakeholders has developed capacity to conduct EbA activities

Lessons learned and best practices

- For natural systems such as mangrove forests, the risk that communities will resume their unsustainable deforestation or harvesting practices is low given their agreement to manage no-take zones in a participatory way. To mitigate this risk, support was provided to create and maintain local enforcement systems for no-take zones within mangroves. The demonstration of benefits from mangroves is expected to create additional incentives for communities to sustainably manage natural systems.
- For manmade protective systems such as sea walls, dikes and spillways, the risk to sustainability arises from potential lack of maintenance. Maintenance works are the local administrations' responsibility and financed from district-level budgets. It is expected that district training on vulnerability will assist local administrations in identifying budgeted maintenance of rehabilitated works.

Impact

Following outcome indicators were measured to assess the project effectiveness:

- Increased local level capacities and knowledge to analyse the threats and impacts of climate change.
- Enhanced government and public engagement in adaptation activities
- Reduced vulnerability to climate change in the coastal zones through adaptation interventions and pilot innovations.

Costs and benefits

- 476 metres of seawall in Pangani have been raised and reshaped and 200 metres constructed; and about 500 metres of groynes constructed along 538 metres at Kilimani.

- At least 17 wells and 6 community rainwater-harvesting devices were established.
- At least 100 people were trained in coastal and climate vulnerability mapping.
- 10 boreholes and 15,000 litres of storage tanks were installed, benefiting over 5,400 people in Bagamoyo District, with a 20% increase in year-round water availability at project sites.
- 1 sustainable mangrove protection plan developed by area
- Rehabilitated around 1,000 hectares of mangrove habitat in Rufiji District, benefiting 31,500 people.
- Installed rainwater harvesting devices to achieve at least 20% increases in year-round water availability for local communities. The relocation of wells and construction of rainwater harvesting devices benefited over 5,400 people in Bagamoyo District alone.
- Twenty-seven master's students undertook research on themes that relate to the two projects.

Stakeholder participatory methodology

- Stakeholders engaged in planning on-the-ground activities including site selections, an environmental impact assessment and awareness-raising. Communities participated in mangrove planting. Some community members were also employed as casual labourers in the construction of infrastructures (sea walls, boreholes and rainwater harvesting systems).
- Post-project, communities are participating in infrastructure and mangroves management.
- Academic and research institutions such as the University of Dar es Salaam and the Institute of Marine Sciences were engaged in capacity-building and project technical support as consultants. Students participated as interns and undertook research in the project areas. FORUMCC, an NGO network partner raised awareness on climate change among communities, creating CBO networks on climate change.
- At least 100 local communities members were trained on: i) water conservation, management and recycling; ii) maintenance of wells and rainwater harvesting devices. One model and five maps were developed with the participation of local government representatives trained in coastal modelling.
- Engaged stakeholders built their capacity to conduct EbA activities, particularly NGOs and management groups.

Link

https://www.unep.org/explore-topics/climate-change/what-we-do/climate-adaptation/ecosystem-based-adaptation/ecosystem-13

Summary of the case study

Case study 15: EbA through Forest Landscape Restoration in Burkina Faso

Brief description

In the early 2000s, the Ouagadougou-based NGO Tiipaalga, began working with smallholder farmers in central Burkina Faso to restore plots of previously cultivated land. After more than a decade of work, this assisted natural regeneration of tree resources is assisting natural regeneration to increase availability of forest and agricultural products, and biodiversity. At a household level, about 3 hectares of degraded land (mostly land that used to be cultivated) is enclosed to allow the natural regeneration of woody and herbaceous.

