Making the Case for Ecosystem-based Adaptation

Building Resilience to Climate Change

UNEP

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SUMMARY OF KEY POINTS

- Ecosystem-based Adaptation (EbA) provides numerous opportunities for natural solutions to manage the impacts of climate change.
- EbA interventions generate a range of significant social, economic, and environmental co-benefits by reducing society's vulnerability to natural hazards, improving the availability of ecosystem services essential to support livelihoods and protecting biodiversity through sustainably managing ecosystems.
- Evidence shows that as part of an integrated adaptation approach, EbA requires comparatively small investment relative to the long-term social, economic and environmental benefits it generates.
- Despite the numerous advantages of EbA, its implementation remains limited by three key challenges: lack of information, lack of financial resources, and institutional resistance.
- Action is needed to mainstream ecosystem-based approaches into national climate change adaptation strategies to make full use of their many opportunities.
- This brief illustrates six policy options for national policymakers to consider in order to address the main challenges faced by EbA and to further encourage its implementation.

Introduction

Healthy ecosystems provide valuable services such as food, clean water, protection from disease, and flood and erosion control, while at the same time building resilience against climate change impacts. This has been recognized by the UNFCCC in decision 1/CP.16 inviting Parties to enhance action on adaptation by ***"building resilience of socio-ecological systems, including through economic diversification and sustainable management of natural resources"***.

This policy brief makes the scientific and economic case for mainstreaming Ecosystem-based Adaptation (EbA) into national policymaking. It is aimed at national governments that are considering investing in EbA as an effective means of building community and ecosystem resilience at national and regional scales, with the aim of reducing vulnerability to climate change impacts.

"the use of biodiversity and ecosystem services to help people adapt to the adverse effects of climate change"

What is Ecosystem-based Adaptation?

Ecosystem-based Adaptation is defined by the Convention on Biological Diversity (CBD) as ***"the use of biodiversity and ecosystem services to help people adapt to the adverse effects of climate change".*** As further elaborated by Decision X/33 on Climate Change and Biodiversity, this definition also includes the ***"sustainable management, conservation and restoration of ecosystems, as part of an overall adaptation strategy that takes into account the multiple social, economic and cultural co-benefits for local communities".***

EbA embraces 'the integrated management of land, water and living resources that promotes conservation and sustainable use in an equitable way', in the context of supporting communities in coping with climate change impacts. It therefore employs familiar tools and measures but conceptualizes and implements them specifically for adaptation to climate change.

Figure 1 demonstrates how EbA can help alleviate major pressures from climate change on ecosystems by managing and restoring ecosystems and the services they produce and in turn enhancing the adaptive capacity of local communities.

The main opportunities provided by EbA include:

- Strengthening the collaboration between sectors involved in managing ecosystems and benefiting from ecosystem services;
- Involving local institutions and stakeholders as key actors in adaptation planning so as to enhance participation and compliance;
- Incorporating traditional knowledge and practices and gender-sensitive tools and approaches in adaptation planning and activities
- Reducing the risk of maladaptation by harnessing ecosystem resilience as part of a broader range of adaptation actions;
- Facilitating collaboration and financial transfers between developed and developing economies; and
- Providing intensified research and development, technology transfer and infrastructure development.

