Ecosystem-based approaches to adaptation: strengthening the evidence and informing policy

Research overview and overarching questions

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Contents

‘Ecosystem-based approaches to adaptation: strengthening the evidence and informing policy’ is a four-year project coordinated by IIED, IUCN and UNEP-WCMC as part of the International Climate Initiative (IKI). It aims to test the effectiveness of ecosystem-based approaches to adapting to climate change, determine the obstacles to their implementation, and influence policy. This background paper presents the overarching questions that the research component of the project is setting out to address.

The problem

Despite the strong theoretical appeal of ecosystem-based adaptation (EbA) and the proliferation of positive stories from across the globe, the approach is not being widely implemented or sufficiently mainstreamed into national and international policy processes. A factor contributing to this is a lack of robust quantitative data, or at least consistently collated qualitative data, on the effectiveness of EbA. This in turn relates to a lack of consensus on how best to measure the effectiveness of EbA at multiple levels.

Ultimate goal of the project

To help climate change policymakers recognise when EbA is *effective* as a result of improved evidence- and community-based learning and, where appropriate, integrate EbA principles into national and international climate adaptation policy and planning processes.

To achieve this, we first need to define ‘EbA’ and ‘effective’.

Definition of EbA

The widely accepted Convention on Biological Diversity (CBD) definition of EbA is *human-centric*:

> “The use of biodiversity and ecosystem services […] to help people adapt to the adverse effects of climate change”[1] “…that may include sustainable management, conservation and restoration of ecosystems, as part of an overall adaptation strategy that takes into account the multiple social, economic and cultural co-benefits for local communities.”[2]

Definition of effective

Given the above, we define as effective:

> An intervention which has restored, maintained or enhanced the capacity of ecosystems to produce services on which local human communities depend for their wellbeing, adaptive capacity or resilience, and which reduces vulnerability, and allows the ecosystem to withstand climate change impacts and other stressors.

This definition generates two major overarching questions that need to be addressed in order to determine whether a particular EbA initiative is effective:

1. Did the initiative allow human communities to maintain or improve their adaptive capacity or resilience, and reduce their vulnerability in the face of climate change, while enhancing co-benefits that promote wellbeing?

2. Did the initiative restore, maintain or enhance the capacity of ecosystems to continue to produce services for local communities, and allow ecosystems to withstand climate change impacts and other stressors?

To be effective, EbA should also be financially and/or economically viable, be supported by local, regional and national governments, and involve synergistic interactions among multiple sectors. This leads to two further overarching questions:

3. Is EbA cost-effective and economically viable?
4. What social, institutional and political issues influence the implementation of effective EbA initiatives and how might challenges best be overcome?

The project questions are broad, and encompass much important detail regarding how we assess and compare effectiveness in ecological, social and economic terms. They lead to a further set of nine more specific questions (see Table 1) that reflect the growing consensus around the key characteristics of, and knowledge gaps associated with, effective EbA (see Box 1 in Annex).

Project objectives and specific questions

'Ecosystem-based approaches to adaptation: strengthening the evidence and informing policy' will test the *effectiveness* of EbA, determine the *obstacles to its implementation* and *influence policy*. To meet these objectives, we will work closely with partners from across a diverse portfolio of 15 EbA projects from 12 countries in the developing world to address nine questions, within four broad themes. The countries covered by the project are Bangladesh, China, Nepal, Burkina Faso, Kenya, Mali, South Africa, Uganda, Chile, Costa Rica, El Salvador and Peru (see the project website at www.iied.org/ecosystem-based-adaptation). The questions derive from a distillation of recent literature reviews of EbA, from recent learning from the field and from previous work by the UNFCCC and IUCN (see the Annex for more detail on the background to the questions). These questions will be addressed through discussions with staff of in-country projects and at the community level. For projects that are coming to an end, this will be more of a one-off interview process with project staff. For ongoing projects, a more iterative 'action learning approach' will be used to empower local actors and communities.