Details

Location: Central Burkina Faso

Type of adaptation: Social, Institutional

Ecosystem/Landscape: Grasslands, Forests, Mangroves Dry forests/Savanah woodlands

Scale: Local

Funding Sources: Bi-/Multilateral donor Project implementation funded through the Fond Français pour l'environnement Mondial (FFEM)

Implementing agencies and partners:
The NGO Tiipaalga (local NGO)

CIFOR supported with research at the sites to assess food security and gender co-benefits and to upscale the initiative to other regions in Burkina Faso

Timeline

First initiative in 2000 (still ongoing)

Lessons learned and best practices

- Restore forests provided safety nets during months when grain is in short supply and during years of intense drought in two ways: direct consumption of edible wild products and income.
- The results show the crucial importance of non-timber forest products (NTFPs) as a safety net for households in periods of low food availability. During this period, food security relies on the progressive availability of NTFPs for food. For instance, nuts of Vitellaria paradoxa and leaves of Bombax costatum, Moringa oleifera and Adansonia digitata, are harvested from May to September. Fruits of Parkia biglobosa, Saba senegalensis and Lannea microcarpa are harvested in May and June.
- The study results show that most products used for direct consumption are harvested by women. This is an important finding showing the link between gender, food security and EbA. Women are largely responsible for securing food for the whole household, particularly for children and the elderly. The restoration areas provide a safety net for the most vulnerable.

Impact

- The majority of interviewed households living around restored forests in three provinces of central Burkina Faso consider restored land to be of high importance for food availability.
- When interviewed, the majority of households said they recognize that the restored plots play a strong role in providing ecosystem services, such as conserving water and preventing erosion.

Costs and benefits

Several social co-benefits emerged from this initiative:

- Gender-enhanced adaptive capacity
- Food security and nutrition
- Diversification of livelihoods.

Stakeholder participation methodology

The stakeholder engagement is collaborative. Project staff provide capacity-building and act as facilitators to engage the community and other stakeholders through formal workshops, peer learning exchanges in the field, regular stakeholder meetings and the co-design of project activities. The project also incorporates local/indigenous knowledge and practices.

Link

https://www.tiipaalga.org/portrait.html

Summary of the case study

Case Study 16: Blue-Green Protectors Programme – SLYCAN Trust

Brief description

This project addresses climate change impacts, developmental needs and resilience through holistic risk management processes with engagement of vulnerable communities to build their economic

resilience, livelihood development and economic diversification. The project looks into participatory and multi-actor partnerships for decision-making to conserve forest ecosystems and address climate risks, through private-public-CSO partnerships.

The knowledge-management and policy-related interventions include national-level conservation actions as well as regional and international level activities. The present phase of the programme is titled: Programme Addressing Climate Change and Uplifting Marginalized Coastal Communities through Mangrove Forest Conservation.

Details

Location: Gampaha, Puttalam, Jaffna and Mannar Districts for conservation efforts, and national level in Sri Lanka for policy internationals

Type of adaptation: Social

Scale: Subnational, National

Ecosystem/Landscape: Mangroves

Funding Sources: Private sector funding: Mistubishi Corportation

CSO funding: Drowning Islands and SLYCAN Trust

Implementing agencies and partners: SLYCAN Trust

Marine Environment Protection Authority of Government of Sri Lanka

Municipal Council of Wattala, Sri Lanka

Climate vulnerability

Protection against coastal erosion, floods and storm surges; dependence of coastal communities on climate-sensitive livelihoods; vulnerability of coastal areas to sea level rise; altered precipitation patterns; and other impacts of climate change.

Timeline

First initiative in 2000 (still ongoing)

Lessons learned and best practices

Inclusive and participatory actions contribute to scaling up conservation efforts:

- Economic and livelihood-related incentives motivate communities to engage in long-term conservation planning and implementation.
- The diverse multi-actor partnerships contributed to replicating the programme efforts initiated in 2018 to different sites, with improved and scaled-up adaptation and conservation actions.
- With the engagement of communities and other interested actors it is possible to develop long-term actions, as opposed to one-off restoration actions across climate change, sustainable development, biodiversity and forestry conservation.
- Private-public-CSO actions contribute to scaling up investments for conservation efforts. The programme is an example of merged finance, which includes financial support from the private sector, the public sector and CSOs.
- Evidence-based policy interventions and knowledge-sharing efforts contribute to successful national- and local-level intervention.

