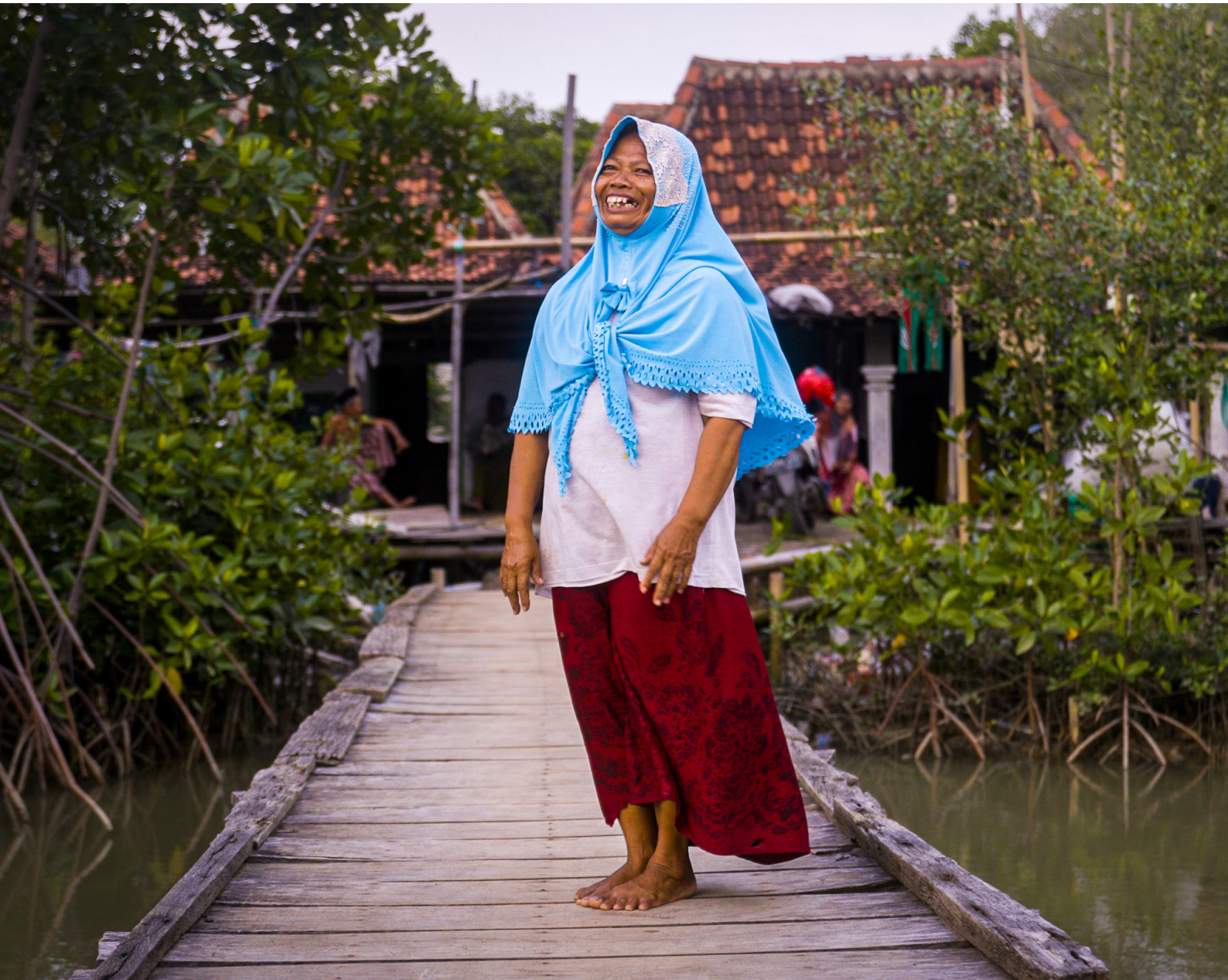
POLICY BRIEF

A Decade of Ecosystem-based Adaptation

Lessons from the United Nations Environment Programme



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Cover photo:
Sifatul Khoiriyah of Timbulsloko village is actively involved in the Building With Nature Indonesia initiative, championing mangrove restoration as a climate adaptation solution. For its achievements, the initiative has been recognized as a UN World Restoration Flagship. Credit: UNEP/Nathanial Brown.

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UN environment programme

GLOBAL ADAPTATION NETWORK

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1 INTRODUCTION

Over the past decade, the United Nations Environment Programme (UNEP) has embraced Ecosystem-based Adaptation (EbA) in supporting climate change response projects across the world. The adoption by UNEP of the EbA approach as a core element of climate change response has enhanced long-term adaptive capacity in communities, improved livelihoods, reduced climate risks and improved the health of ecosystems. This briefing note summarises the key lessons from UNEP's experiences across multiple countries and ecosystems over the past ten years.

Why Adopt an Ecosystem-based Approach to Adaptation?

Ecosystems provide a range of valuable services globally that are essential for human well-being, including regulating climate, providing food and water, and supporting livelihoods. By conserving and restoring ecosystems, such as forests, wetlands, and coastal areas, communities can enhance their resilience to climate impacts. EbA involves the conservation, sustainable management, and restoration of ecosystems as part of an overall strategy to reduce vulnerability and increase the resilience of people and ecosystems to the effects of climate change (UNEP 2019). In addition, EbA can play an integral role in disaster risk management for communities, particularly the poor and women, who are most vulnerable to the impacts of climate change, such as severe and extreme weather events (Nellemann et al. 2011; UNEP 2019a).

An ecosystem-based approach to adaptation offers numerous co-benefits beyond climate resilience. For instance, conserving biodiversity and restoring natural habitats can enhance local biodiversity, protect endangered species, and maintain ecosystem services that support agriculture, fisheries, and tourism (UNEP 2022a). Moreover, investing in ecosystem-based adaptation strategies often proves to be more cost-effective and sustainable in the long term compared to traditional infrastructure-based approaches.

Examples of EbA include restoring and managing coastal ecosystems to protect shorelines and human settlements from storm surges; controlling invasive alien species to protect water and food security and reduce land degradation and the impacts of wildfires; conserving, managing, and restoring ecosystems to help protect existing infrastructure (for example, stormwater management systems, roads, and bridges); and restoring water catchments to control water flows and prevent floods and landslides.