We acknowledge that not all projects will have answers to all questions, and not all answers will be comparable. However, this research process will shed much light on how best to evaluate the effectiveness of EbA and it will improve understanding about whether, when and how EbA is effective. The long-term aim is that, in collaboration with a widening circle of partners, our approach be scaled-up and applied to multiple projects spanning a wide range of ecological, climatic, socioeconomic and political contexts.

Table 1 Overarching questions being researched by this project

1) Effectiveness for human societies
Did the initiative allow human communities to maintain or improve their adaptive capacity or resilience and reduce their vulnerability in the face of climate change, while enhancing co-benefits that promote long-term wellbeing?
1. Did the EbA initiative improve the resilience and adaptive capacity of local communities, and help the most vulnerable (eg women, children and indigenous groups)? If so, over what time frames were these benefits felt, and were there trade-offs (or synergies) between different social groups?
2. Did any social co-benefits arise from the EbA initiative and if so, how are they distributed and what are the trade-offs between different sectors of society?
3. What role in the EbA initiative did stakeholder engagement through participatory processes and indigenous knowledge play? Did/does the use of participatory processes support the implementation of EbA and build adaptive capacity?
2) Effectiveness for the ecosystem
Did the initiative restore, maintain or enhance the capacity of ecosystems to continue to produce adaptation services for local communities, and allow ecosystems to withstand climate change impacts and other stressors?
4. What were/are the factors threatening local ecosystem(s)? How did/do these pressures affect the resilience of the ecosystem(s) to climate change and other stressors, and their capacity to deliver ecosystem services over the long term?
5. After the EbA initiative, which ecosystem services were restored, maintained or enhanced, and did the resilience of the ecosystem(s) change? Over what geographic scale(s) and time frame(s) were these effects felt, and were there trade-offs (or synergies) between the delivery of different ecosystem services at these different scales?
3) Financial and economic effectiveness
Is EbA cost-effective and economically viable over the long term?
6. What are the general economic costs and benefits of the EbA initiative? How cost-effective is it, ideally in comparison to other types of interventions, and are any financial or economic benefits sustainable over the long term?
4) Policy and institutional issues
What social, institutional and political issues influence the implementation of effective EbA initiatives and how might challenges best be overcome?
7. What are the key policy, institutional and capacity barriers to, or opportunities for, implementing EbA at the local, regional and national levels over the long term?
8. What, if any, opportunities emerged for replication, scaling up or mainstreaming the EbA initiative or for influence over policy, and how?
9. What changes in local, regional and/or national government or in donor policies are required to implement more effective EbA initiatives?

Annex: Background to research questions

Synopsis: Despite the strong theoretical appeal of ecosystem-based approaches to adaptation (EbA) and the proliferation of positive stories from across the globe, the approach is not being widely implemented or sufficiently mainstreamed into national and international policy processes. A major part of the explanation for this is a lack of robust quantitative data, or at least consistently collated qualitative data, on the effectiveness of EbA. This in turn relates to a lack of consensus on how best to measure the effectiveness of EbA at multiple levels. Drawing on the literature, in particular work by IUCN, and in close consultation with in-country experts, we will develop a framework for evaluating effectiveness and obstacles to implementation of EbA initiatives, and will test and refine these methods by collating data from a diverse portfolio of EbA initiatives across the developing world. By doing so, this project ultimately aims to help policymakers recognise when and how EbA is effective as a result of improved evidence- and community-based learning and, where appropriate, how they can integrate EbA principles and approaches into national and international climate adaptation policy and planning processes.

See Glossary for underlined terms.

Background

The problem: how should we be adapting to climate change?

Global climate is changing rapidly,[3] and the hazards arising — extreme weather, growing frequency of droughts, floods and fires, sea level rises, crop failures and so forth — are being felt across the globe and increasingly threaten lives and livelihoods.[4] With global temperatures locked into at least 1.5–2ºC of warming by 2100,[5] adapting to climate change is arguably humanity's biggest challenge this century. The cost of meeting this challenge has been estimated at US$49 billion to US$171 billion per year,[6]. A major outcome of recent international Conference of Parties (CoP) negotiations as a commitment to generate at least US$100 billion per annum to meet global adaptation needs. The key question is: of the various approaches to adaptation, which should be adopted, under what conditions, and in what regions?