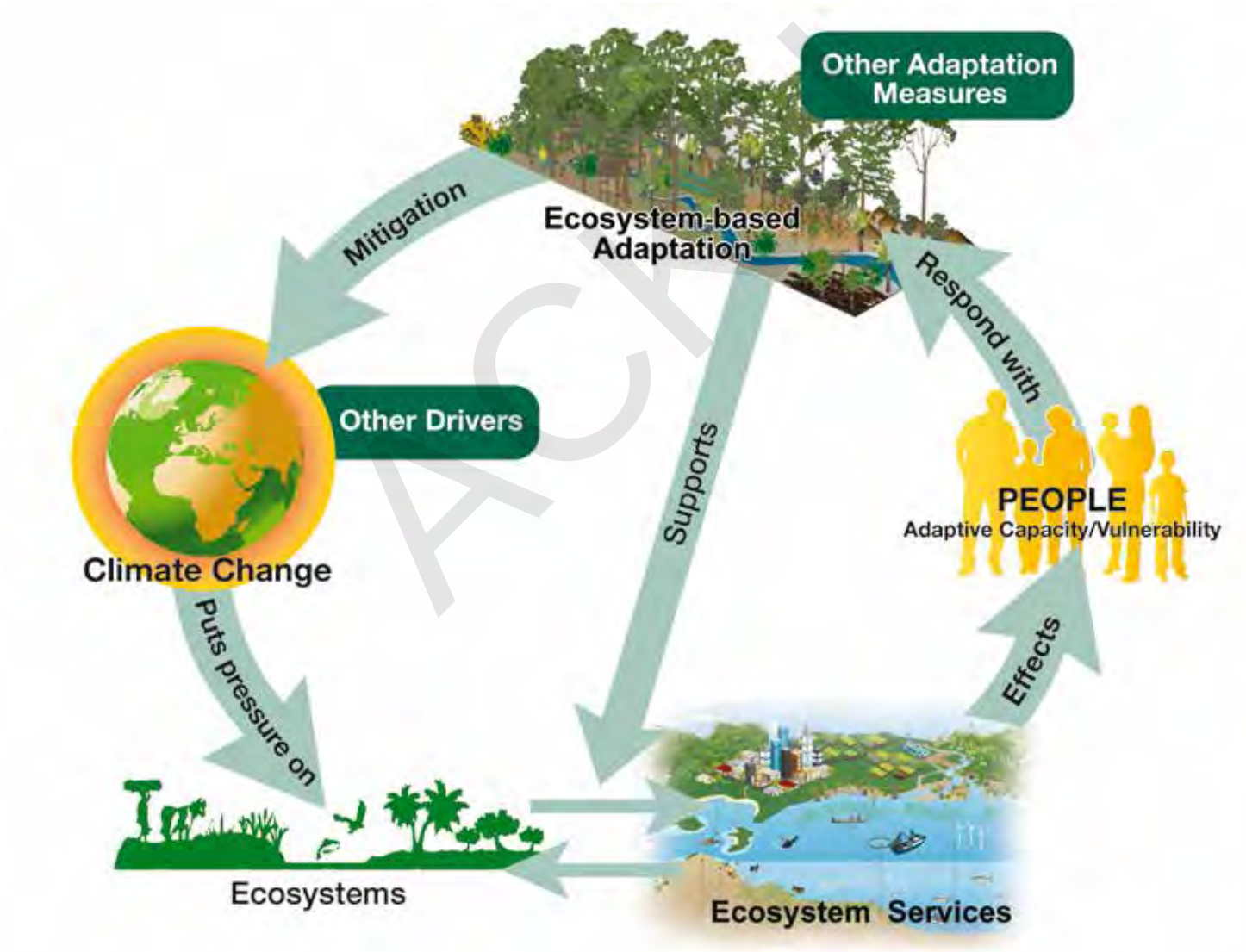