UNEP & Ecosystem-based Adaptation

The EbA definition was adopted into the multilateral Convention on Biological Diversity in 2010. Since then, UNEP has been mandated to support the worldwide development and implementation of EbA (UNEP 2019b; UNEP 2021a). In 2014, the United Nations Environment Assembly adopted Resolution 1/8, which encouraged countries to include EbA in their policies and requested that UNEP partner with governments and other stakeholders to develop and implement EbA programmes (UNEP 2021a). Furthermore, through its 2022-2025 Medium-Term Strategy, UNEP has committed to "supporting country and stakeholder emission cuts and adaptation to climate change to facilitate stronger interactions between science, policy, finance, technology and the economy" (UNEP 2021b).

To achieve these commitments, UNEP has developed a range of EbA resources to assist countries and communities in planning and implementing EbA interventions. For example, through the National Adaptation Plan Global Support Programme (NAP-GSP), UNEP was tasked with developing supplementary guidelines detailing a process for countries to incorporate EbA into their National Adaptation Plans (NAP). UNEP has also developed several EbA-related toolkits, videos, and other resources to assist EbA practitioners.

Since 2010, UNEP has also worked directly with decision-makers and implementers in more than 30 countries to develop knowledge on how EbA can contribute to countries' adaptation efforts and assist vulnerable communities as they implement EbA measures. With funding primarily from the Global Environment Facility (GEF), the Adaptation Fund and the Green Climate Fund (GCF), UNEP has supported at more than 50 EbA projects across Africa, Asia-Pacific, Latin America and the Caribbean, and Europe (UNEP 2019b). Combined, these EbA projects are aiming to restore 131,000 hectares of ecosystems while benefiting around 2.7 million people.

Over the past ten years, UNEP's approach to EbA implementation has evolved and adapted, with lessons incorporated into new EbA projects. This policy brief summarises several of these key lessons learned using a case study approach. The five case studies presented in this brief cut across different ecosystems, regions, and scales. For each case study, specific lessons are highlighted to illustrate commonalities typically occurring across multiple projects and regions that have, and continue to provide, invaluable insights for UNEP in planning and implementing adaptation projects.

2 NEPAL CASE STUDY: ECOSYSTEM-BASED ADAPTATION IN FORESTS & RANGELANDS

Context

The *Catalysing Ecosystem Restoration for Climate Resilient Natural Capital and Rural Livelihoods in Degraded Forests and Rangelands of Nepal* project is being undertaken in Nepal, a mountainous, landlocked country in central Asia. The project aims to reduce the vulnerability and build the resilience of people living in rural parts of Nepal through EbA including the restoration of degraded forests and rangelands in Nepal's high mountain and mid-hills areas. The results of the ecosystem restoration include promoting groundwater recharge, improving soil quality, reducing flooding and landslides, reducing the urban 'heat island' effect and increasing food and water security. The project specifically focuses on building capacity in government and communities to use EbA as an integrated approach to address current and future climate risks (UNEP 2022a).

The project consisted of the following three components:

1. INCREASING THE CAPACITY OF GOVERNMENT OFFICIALS AND LOCAL USER GROUPS TO IMPLEMENT EBA
2. USING NATIONAL POLICIES AND STRATEGIES STRENGTHENED TO PROMOTE EBA IMPLEMENTATION
3. IMPLEMENTING AND MONITORING EBA BY USER GROUPS TO RESTORE FORESTS AND RANGELANDS

Climate Risk & Impacts

Climate Hazards

- Intensified climate change impacts, featuring fluctuating rainfall patterns leading to frequent droughts and severe flooding and landslides.

Impacts on Ecosystems

- Soil erosion caused by exposure to raindrop impact and storm events.
- Increased sedimentation load in streams and reduced water quality due to soil erosion.
- Decrease in water infiltration leading to increased runoff and erosion.

Impacts on Communities

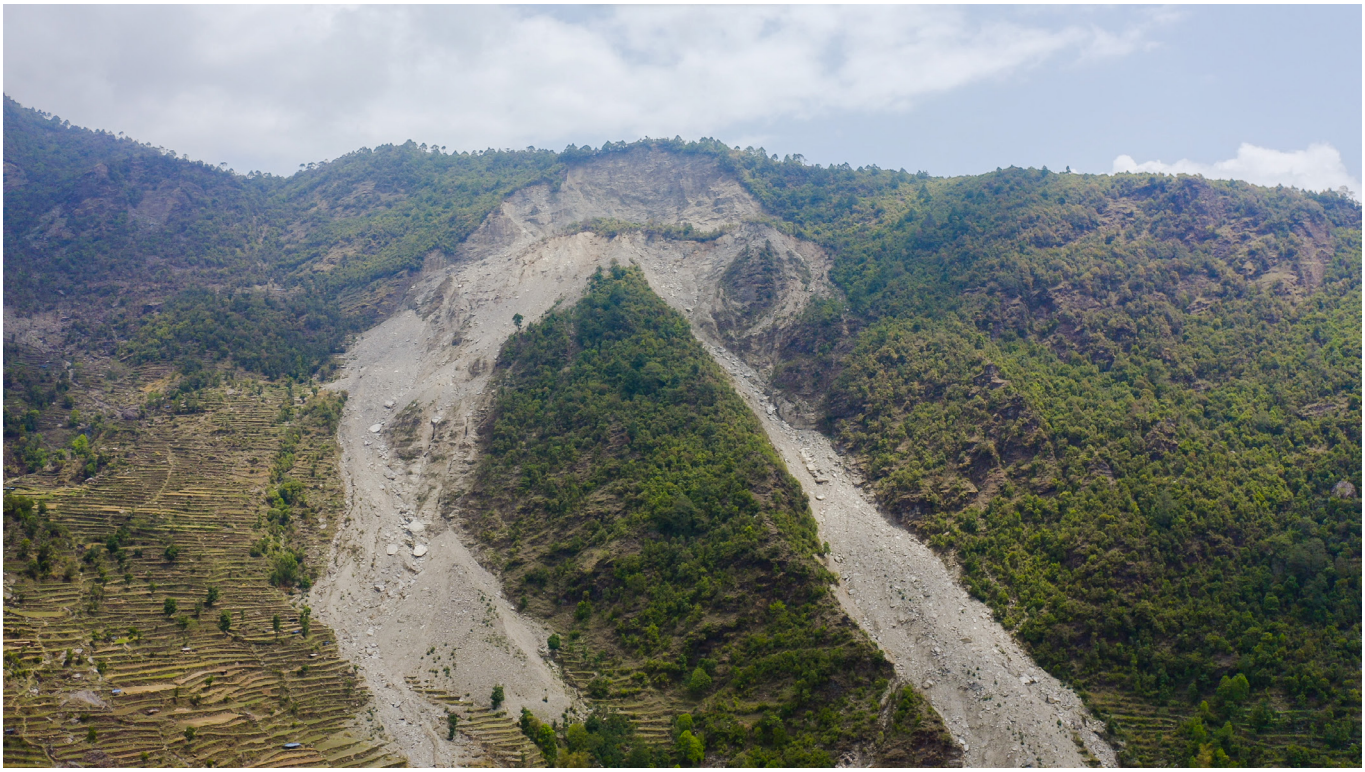
- These climate change impacts are driving significant soil erosion, crop loss, forest degradation, and a lack of potable water, threatening both food security and livelihoods dependent on natural resources.
- Decrease in agricultural productivity, food security, and degradation of natural ecosystems and biodiversity due to the aforementioned impacts.
- Endangerment of rural residents' lives and livelihoods due to the degradation of natural ecosystems.
- Potential threat to the Nepalese economy due to the impacts on rural livelihoods