Impacts

- Contributed to livelihood development activities, nursery development and ecotourism to over 6,000 direct beneficiaries, with 200,000 indirect beneficiaries through awareness-raising, youth and national-level workshops.
- Conserved or restored more than 30 hectares of mangroves providing between $400,000 and $684,000 worth of ecosystem services per year.

- Contributed to biodiversity conservation through adaptation and conservation actions through biodiversity assessments.
- Lessons learned shared with a regional and global stakeholder audience, and UNFCCC-related activities.
- Successfully contributed to national processes such as the NDC review process of Sri Lanka and local waste management planning processes.

Costs and benefits

- Increased the cost–benefit of climate finance investments, which build resilience of communities.
- Multi-fold activities and outcomes included evidence-based research interlinked with multiple sectors.
- Engagement with government entities with local actors and communities from the initial stage of the project provided the opportunity to build trust among the multiple stakeholders and contributed to effective action, preventing the duplication of actions by parties.
- Engagement of youth and women in the project activities at local level.
- Based on the assessments and research conducted, the activities were successful in documenting the biodiversity of the sites. Certain sites were discovered to be of high importance, which could lead to an ecotourism focus.

Stakeholder participation methodology

- Included small group consultations with communities and key stakeholders for research and activity planning, consultations for decision-making processes, and identifying key interventions.
- The stakeholder engagement was also inclusive to capacity-building and awareness-raising, where the activities focused on all actors to enhance awareness of conservation and adaptation actions and other themes.
- Knowledge-sharing activities involved regional and international bodies, such as the UNFCCC, including the Nairobi Work Programme, in disseminating knowledge and good practices.
- Allowed youth to share experiences at the Global Youth Forum on Climate Change, which featured different project proposals by youth on biodiversity and forestry conservation.

Link

https://www.slycantrust.org/post/blue-green-protectors-mangrove-restoration-in-sri-lanka

Summary of the case study

ANNEX V: KEY TERMS

Term / Definition and Source

Adaptation to climate change:

The process of adjustment to actual or expected climate and its effects. In human systems, adaptation seeks to moderate harm or exploit beneficial opportunities. In natural systems, human intervention may facilitate adjustment to expected climate and its effects (IPCC AR5)

Adaptive capacity:

The combination of the strengths, attributes and resources available to an individual, community, society or organization that can be used to prepare for and undertake actions to reduce adverse impacts, moderate harm, or exploit beneficial opportunities (IPCC)

Biological diversity:

The variability among living organisms from all sources including, inter alia, terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part; this includes diversity within species, between species and of ecosystems

Climate extreme:

The occurrence of a value of a weather or climate variable above (or below) a threshold value near the upper (or lower) ends of the range of observed values of the variable (IPCC)

Community-based adaptation:

A community-led process, based on communities' priorities, needs, knowledge and capacities, which should empower people to plan for and cope with the impacts of climate change (IIED)

Drivers of change:

Factors that, directly or indirectly, cause changes in nature, anthropogenic assets, nature's contributions to people and a good quality of life (IPBES)

Ecosystem approach:

Strategy for the integrated management of land, water and living resources that promotes conservation and sustainable use in an equitable way (CBD)

Ecosystem-based adaptation:

Incorporates biodiversity and ecosystem services into an overall adaptation strategy to help people to adapt to the adverse effects of climate change (CBD)

Ecosystem-based disaster risk reduction:

Sustainable management, conservation and restoration of ecosystems to reduce disaster risk, with the aim to achieve sustainable and resilient development (Estrella and Saalismaa 2013)

Ecosystem function:

The flow of energy and materials through the biotic and abiotic components of an ecosystem. It includes many processes such as biomass production, trophic transfer through plants and animals, nutrient cycling, water dynamics and heat transfer (IPBES)