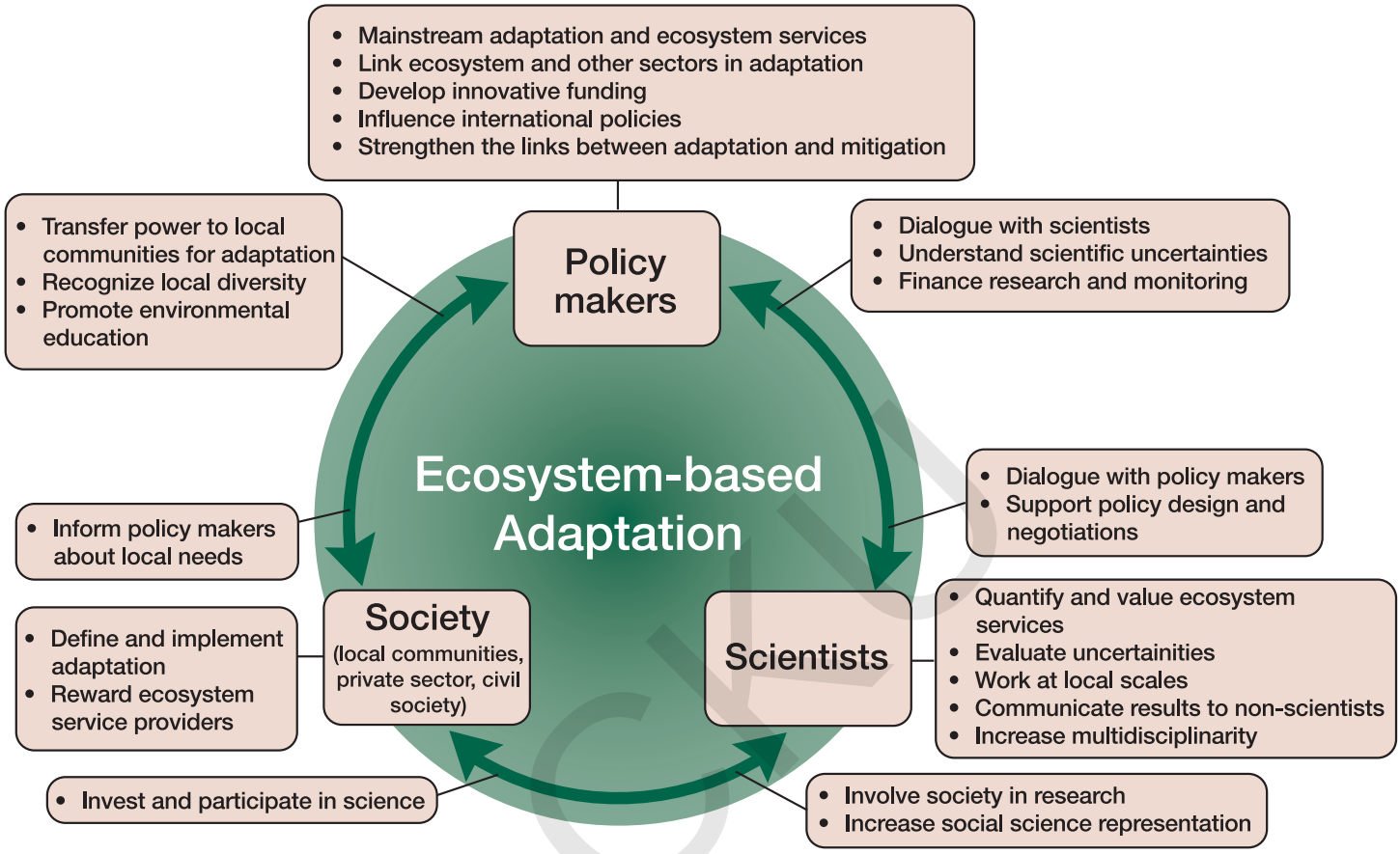