Results and Outcomes

Capacity Building

The project organised several capacity-building and training activities on EbA planning and implementation for government officials, community leaders and ward officials, local journalists, and students. More than four hundred participants benefited from the training events. Following the training, government officials and local journalists are now applying EbA measures and producing news in media related to EbA. In addition, more than 20 research grants have been awarded so far to students researching EbA.

Several EbA Protocol validation workshops, technical workshops and consultative meetings were also held to facilitate the establishment of EbA Working Groups



A landslide in 2020 devastated Lapilang village in the Dolakha region of Nepal. Credit: UNEP/Marcus Nield.

in different districts. In addition, EbA curricula and toolkits have been developed to assist the working groups in implementing EbA interventions. The project has also developed guidelines for mainstreaming EbA in Community Forestry Operational Management Plans (CFMPs). Based on the guidelines, more than 100 CFMPs have been updated and are operational.

Implementation

The current trend of unsustainable forest exploitation has resulted in the degradation of the forest resource base and associated grasslands due to unsustainable livestock farming and fuelwood collection. These issues exacerbate droughts, floods, and landslides, and emphasise the urgent need for sustainable forest management and conservation in climate change adaptation efforts. More than 130 hectares of degraded forests and 150 hectares of degraded rangelands have been restored through the programme. Similarly, 355 hectares of terraces have been improved to reduce erosion and conserve agricultural land. In addition, filtering dams have been constructed, which slow runoff, reduce water erosion, retain sediment and promote water filtration, and several water conservation ponds have been constructed or rehabilitated (UNEP 2022a).

Challenges and Lessons Learned

To restore the degraded forest, seedlings were grown and planted in suitable locations. The seedling survival rate was between 18% and 56%. This survival rate could be attributed to the high rate of termite infestations, and the hot weather conditions and drier climate which prevails in the area. In addition, survival rates matched soil moisture availability.

One of the key lessons from the Nepal EbA experience was the importance of **identifying, demonstrating and sequencing EbA benefits for local communities.** For example, in the forest restoration element, significant emphasis was initially placed on quantifying and achieving the ecological outcomes of the forest rehabilitation, while there were no immediate benefits to the community from the intervention. The benefits to the community would mainly be realized in the medium to long term when the forest was mature. As a result, more short-term and innovative livelihood benefits needed to be identified, such as bee-keeping and other forest-based enterprise interventions. In contrast, the water harvesting element of the EbA intervention was able to demonstrate immediate livelihood benefits. The water harvesting dams, situated upstream, resulted in downstream spring regeneration with improved water quality and quantity. This tangible and direct benefit to communities resulted in significant support for the EbA intervention.

A second key lesson from the Nepal EbA project is the importance of **finding solutions in which grey and green infrastructure can work together** rather than being presented as alternatives. For example, in the topsoil and water conservation component of the project, it was necessary to combine physical and natural infrastructure interventions to achieve the project's overall objectives. As a result, the central and

local governments implemented hard infrastructure (such as check dams, embankments and retaining walls). At the same time, the EbA intervention included a range of softer solutions, such as improved terraces, filtering dams and bio-engineering plans to stabilize riverbanks. This integration between grey and green infrastructure also laid the groundwork for stronger collaboration between the EbA stakeholders and government departments, which then, in turn, promoted with EbA policy integration and future budget allocation for adaptation.

3 GAMBIA CASE STUDY: LARGE-SCALE ECOSYSTEM-BASED ADAPTATION AND NATURE-BASED ENTERPRISES

Context

The *Large-scale ecosystem-based adaptation in The Gambia: Developing a climate-resilient, natural resource-based economy* project is being undertaken in The Gambia in West Africa. The project is being implemented in four regions of The Gambia: Lower River Region; Upper River Region; Central River Region North; and Central River Region South. The project started in August 2017 and is expected to reach completion in August 2025 (GCF n.d.).

The objective of this project is to restore and rehabilitate more than 10,000 hectares of wildlife and protected areas (including degraded forest, savanna, and mangrove areas) as well as 3,000 hectares of degraded farmland areas through ecosystem-based adaptation to build climate resilience for rural villages against floods and storm surges in The Gambia. The restoration and rehabilitation include planting several resilient multi-purpose plant species that can provide ecosystem goods and services for local communities. The project also aims to establish natural resource-based enterprises, which will help the country to transition towards a green economy (UNEP n.d.).

The project consisted of the following three components:

1. RESTORING DEGRADED FOREST AND AGRICULTURAL LANDSCAPE WITH CLIMATE-RESILIENT PLANT SPECIES THAT PROVIDE ECOSYSTEM GOODS AND SERVICES

2.ESTABLISHING COMMUNITY-BASED COMMERCIALLY VIABLE NATURAL RESOURCE-BASED ENTERPRISES TO BE MANAGED BY THE COMMUNITY-BASED ORGANIZATION

3. POLICY SUPPORT, INSTITUTIONAL STRENGTHENING AND KNOWLEDGE GENERATION TO SUPPORT LARGE-SCALE IMPLEMENTATION OF EBA

Climate Risk & Impacts

Climate Hazards

- Increased irregular rainfall patterns and heightened intensity of droughts and floods.
- Storm surges, river flooding, coastal erosion, sea level rise and saline-water intrusion into groundwater and streams are forecast to increase in severity and frequency due to climate change.
- Rising temperatures and erratic rainfall are leading to increased water stress and wildfires (particularly during the dry season).