To date, the dominant approach to climate change adaptation has been investment in engineered interventions, such as sea walls, levees or irrigation infrastructure.[7] However, there is growing recognition that nature-based solutions or ecosystem-based approaches (EbA) may often provide the optimal (ie the most cost-effective and beneficial) adaptation solution. The widely accepted Convention on Biological Diversity (CBD) definition of EbA is explicitly *human-centric*: "The use of biodiversity and ecosystem services […] to help people adapt to the adverse effects of climate change"[1] "…that may include sustainable management, conservation and restoration of ecosystems, as part of an overall adaptation strategy that takes into account the multiple social, economic and cultural co-benefits for local communities."[2] As such, EbA approaches include "the potential for natural infrastructure to provide... disaster risk reduction, food security, sustainable water management and livelihood diversification".[7] A key example is the restoration of coastal ecosystems (reefs, mangrove forests and marshes) to dissipate the energy of powerful tropical storms,[8] the frequency of which is increasing under climate change.[9]

The solution: the role of EbA in the post-2015 policy arena

EbA is a very powerful concept. It has the potential to increase both social and ecological resilience to climate change and adaptive capacity in a long-term, economically viable and flexible way. Though often rooted in traditional knowledge and inclusive of the poorest and most vulnerable, it can also be key to sustainable development in developed countries. As

such, it unifies all three Rio Conventions. Its emphasis on maintaining or restoring biodiversity and ecosystem services and increasing habitat connectivity conserves biodiversity and thereby helps countries meet their obligations under the CBD. By increasing resilience to climate change at the same time as providing co-benefits such as carbon sequestration, EbA helps countries meet mitigation targets mandated under the United Nations Framework Convention on Climate Change (UNFCCC). Meanwhile, EbA often involves maintaining or restoring the capacity of an ecosystem to regulate water cycles and thus aligns with the goals of the United Nations Convention to Combat Desertification (UNCCD). In tandem, effective EbA promotes sustainability across multiple diverse sectors, from agriculture and forestry, energy and water to social justice, education and livelihood diversification, and as such could help countries meet the recently ratified Sustainable Development Goals (SDGs). In other words, EbA should be writ large in the post-2015 policy agenda, formally mainstreamed in international policy and broadly implemented. A growing number of organisations and countries are adopting EbA as a means for climate adaptation, especially at the community level and in the context of disaster risk reduction.[10] However, relative to hard infrastructural options, EbA is poorly represented in climate policy and currently receives a small proportion of adaptation finance.[11]

Why is EbA not being implemented and mainstreamed?

Recent reviews of the EbA literature highlight four major explanations for the low policy uptake of EbA.[12,13,14,15] First, there is uncertainty over how best to finance EbA in a locally sustainable and long-term way; while payment for ecosystem services (PES) may provide the answer in theory, there is a lack of evidence from the field as to how this might work in reality.[16] Moreover, alternative financial mechanisms such as large-scale government social protection, employment generation, or environmental management programmes (eg the Working for Water programme in South Africa) may provide more powerful solutions, though comprehensive assessment of their relative merits is lacking.

Second, there is a “mismatch between long-term impacts of climate change and short-term dynamics of governance and decision making”.[13,17] Engineered solutions to climate hazards are inflexible but can usually be implemented rapidly with immediate benefits, whereas EbA offers long-term flexible solutions with benefits that might not be reaped when the costs are felt (or within standard political or electoral cycles). Robust economic valuation of natural capital, combined with incentives to offset short-term costs, can help overcome these challenges.