Figure 1: Ecosystem-based Adaptation conceptualized in the Driving Forces-Pressures-State-Impacts-Responses (DPSIR) framework.

Figure 2: Roles of stakeholders in implementing EbA. *Adapted from Vignola et al. (2009)*



EbA is applicable across a wide range of geographical areas, sectors and stakeholders in both developed and developing countries. It can be incorporated into many areas including coastal defence, flood and drought management, agriculture, resource provision, urban planning, disaster risk reduction, conservation and tourism.

The involvement of policymakers and multiple stakeholders with distinct roles and responsibilities (Figure 2) is critical to successful EbA because ecosystems typically support diverse sectors and different social groups in multiple ways. For instance a forest may provide local communities with forest goods for their livelihoods (e.g. timber, game, nuts and fruits, fibre), while at the same time supporting commercial tourism and timber harvesting. Furthermore, the hydrological regulation provided by these forests also benefits geographically distant sectors such as agriculture and hydroelectric plants through provision of water flow and flood regulation as well as minimization of erosion and siltation.

The growing interest in EbA has prompted discussion and development of a number of guiding documents. These include a draft set of principles developed to guide national planning and implementation (see Box 1) and a decision support framework focused on the operational level, that assists adaptation practitioners on the selection, design and implementation of adaptation projects.

Advantages of EbA

EbA presents three key advantages over other adaptation approaches: it can deliver multiple co-benefits, help avoid maladaptation and contribute to a 'no regrets' approach to address climate change. Unlike many more narrowly focused engineering adaptation measures, such as for example seawalls or dams, EbA delivers simultaneously for climate change adaptation and mitigation, environmental protection, biodiversity conservation and sustainable economic development.

Co-benefits of EbA

EbA has the capacity to deliver multiple co-benefits in a range of ecosystems (Table 1).

Box 1: Draft Principles for Ecosystem-based Approaches to Adaptation

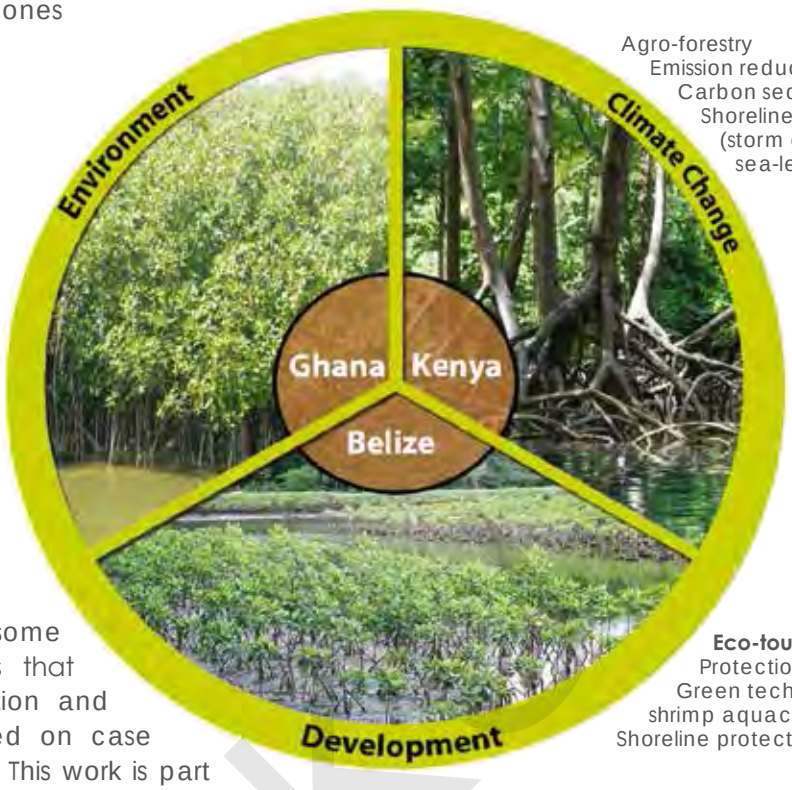
EbA:

1. Promotes multi-sectoral approaches.
2. Operates at multiple geographical scales.
3. Integrates flexible management structures that enable adaptive management.
4. Minimises trade-offs and maximizes synergies with development and conservation goals to avoid unintended negative social and environmental impacts.
5. Incorporates best available science and local knowledge, and fosters knowledge generation and diffusion.
6. Promotes resilient ecosystems and nature-based solutions to provide benefits to people, especially the most vulnerable.
7. Is participatory, transparent, accountable, and culturally appropriate, while actively embracing equity and gender issues.