Impacts on Ecosystems

- Increased flooding of ecosystems - 33% of land in The Gambia is lower than 10 meters above sea level and between 10% and 20% of the land area is flooded daily or seasonally.
- Increased ecosystem vulnerability due to water stress and wildfires - over 79% of forests experience fires annually, and fire occurrences have increased by nearly 50% lately. Due to the lack of firebreaks around community forests and community protected areas, bushfires pose a significant risk to new seedlings.

Impacts on Communities

- Changing rainfall impacts the country's largely rain-dependent agricultural sector.
- Compounding vulnerability of people due to rising temperatures, deforestation, erratic rainfall, and increasing water stress.
- These climatic shifts are causing significant declines in crop yields, directly threatening the predominantly rain-dependent agricultural sector that employs 44% of the national workforce and provides two-thirds of household income.
- Climate projections suggest a potential 50% yield reduction from rainfed agriculture in West Africa by 2020.
- A substantial number of rural households in Gambia already face a "hunger season" between July and September, during which food supplies dwindle.
- Conflict between humans and wildlife as forest fires force migration of wildlife into new areas and communities to move into areas previously used by large animals.

- Along with population growth and increasing extreme droughts, some agropastoralists now practise long-distance transhumance leading to conflicts between pastoralists and farmers.

Results and Outcomes

Capacity Building

Numerous participatory planning and design activities were undertaken with local communities through the project to integrate them into activities aimed at the sustainable management of natural resources.

60 community forest enterprises have completed training on commercial beekeeping, including instruction on hive installation, the application of catcher boxes, and modern harvesting methods.

Improving Adaptive Capacity

The restoration and rehabilitation of mangroves have increased the adaptive capacity and reduced the vulnerability of communities along the river by reducing the impacts of storm surges, flooding, and bank erosion related to wave action.

To increase the adaptive capacity and reduce communities' vulnerability to wildfire, the project has initiated efforts to remove excess fuel, low branches and competitor plants, and to create fire belts (fire breaks) in the regions where the project is being implemented (UNEP 2019a)

Implementation

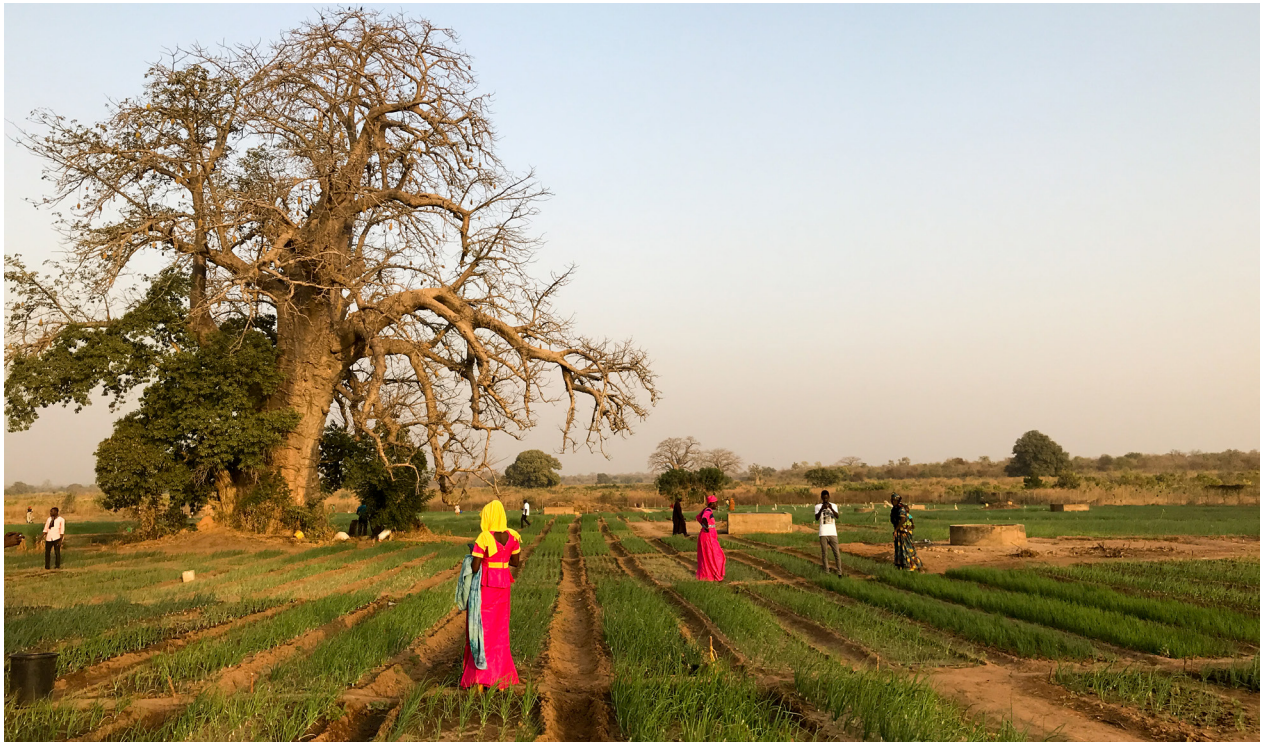
The project has innovatively led to the creation of a medium-scale natural resource enterprise, known as the 'Central Processing Facility' in Brikamaba. The Central Processing Facility will serve as a key infrastructure for the gathering and value enhancement of natural resource products obtained from rejuvenated ecosystems.

Through the implementation of the project, millions of mangrove trees have been planted along the Gambia River. The mangroves help to reduce the vulnerability to the salinisation of vulnerable inland agricultural land by stopping water from penetrating farther inland (UNEP 2019a).

The project included restoration and rehabilitation of wildlife, protected and farmland areas through the planting of a variety of climate-resilient plants (including multipurpose plant species and enrichment planting to reduce soil erosion), as well as the creation of natural resource-based business and related employment opportunities (UNEP 2019a).

Challenges and Lessons

A key lesson from the Gambia EbA intervention was **identifying and addressing the interwoven stresses on ecosystems to avoid maladaptation** and potential conflict. Transhumance is a tradition in the region, where pastoralists migrate across borders into the



Crops established by a UNEP Ecosystem-based Adaptation project in Gambia. Credit: UNEP/Hannah McNeish

Gambia from neighbouring Senegal. Climate change and socio-economic changes are driving an increase in people migrating due to changing rainfall patterns and decreased vegetation cover, which is increasing pressure on water availability in the Gambia and creating conflict with communities that rely on this water. The stress on water availability is further exacerbated by saline intrusion, driven in part by sea level rise. Saline intrusion also reduces the areas available for cropping, pushing people into areas previously used for rice crops, but also by large fauna like hippopotami.