Third, the evidence base for the effectiveness of EbA (including its economic viability) is currently weak, and there are growing demands from scientists and practitioners for robust quantitative or consistently collated qualitative data on the ecological, social and economic effectiveness of EbA projects relative to hard infrastructural or other alternatives.[18,19] It is only on this basis that policymakers can make informed responses to climate change and determine optimal ways forward for adaptation planning.[20] In particular, there is uncertainty in the science underpinning EbA. We lack understanding of how, and over what temporal and geographical scales, the natural environment buffers human communities against the effects of climate change (so-called ‘adaptation services’); how different services might trade off against one another; and how climate hazards interact with other stressors (eg land-use change) to influence adaption services and determine tipping points beyond which ecosystem functions fail and cannot recover.[5,18] Such uncertainty makes it hard to quantify the long-term costs and benefits of particular forms of conservation management, hindering implementation of effective EbA.

The final major challenge to EbA relates to issues around governance. EbA necessitates communication and cooperation over multiple sectors and scales of governance, with recognition of the diversity of local situations and with different institutions “jointly coordinating resource management over varying geographical or administrative scales”.[13] This flexible

model of governance is hard to achieve and thus rare. If EbA is to be implemented more broadly, we need a greater understanding of the degree to which it can be achieved under different models of governance, as well as of the political institutional barriers to developing flexible models.[11,13,14]

This project: what does effective EbA look like?

'Ecosystem-based approaches to adaptation: strengthening the evidence and informing policy' will focus on the last two challenges: (1) strengthening the evidence base on the effectiveness and economic viability of EbA and (2) identifying and overcoming political and institutional obstacles to implementation.

A major obstacle to meeting these challenges is a lack of consensus on how best to assess effectiveness at the local, regional and national levels. Currently, there is no single metric for assessing the effectiveness of adaptation in general, much less EbA effectiveness, and there is no standardised methodology to quantify the costs and benefits of different adaptation approaches. What counts as 'effective' adaptation can depend on the context within which decisions about adaptation are made, for example, the organisational objectives of those implementing any initiative or the initiative beneficiaries. Nonetheless, on the basis of the CBD definition of EbA given above, we define effectiveness in the simplest, broadest terms as:

> An intervention which has restored, maintained or enhanced the capacity of ecosystems to produce services on which local human communities depend for their wellbeing, adaptive capacity or resilience, and which reduce vulnerability, and which allows the ecosystem to withstand climate change impacts and other stressors.

This definition generates two major overarching questions that need to be addressed in order to determine whether a particular EbA initiative is effective:

1. *Did the initiative allow human communities to maintain or improve their adaptive capacity or resilience, and reduce their vulnerability in the face of climate change, while enhancing co-benefits that promote long-term wellbeing?*
2. *Did the initiative restore, maintain or enhance the capacity of ecosystems to continue to produce adaptation services for local communities, and allow ecosystems to withstand climate change impacts and other stressors?*

Following from the definition above, EbA should be financially and/or economically viable, and be supported by local, regional and national governments and involve synergistic interactions among multiple sectors. Therefore, two further overarching questions are:

3. *Is EbA cost-effective and economically viable for the long term?*
4. *What social, institutional and political issues influence the implementation of effective EbA initiatives and how might challenges best be overcome?*

These questions are broad, and encompass much important detail regarding how we assess and compare effectiveness in ecological, social and economic terms. They lead to a further set of nine more specific questions that reflect the growing consensus around the key characteristics of effective EbA (see Box 1). In particular, they reflect the general agreement that effective EbA should maintain or enhance ecological and social resilience and adaptive capacity for the long term; be based on best available science but developed with reference to traditional knowledge; encompass the needs of the most vulnerable; be highly participatory and community-based, incorporating basic human rights principles; involve multiple sectors and stakeholders; and involve transformational change.

In this project, we seek answers to these nine key broad questions from in-country partners across a diverse range of EbA and EbA-related projects (see Table 1). We acknowledge that not all projects will have answers to all questions, and not all answers will be comparable.