EbA interventions	Benefits
Restoring fragmented or degraded natural areas	Enhances critical ecosystem services, such as provision of water, food & fisheries
Protecting groundwater recharge zones & restoring floodplains	Secures water resources to assist communities in coping with drought & flooding
Connecting expanses of forests, grasslands, reefs & other habitats	Enables people, flora & fauna to migrate as climate changes
Protecting and restoring natural infrastructure such as barrier islands, dunes, mangroves, coral reefs, wetlands & forests.	Protects communities & infrastructure from sealevel rise, natural hazards, erosion & flooding

Table 1: Examples of Ecosystem-based Adaptation interventions and their benefits

Figure 3: Co-benefits from climate change adaptation and mitigation actions in coastal zones



For example, Figure 3 illustrates some of the co-benefits from actions that deliver climate change adaptation and mitigation in coastal zones based on case study work across three countries. This work is part of an ongoing project[6] aiming to identify climate smart investment strategies for the coastal zone.

Making a Case for EbA

A number of initiatives worldwide use EbA to restore, maintain and harness ecosystem resilience in order to deliver a host of ecosystem services. Results indicate a strong scientific case for applying EbA as an adaptation approach. For example, the use of coastal wetlands, including marshes and mangroves, can sequester significant amounts of atmospheric carbon. As a conservative estimate, mangroves sequester an estimated 112 ± 85 Tg C per acre, which is comparable with the sequestration rate of tropical terrestrial forests[7,8].

Strengthening and protecting ecosystems is a relatively small, long term investment that generates an array of short- and long-term environmental, social and financial benefits. Examples of the cost effectiveness of EbA generally indicate that benefits outweigh costs[9]. However, cost-benefit comparisons between EbA and non-EbA options, or between integrated interventions that include EbA vs those that do not, are rare, indicating a clear information gap that needs to be filled.

The Economics of Ecosystems and Biodiversity (TEEB) initiative estimated the costs and benefits of ecosystem restoration for adaptation across nine biomes, and found that benefit/cost ratios over 40 years ranged from around 3 to 75, indicating large net benefits[10] from investing in EbA[11]. In addition, a recent European Commission-funded project[12] compared information on the costs and benefits of ecosystem-based approaches against more traditional engineering approaches for addressing climate change impacts across Europe. Although the study did not carry out a comprehensive assessment of costs and benefits due to the lack of quantitative data, it concluded that *"the majority of projects using ecosystem-based approaches can be considered beneficial from an economic point of view if one takes account of the long-term social and ecological benefits that are associated with the projects [...] making those projects using ecosystem-based approaches potentially more cost-effective than traditional engineered approaches."*

The protection and restoration of mangroves provides a powerful example of social, ecological and economic benefits provided by EbA (see Box 2). In addition to this example, there are many other ecosystems where EbA has been shown to be successful[13,14].

EbA Challenges

The implementation of EbA remains hampered by three key challenges: lack of information, lack of financial resources, and institutional resistance.

Lack of information includes uncertainties in future projections of climate impacts, ecological and societal vulnerability and economic growth. These forecast uncertainties are exacerbated by the relative paucity of information from monitoring and evaluation of the effectiveness of past and ongoing EbA interventions. Developing climate risk analyses and vulnerability assessments that make use of scientific and traditional knowledge on ecosystem services and adaptation potential are possible solutions.

The financial challenge includes lack of financial resources for project implementation as well as for capacity building. Increased financial allocation for EbA from new and existing sources, dissemination of information on EbA and general education and awareness-raising exercises are possible solutions.

The institutional challenge arises because EbA requires cooperation across institutions, ministries, communities and the private sector. Often the benefits of EbA are spread across numerous sectors and most visible over the long-term while institutional decision-making tends to be focused sectorally and on shorter timescales. Establishing integrated approaches to adaptation planning and sustainable development, streamlining procedures, adopting bottom-up approaches and fostering public private partnerships are potential solutions to address this challenge.