The complexity of these stresses required a systems approach in the EbA intervention. An example of this systems approach was conserving areas with natural depressions for water management activities rather than installing plastic or metal water tanks. Conserving these areas of natural depression had a range of social and ecological benefits and demonstrated a way of working with nature for natural water storage. Financial incentives were also introduced to protect trees that were planted for reforestation, and, in some areas, the planted tree species were changed to fruit trees and wild edible plants to provide co-benefits to the community. The project has also supported the establishment of small community-based businesses that reduce wildfire risk and intensity by harvesting Andropogon grass (that outcompetes trees for soil moisture) and turning the harvested grass into animal feed (UNEP 2019a). There was also a move away from a focus on specific plant species to rather support natural regeneration in large areas of land.

A second key lesson area in the Gambia was the **process of ensuring demonstrable gender benefits** from the EbA intervention. Gender was central during the design of the project. For example, at the project concept stage, there was 50% representation by women during consultations at the community level when interventions were initially identified. Gender groups were engaged separately from men to encourage appropriate interventions. However, during implementation, several challenges around traditional gender roles emerged. Ownership of land primarily by men was a key barrier, as customs restricted the planting of trees to landowners only. As land is primarily owned by men, it was difficult for women to become involved and benefit from tree planting.

To ensure real gender outcomes were realised (beyond participation in engagements), effort was placed on strengthening livelihood interventions that are dominated by women (e.g., gardening). There was also deliberate emphasis placed on ensuring that women and people living with disabilities were represented on management committees. Currently, women make up as much as 40% of management positions in community committees. Emphasis was also placed on changing perceptions in communities about gender roles. For example, there was strong messaging that women having access to land can result in benefits for the entire community.

4 TANZANIA CASE STUDY: COMBINING ECOSYSTEM RESTORATION WITH FLOOD DEFENCE INFRASTRUCTURE

Context

In Tanzania, two UNEP EbA projects focused on coastal areas in Dar es Salaam and the five coastal districts of Pangani, Bagamoyo, Rufiji, Mijni and Mkoani. The projects were undertaken between November 2012 and March 2019. Their objective was to reduce the vulnerability of infrastructure, economy, ecosystems, and livelihoods in coastal communities (UNEP 2019c). A number of ecosystem rehabilitation interventions (such as restoring mangrove and coral habitats) were implemented together with hard infrastructure interventions (such as building seawalls, groynes and dikes) to reduce erosion, flooding and saltwater intrusion. These interventions were complemented by livelihood support projects such as the provision of boreholes, rainwater tanks and efficient cook stoves.

The projects consist of the following three components:

1. ADDRESSING CLIMATE CHANGE IMPACTS ON KEY INFRASTRUCTURE AND SETTLEMENTS

2. SUPPORTING ECOSYSTEMS-BASED INTEGRATED COASTAL AREA MANAGEMENT (EBICAM)

3. IMPROVING KNOWLEDGE, COASTAL MONITORING AND POLICY LINKAGES

Climate Risk and Impacts

Climate Hazards

- Increasing temperatures, rising sea levels, intensified rainfall, and prolonged dry spells, which are linked to heat waves, water scarcity, and flooding as well as increasing ocean and freshwater temperatures.

Impacts on Ecosystems

- Deforestation of mangroves and urbanisation have reduced ecosystem services provided by mangroves such as storm-surge buffering and flood defence.
- Sea water advance has led to increased soil salinity, negatively impacting local water sources, and causing crops to fail and livestock diseases to spread.
- Coastal and inland fisheries are also threatened by sedimentation after heavy rains and increasing ocean and freshwater temperatures.

Impacts on Communities

- The climate hazards disproportionately expose the marginalised 75% of urban inhabitants who live in informal settlements to heat waves, water scarcity, and flooding.
- Approximately 25% of the United Republic of Tanzania's population residing along the coastlines faces increasing risks of inundation, salinisation, and storm surges, posing similar threats to the country's coastal infrastructure and ecosystems.
- The depletion of surrounding forests has reduced access to fresh water and food.
- Increased salinity of well water has led to health problems such as yellowing of teeth, stomach upsets in children, headaches, and nausea.
- Economic impacts due to damage to infrastructure and reduced availability of clean water (UNDP 2022; UNEP 2022b).

Results and Outcomes

Capacity Building

Strong community participation led to the registration of community organisations and the creation of local networks.

Up to 140 individuals received training in mapping coastal and climate vulnerabilities. Utilising three coastal vulnerability assessments and four participatory vulnerability assessments, climate-sensitive communities were identified.

Collaboration with the University of Dar es Salaam led to field research by 29 undergraduate and 12 graduate students, documenting climate risks and adaptation options at project sites.

Improving Adaptive Capacity

The project saw the establishment or registration-in-process of 38 community-based organisations.

Creation of community groups for mangrove management and establishment of 'no-take zones' to reduce deforestation.

At least 140 people were trained in coastal and climate vulnerability mapping.

Adaptive management techniques were implemented to experiment with various types of mangrove plants and their planting spacing needs. This strategy enhanced the survival rate of the mangroves, enabling surplus seedlings to be redirected and planted in other locations.

Implementation

The two projects are estimated to have benefitted a total of 526,000 people.

The project resulted in the successful construction of 2,800m of sea defence structures, including seawalls and groynes, to protect from rising sea levels. It also restored 3,000m2 of coral reefs and 1,245 hectares of mangroves that provide flood defences and habitats for fish. 3,000 efficient cooking stoves were distributed to reduce mangrove and forest deforestation for fuel.

Ten boreholes were successfully drilled, and 15,000 litres of storage tanks were constructed for each borehole.

A total of 2,300m2 of drainage channels were cleaned and restored, benefiting 1,500-2,000 households, and preventing annual floods. Ten boreholes were drilled, and a 15,000-liter storage tank was constructed for each borehole, improving water access for over 10,000 people (UNEP 2019c).