Ecosystem health:

Ecosystem health is a metaphor used to describe the condition of an ecosystem, by analogy with human health. The apparent health status of an ecosystem can vary, depending upon which metrics are

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References and Annexes

employed in judging it, and which societal aspirations are driving the assessment (IPBES)

Ecosystem services:

The benefits people obtain from ecosystems: provisioning services, such as supply of food, fibre, timber and water; regulating services, such as carbon sequestration, climate regulation, water regulation and filtration, and pest control; cultural services, such as recreational experiences, education and spiritual enrichment; and supporting services, such as seed dispersal and soil formation (Millennium Ecosystem Assessment 2005)

Forest:

Definitions of forests vary among countries, depending on the ecoregion and forest types. For specific accounting purposes under the Kyoto Protocol (and not generally applicable under the UNFCCC or Paris Agreement), a forest is a minimum area of land of 0.05–1.0 hectares with tree crown cover (or equivalent stocking level) of more than 10-30% with trees with the potential to reach a minimum height of 2–5 meters at maturity in situ (UNFCCC 2001)

Gender mainstreaming:

A globally recognized strategy for making women's as well as men's concerns and experiences an integral dimension of the design, implementation, monitoring and evaluation of policies and programmes in all political, economic and societal spheres

Governance:

A comprehensive and inclusive concept of the full range of means for deciding, managing, implementing and monitoring policies and measures. Whereas government is defined strictly in terms of the nation-state, the more inclusive concept of governance recognizes the contributions of various levels of government and the contributing roles of the private sector, of nongovernmental actors and of civil society (IPCC SR15)

Incremental adaptation:

Refers to actions where the central aim is to maintain the essence and integrity of the existing technological, institutional, governance and value systems, such as through adjustments to cropping systems via new varieties, changing planting times or using more efficient irrigation

Integrated water resource management:

A process that promotes the coordinated development and management of water, land, and related resources in order to maximize the resultant economic and social welfare in an equitable manner without compromising the sustainability of vital ecosystems (GWP 2000)

Least developed country:

A country that exhibits the lowest indicators of socioeconomic development, with the lowest Human Development Index ratings of all countries in the world.

Mitigation (of climate change):

A human intervention to reduce the sources or enhance the sinks of greenhouse gases (IPCC)

Monitoring:

Systematically collecting and documenting data on specified indicators with the aim of tracking change. This enables planners and practitioners to improve adaptation efforts by adjusting processes and targets, and can be carried out during implementation throughout the lifetime of the adaptation/ risk reduction intervention (UNFCCC)

Nature-based solutions:

Actions to protect, sustainably manage and restore natural or modified ecosystems. They address societal challenges (e.g. climate change, food and water security, natural disasters) effectively and adaptively, while simultaneously providing human well-being and biodiversity benefits (IUCN)

Resilience:

The ability of a system and its component parts to anticipate, absorb, accommodate or recover from the effects of a hazardous event in a timely and efficient manner, including through ensuring the preservation, restoration or improvement of its essential basic structures and functions (IPCC)

Social-ecological system:

A coupled system of humans and nature that constitutes a complex adaptive system with ecological and social components that interact dynamically through various feedbacks (Stockholm Resilience Centre)

Transformational adaptation:

Seeks to change the fundamental attributes of systems in response to actual or expected climate and its effects, often at a scale and ambition greater than incremental activities. It includes changes in activities, such as changing livelihoods from cropping to livestock or by migrating to take up a livelihood elsewhere, and also changes our perceptions and paradigms about the nature of climate change, adaptation and their relationship to other natural and human systems (IPCC AR5)

Vulnerability:

The propensity or predisposition to be adversely affected. Vulnerability encompasses a variety of concepts including sensitivity or susceptibility to harm and lack of capacity to cope and adapt (IPCC AR5)

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