Box 2: Mangrove ecosystems: a cost-effective adaptation solution with social and environmental benefits

One of the most well-known Ecosystem-based Adaptation options in the developing world over the past few years has been the protection, restoration and sustainable management of mangrove forests. These forests protect the shoreline and communities from storm surges, tsunamis and sea-level rise, and are an excellent example of a no regrets solution providing multiple benefits *(Figure 3)*. They play a key role in securing human livelihoods by providing ecosystem goods such as food, timber and medicine[15,16]. Furthermore, mangroves increase fishery and aquaculture yields since many commercial fish species depend on mangrove habitat during their juvenile stages, and shrimp-mangrove integrated farming systems, for example in the Mekong Delta of Vietnam, have increased the productivity of aquaculture facilities.

Cost-benefit analyses of mangrove restoration projects have shown that rehabilitation can provide net economic benefit even when only considering the direct use of products such as timber, fish and honey by local communities, with considerable additional value from shoreline protection[17]. Moreover, mangrove restoration can sometimes be more cost-effective than maintaining hard structures, particularly over long relatively undeveloped coastline. In Vietnam, for example, planting 12,000 ha of mangroves cost $1.1 million but saved an estimated $7.3 million/year in dyke maintenance[18]. The value of mangroves is not only apparent in developing countries. The annual economic value to the fisheries industry derived from mangroves in the Gulf of California, for example, has been estimated to be US$37,500 per hectare of mangrove fringe[19].

Finally, and most importantly, mangrove forests are highly resilient, with the ability to recover after extreme events with a high degree of ecological stability. Mangrove forests can actively raise the forest floor in response to sea-level rise, as their presence enables accumulation of sediment above the tidal range[20]. Although their ability to do this effectively depends on the rate of sea-level rise[21,22] studies suggest that mangroves today are keeping pace with sea level rise and that restoration and management can therefore enable mangrove Ecosystem-based Adaptation to climate change.

Policy Recommendations

In order to overcome the main challenges and derive some of the primary benefits of implementing EbA, a set of recommendations is listed below for policymakers to consider.

1. **Mainstream EbA into national adaptation, biodiversity and sustainable development policies.** Because EbA cuts across several sectors its effectiveness depends on being mainstreamed across numerous sectors. Putting in place supportive policies and incentives to help local communities implement and derive benefits from EbA is also necessary.
2. **Develop innovative funding for EbA.** Secure long-term funding for EbA to ensure its integration into strategic planning and sustainable development interventions at national, regional and global levels.
3. **Support research so that EbA is guided by the best available science.** More research is needed in order to assess future climate risks and vulnerabilities, better quantify the costs and benefits of EbA and enhance evidence on the role of ecosystem services in reducing vulnerability to climate change.
4. **Promote knowledge exchange and the development of practical tools and guidance for implementing EbA** as part of broader adaptation planning strategies. Share best practices and experiences derived from implementing EbA across a range of ecosystems and geographical regions.
5. **Develop education, training and communication capabilities.** Increasing awareness of the role of ecosystems and ecosystem management in climate change adaptation is essential in order to increase communities' adaptive capacity.
6. **Undertake systematic monitoring and evaluation to assess the strengths and weaknesses of EbA activities.** Effective EbA benefits from an adaptive monitoring framework that enables learning and change.

Conclusions

Ecosystem-based Adaptation (EbA) restores, protects and manages ecosystems in order to help human communities cope with the impacts of climate change. As outlined in this brief, EbA has already proven its worth across numerous sectors and countries. Evidence is emerging of its success in helping people adapt to climate variability and reduce their vulnerability to climate impacts. With these impacts increasingly being felt across the world, there is an urgent imperative to increase resilience to climate change while fostering sustainable economic development at local, national and regional levels. Although it remains underutilized at present, EbA provides a viable strategy for pursuing development goals simultaneously with climate change adaptation and mitigation targets.

To successfully implement EbA, stakeholders have opportunities to liaise with a variety of organizations at local, national and international levels to address the existing challenges of lack of information, finance and institutional capacity. Through partnerships, governments and communities can harness EbA approaches to benefit from ecosystems, improve livelihoods, and achieve sustainable development.

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