Challenges and Lessons

Although there were significant successes in the outcomes related to infrastructure and ecosystem services, there were challenges regarding mainstreaming and long-term implementation of the interventions. One of the key lessons from the EbA programme in the United Republic of Tanzania is the importance of **identifying key levers that can support future replication** of the EbA interventions. In the United Republic of Tanzania, the government devolves land use planning to the village level. Villages develop integrated and multi-sectoral land use plans through participatory community processes with guidance and support from the Districts and the National Land Use Planning Commission. This method can result in the protection and rehabilitation of particular ecosystems and ecosystem services that are essential to livelihoods, food and water security, as there has been a collective agreement around that specific land use.

Among the contributing factors that have increased the success of EbA interventions was the **consistent engagement of district and community stakeholders in the implementation of the projects.** This encouraged commitment and ownership on the part of district council focal points, non-governmental organisations, and community-based organisations. There is a high likelihood of institutional sustainability of EbA interventions as a result of the lead role given to District Councils for the coordination of activities at the project sites.

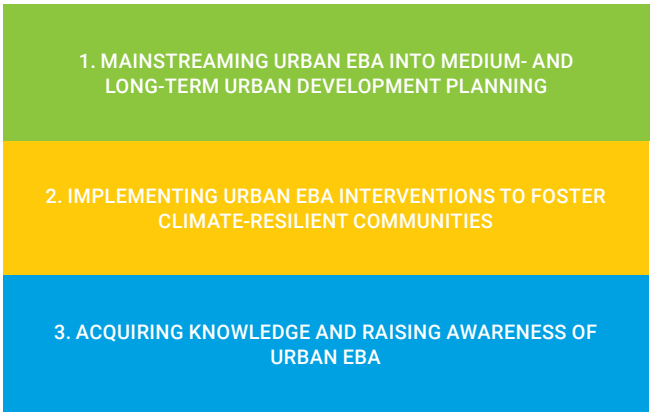
Linked to the above lesson on replication is the importance of **integrating EbA interventions with local budget planning processes.** A key observation during implementation was that a lack of climate finance mechanisms and constrained local government budgets made it difficult to replicate the EbA programmes and expand the Integrated Coastal Area Management. This constraint was partly addressed by ensuring the EbA interventions were built into district plans and budgets. As the government's procurement system was used to acquire goods and services, this embedding process did, however, cause a loss of efficiency and effectiveness. Nevertheless, the budget integration significantly encouraged local and country ownership and ultimately sustainability of the interventions.

5 LATIN AMERICA AND THE CARIBBEAN CASE STUDY: ECOSYSTEM-BASED ADAPTATION IN CITIES

Context

The CityAdapt: Building climate resilience of urban systems through Ecosystem-based Adaptation (EbA) in Latin America and the Caribbean project, also known as CityAdapt LAC, is being undertaken in three medium-sized cities in Latin America and the Caribbean: San Salvador in El Salvador, Kingston in Jamaica, and Xalapa in Mexico. The objective of this project is to increase the ability of local governments and local communities in the three cities to adapt to the impacts of climate change. The project aimed to directly benefit over 98,000 individuals across the three cities (UNEP 2022c).

The project consisted of the following three components:



Climate Risk and Impacts

Climate Hazards

- In Xalapa, Mexico, a city of approximately 450,000 people, unstable weather patterns marked by fluctuating temperatures and rainfall are destabilizing mountain slopes, leading to frequent landslides and floods.
- Jamaica, a Caribbean island housing nearly 3 million people, is highly susceptible to climate change effects, experiencing devastating floods and droughts, particularly in its capital, Kingston, which has a population of approximately 600,000 people.

- El Salvador has seen an increase in extreme storms in recent years due to climate change, most damaging in the metropolitan area of its capital city of San Salvador, home to over 1.6 million people. These climate challenges are exacerbated by urbanisation and deforestation.

Impacts on Ecosystems

- Urban and peri-urban forested areas and natural ecosystems within watersheds, which provide a natural defence against floods, droughts, and landslides—the three main climate hazards facing these cities—are increasingly under threat.

Impacts on Communities

- Increased climate vulnerability of urban communities in the cities of San Salvador, Kingston, and Xalapa to floods, landslides, and droughts due to reduced ecosystem services (UNEP and GEF n.d.).

Results and Outcomes

The CityAdapt project is still ongoing, but the preliminary results and outcomes are summarised below.

Capacity Building

Key messages relating to urban EbA have been disseminated to decision-makers as well as wider audiences in the three cities through a capacity-building programme, including an online course and a series of monthly webinars. Additional content, including videos, guidelines and other publications, has been developed and shared through digital and social networks. A web platform was developed (https://cityadapt.com/) and has been instrumental in facilitating communication. Research partnerships have been established in Xalapa and San Salvador to generate scientific knowledge on the benefits of EbA in urban areas. A similar research partnership is being developed in Kingston. A technical guideline was also developed for implementing nature-based solutions in the region (UNEP 2022c). Training was provided to local government authorities and relevant private sector stakeholders in each of the three cities on implementing urban EbA (UNEP 2022c). In addition, training took place in community spaces in each city that promoted additional climate-resilient livelihoods from EbA (UNEP 2022c).

Implementation

All three cities have made progress in the implementation of nature-based solutions to address climate risks. Specifically, in San Salvador, more than 40,000 lineal metres of vegetated infiltration ditches and almost 600 hectares of coffee plantations have improved agroforestry systems. Surface water infiltration in key water and soil retention areas in the city was improved by building 30 absorption wells. In Xalapa, plants were sown along 3.46km of an urban river as part of its restoration, 4 infiltration gardens were created to help reduce flooding in front of a hospital and a school, plants were sown as part of ecosystem conservation and soil restoration efforts on 8.2 ha of a hill in the city and a natural wetland was rehabilitated along with the construction of infiltration trails in a natural protected area of the city. Furthermore, over 600 trees were planted and adopted by families in the peri-urban parts of Xalapa as part of a “one tree per household” initiative. In Kingston, reforestation activities were undertaken in community and school spaces as well as in a watershed area, 2ha of wetland area were restored, and 250 bee colonies were distributed as part of an apiculture alternative livelihood strategy. 29 rainwater harvesting systems have been installed in public buildings and schools in all three cities. All three cities also collaborated with local schools to develop 24 urban gardens.

Challenges and Lessons

A key lesson from the CityAdapt EbA intervention was the value of **designing and implementing EbA interventions** across legislative boundaries by taking a “watershed perspective”. This watershed approach was instrumental during the development of the risk assessments as well as for the identification of the combination of nature-based solutions to be implemented. This approach also showcases the potential for enhanced impact when designing interventions that include actions in rural, peri-urban and urban areas.

A second lesson from the CityAdapt EbA intervention was the importance of **clearly and intentionally communicating the benefits of EbA** throughout the project implementation. At the start of the CityAdapt project, it was evident that there needed to be a better general understanding of EbA concepts and principles. There were also entrenched traditional

practices implemented by actors that were not always immediately open to integrating the multiple services that ecosystems can provide. For example, in El Salvador, there were strong reluctances to use infiltration ditches and agroecological measures over rainfed agriculture to enhance coffee production although frequent and prolonged droughts were affecting yield.

It was therefore necessary to develop a range of tailored communication materials, such as practical guidelines, protocols, fact sheets, training programs and media material. The communication materials focused on introducing complex concepts (such as adaptation to climate change, EbA and Nature-based Solutions) to a variety of audiences. The communication included demonstrations of how pilot sites have successfully used the proposed EbA interventions to support local communities and governments in taking adaptation action through nature-based solutions. The materials were also designed in a way to increase stakeholder buy-in and ensure the sustainability of the measures and project goal. Significantly, the communication tools were not used only at the end of the project to report to stakeholders on the outcomes but were employed throughout the project's lifetime to facilitate implementation.

An additional lesson from the CityAdapt project is the importance of **building representative and long-term monitoring frameworks** for EbA interventions. To be representative, the CityAdapt monitoring framework needed to measure outputs and outcomes beyond ecosystem restoration. This included impacts on human health, community resilience and socio-economic systems. Monitoring was often a challenge due to data availability, and in many instances, proxy indicators needed to be used to assess the impacts of interventions. However, being able to determine outcomes beyond direct ecological benefits was critical to the pilot sites in order to demonstrate the benefits of an EbA approach.

To achieve long-term monitoring objectives, as well as local engagement and sustainability of the measures, it was necessary to evolve from using monitoring indicators towards impact indicators. For example, additional small hydrometeorological stations were installed, which provide real data to decision-makers and monitoring institutes. Cost-benefits analysis were also elaborated for implemented measures in all three cities. When this data is analysed, it shows the impact of the interventions and their cost-effectiveness, while providing additional information on the overall impacts of climate change in the long term. The monitoring and evaluation framework in Xalapa and Kingston also included detailed surveys and responsibilities of different beneficiaries for the monitoring. There was also close collaboration with local research institutions that could monitor the impacts beyond the project timeframe. This long-term relationship with research institutions was further strengthened by actively including one of the universities as a site for a wetland and rainwater harvesting intervention.

A UNEP project funded by the Global Environment Facility built sea defences to protect businesses in Dar-es-Salaam, Tanzania. Credit: UNEP/Marcus Nield.

6 CAMBODIA CASE STUDY: ENHANCING CLIMATE RESILIENCE OF COMMUNITIES IN PROTECTED AREAS

Context

Increased forest degradation has occurred in Cambodia due to communities relying more heavily on ecosystem goods and services from forests to supplement their incomes and food needs. The Enhancing Climate Change Resilience of Rural Communities Living in Protected Areas of Cambodia project took place in Cambodia, in south-east Asia, between 2013 and 2021. The project was undertaken in five Community Protected Areas (CPAs) spread over four Cambodian provinces. The overall objective of this project was to boost the availability of food and lessen soil erosion in Cambodian communities near five CPAs (UNEP 2022d). The project activities included restoring forest, with multi-use trees being planted alongside rice paddies to reduce erosion and enhance soil productivity. Alternative livelihood strategies were also supported through, for example, training on how to create 'home gardens' of vegetables.

The project consisted of the following three components:

1. TECHNICAL EXPERTISE AND A LOCAL ENABLING FRAMEWORK FOR FOREST RESTORATION AND ECO-AGRICULTURE INTERVENTIONS THAT BUILD CLIMATE RESILIENCE DEVELOPED AT CPA INTERVENTION SITES THROUGH A CONSULTATIVE AND PARTICIPATORY PROCESS.

2. MULTI-USE FORESTS ESTABLISHED AND MAINTAINED AND AGRICULTURAL PRACTICES DIVERSIFIED/INTENSIFIED TO SUPPLY A DIVERSE RANGE OF FOOD AND STABILIZE TOPSOIL, DESPITE AN INCREASE IN CLIMATE CHANGE-INDUCED DROUGHTS AND FLOODS.

3. INTEGRATION OF CLIMATE CHANGE RISKS AND ECO-AGRICULTURE INTO CAMBODIA'S ADAPTATION FRAMEWORK AND RELATED SECTOR POLICIES.

Climate Risk and Impacts

Climate Hazards

- Rising temperatures, frequent droughts, and altered seasonal rainfall patterns.

Impacts on Ecosystems

- Increased forest degradation and decreased freshwater availability, both of which could negatively affect biological diversity and ecosystem goods and services
- Unpredictable rainfall patterns are causing increased soil erosion.

Impacts on Communities

- Negative effects on agricultural productivity and poverty reduction efforts due to erratic rainfall.
- Damage to infrastructure due to floods and droughts.
- Increased reliance on ecosystem goods and services from forests to supplement incomes and food services due to crop damage and failures, leading to exacerbated forest degradation (UNEP 2022d; World Bank 2022).
- Decreased freshwater availability, which could in turn diminish water security as well as agricultural and fishery production, resulting in severe threats to food security and public health in vulnerable locations.
- Unpredictable rainfall patterns are causing increased soil erosion on farms, crop failures due to droughts, and infrastructure damage that impedes farmer's access to markets.

Results and Outcomes

Capacity Building

Four CPA management plans were created. Technical expertise was acquired by government officials participating in the project through the development of various project outputs such as the baseline survey, situation analysis, economic assessments, the development of forest restoration and conservation agriculture protocols, and the implementation of the various project interventions (UNEP 2022d)

Improving Adaptive Capacity

The project was estimated to have benefited approximately 24,000 individuals across the five project sites in Cambodia. The benefits from these initiatives implemented under the project include ecosystem benefits (such as healthier forests, reduced soil erosion, increased carbon sequestration and improved water quality and flow in watercourses) and human welfare benefits (such as increased productivity of forest-based livelihoods, increased household income, reduced climate vulnerability and increased adaptive capacity) (UNEP 2022d).

Implementation

More than 1,800 CPA-member households received fruit trees and more than 11,500 households in areas surrounding the CPA target sites also received fruit trees, which has contributed to increasing food supply for these households. The area of multi-use forest was also expanded which had the additional benefit of topsoil stabilisation.

Challenges and Lessons

One of the key lessons from the Cambodia EbA intervention was the importance of **managing expectations of new livelihood activities** as not all activities result in significant additional income. The project catalysed several additional livelihood options, such as chicken and cricket-raising. However, it was not always possible to generate enough income from these livelihood interventions so that they could act as a primary source of income. Instead, they were seen as a diversification of existing income streams, or a diversification of food sources intended to supplement household consumption.

It was possible to identify a few cash-generating livelihood options (for example, selling pineapples). However, these products were only successful when there was a clear need in the market. Their success was also often driven by "model farmers" or local champions who could support other farmers to supplement the supply of products. Success was also related to proximity to external markets. The closer the farmers were to the market, the easier it was to sell the products. Therefore, physical distance to markets could be included as a critical consideration in site selection when adaptation interventions intend to generate income.

A second key lesson relates to the i**mportance of building trust with communities** where EbA interventions occur. EbA interventions typically introduce new concepts and ideas that communities are unfamiliar with. For the interventions to be supported, it is necessary to promote trust between the EbA implementation team and the community. This trust was partly created by involving local government officials as liaison officers. The officials were known in the community and were familiar with the existing community structures. It was also essential to leverage existing structures in the community to assist with project management. For example, CPA committees were structures that communities were familiar with, and they played a key role in mobilising support for the EbA interventions. A third strategy for building trust was ensuring communities were involved in the decision-making during the design and EbA intervention identification phases as well as during the implementation of the interventions.

6 KEY MESSAGES

The case studies summarised above indicate the successes, challenges, and lessons from UNEP's EbA implementation over the past 10 years. It is evident that the success of such initiatives is contingent on several key factors.

Take a holistic approach

- Identify and address the interwoven stresses on ecosystems to avoid maladaptation and potential conflict (e.g., transhumance, saline intrusion, wildfire risk).
- Design and implement EbA interventions across legislative boundaries (e.g., using a "watershed perspective") to enhance impact.
- Ensure that EbA interventions integrate ecological considerations of ecosystems with relevant livelihood interventions, governance, social participation, and capacity building that contribute to effective adaptation.
- Make sure that the EbA intervention takes varying land uses and habitat types (e.g., agriculture, mountain, forestry, coastal, urban, or freshwater ecosystems) into account. Including varying land uses and habitat types can unlock different ecosystems to build the resilience and adaptation to climate change through restoration, rehabilitation, watershed conservation, integrated coastal management, eco-agriculture, and the use of grey and green infrastructure.
- Ensure that common project strategies to implement EbA across different ecosystem types are considered during the design of the EbA project. Common project strategies may include assessment of ecosystem services, risk and vulnerability assessment, cost-benefit analysis, gender and livelihood assessments, long-term

monitoring, local budget and planning, integration of human rights, gendered analysis of impacts and benefits, communication, policy mainstreaming efforts and spatial planning.

Focus on addressing the adaptive capacity needs of local stakeholders

- Identify, demonstrate, and sequence EbA benefits for local communities in both the short and long term (e.g., beekeeping, forest-based enterprises, engaging the community during the raising of saplings, nursery management, overseeing and managing plantations as immediate sources of income, etc.).
- Recognise gender and other considerations (e.g., age, ethnicity, socio-economic status, disability, etc.) as important to the success of EbA by demonstrating gender benefits from the EbA intervention, addressing traditional gender roles, and ensuring women's and disabled people's representation on project management committees.
- Ensure demonstrable gender benefits from the EbA intervention, addressing traditional gender roles, and ensuring women's and disabled people's representation on management committees
- Manage expectations of new livelihood activities as they often diversify existing income streams rather than becoming primary income sources. Work also needs to be undertaken on connecting new livelihoods activities and products to markets.
- Build trust with communities where EbA interventions occur, involving local government officials, leveraging existing community structures, and ensuring community involvement in decision-making during all phases.

Focus on long-term sustainability

- Find solutions where grey (built) and green (natural) infrastructure can work together instead of being presented as alternatives, promoting stronger collaboration between EbA stakeholders and government departments.
- Identify key levers that can support future replication of the EbA interventions (e.g., community-led land use plans integrating ecosystem-based adaptation and resilient livelihoods).
- Integrate EbA interventions into local budget planning processes to ensure the sustainability and potential expansion of the EbA interventions.
- Ensure that gender and other considerations (e.g., age, ethnicity, Indigeneity, socio-economic status, disability, etc.) are taken into account as these can contribute towards the sustainability of an EbA intervention.
- Integrate EbA interventions with local budget planning processes to ensure sustainability and potential expansion.
- Build representative and long-term monitoring frameworks for EbA interventions that measure impacts on human health, community resilience, and socio-economic systems.
- Consistently engage district and community-based stakeholders in the implementation of EbA activities. Consistent engagement can engender encouragement, commitment, and ownership of the EbA project, while also ensuring the institutional sustainability of results (e.g., engagement of district councils).

Strengthening project design and quality

Over and above the lessons highlighted in these case study summaries, a number of additional lessons have been learned through UNEP's support to implement EbA interventions. Many of these lessons relate to ensuring that EbA projects are designed to improve efficiency and effectiveness. Project designers and implementers should ensure that they:

- Design the EbA project so that it generally takes a gender-responsive approach that integrates human rights and local knowledge, while also aligning with relevant environmental and social safeguards and standards.
- Understand all the legal rights and obligations related to climate change, land ownership and use, and property, as these are crucial for ensuring the sustainability of the EbA measures.
- Coordinate the designing of an EbA project between international donors, government teams, and community-based organisations.
- Make use of awareness-raising, communication drives, stakeholder participation, and alignment with national and local priorities to ensure that the partner country takes ownership of the EbA project and that political will in the country is aligned with the EBA project, as these aspects are essential for the sustainability of the EbA project (Imam 2020).

These lessons provide valuable insights for future EbA programming, emphasising the need for community involvement, trust-building, and the integration of various infrastructural and livelihood strategies. Applying these lessons to future EbA projects will potentially strengthen the sustainability and management of the projects while supporting the addressing of multiple climate change risks and drivers of vulnerability. Ultimately, the application of these lessons will contribute towards harnessing the full potential of nature-based solutions for climate change adaptation.

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