Moreover, some questions (eg those relating to economic viability) will require leverage of extra funding. However, this research process will shed much light both on how best to evaluate the effectiveness of EbA and on whether, how and when EbA is effective. The long-term aim is that in collaboration with a widening circle of partners, our approach will be scaled-up and applied to multiple projects spanning a wide range of ecological, climatic, socioeconomic and political contexts.

Objectives and specific questions

This project will test the *effectiveness* of EbA, determine the *obstacles to its implementation* and *influence policy*. To meet these objectives, we will work closely with partners from across a diverse portfolio of 15 EbA projects from 12 countries in the developing world and address nine questions, within four broad themes (Table 1). Here follows the breakdown of these questions, together with brief synopses of their context. The questions derive from a distillation of recent literature reviews of EbA and from recent learning from the field by IUCN.

Theme A. Effectiveness for human societies

Q1. *Did the EbA initiative improve the resilience and adaptive capacity of local communities, and help the most vulnerable (eg women, children and indigenous groups)? If so, over what time frames were these benefits felt, and were there trade-offs (or synergies) between different social groups?*

EbA is human-centric, emphasising the adaptation benefits to people of maintaining or enhancing ecosystem resilience. However, currently there is a lack of consistently collated data on the impacts of EbA initiatives on the resilience and adaptive capacity of local human communities. It is often claimed that the world's poor are both the most vulnerable to climate change impacts and the most reliant on natural resources. However, few studies closely examine who benefits from EbA initiatives amongst vulnerable communities (ie women, children and indigenous groups) and across broader scales.[18,26] Therefore, this project will determine whether and how EbA helps these groups and clarify both the winners and losers from EbA initiatives.

Q2. *Did any social co-benefits arise from the EbA initiative and if so, how are they distributed and what are the trade-offs between different sectors of society?*

Beyond helping people adapt to the adverse effects of climate change, EbA has the potential to provide a wide range of social benefits (co-benefits). These range from food and water security to disaster risk reduction, livelihood diversification and reduction in conflict over scarce resources.[27,28] Understanding the interplay between these benefits will improve the design and targeting of EbA projects as well as help with choices between EbA options, or between EbA and non-EbA alternatives. However, few EbA assessments capture the full value of these co-benefits effectively because they are often hard to measure, and consequently we have little understanding of (a) how co-benefits are distributed among different sectors of society, or (b) how they might trade off against (or synergise with) one another.[18,19,29] Therefore, this project aims to improve the ways in which the social co-benefits of EbA are captured and articulated; to clarify how co-benefits are distributed across communities; and to determine the extent to which different co-benefits conflict with or complement one another. This work will be conducted with a view to making it straightforward to collect similar data in future at different operational levels (community, local government, project implementers, and so on).

Q3. *What role in the EbA initiative did stakeholder engagement through participatory processes and indigenous knowledge play, and did/does the use of participatory processes support the implementation of EbA and build adaptive capacity?*

A key attribute of effective EbA is the use of fully participatory processes, in other words, EbA initiatives should be accountable to those they are meant to assist and not simply to those providing support (ie donors or governments; see Box 1). Participatory approaches to adaptation interventions can empower local communities and facilitate joint learning and two-way knowledge exchange between the community, especially more vulnerable members, and external stakeholders/beneficiaries.[19,30,31] In this project, we will determine the extent of direct involvement of communities in the establishment and maintenance of the EbA initiative, and whether this involvement helped to build resilience and adaptive capacity.

Theme B. Effectiveness for the ecosystem

Q4. *What were/are the factors threatening local ecosystem(s)? How did/do these pressures affect the resilience of the ecosystem(s) to climate change and other stressors, and their capacity to deliver ecosystem services over the long term?*

Q5. *After the EbA initiative, which ecosystem services were restored, maintained or enhanced, and did the resilience of the ecosystem(s) change? Over what geographic scale(s) and time frame(s) were these effects felt, and were there trade-offs (or synergies) between the delivery of different ecosystem services at these different scales?*

Natural environments provide a wide range of ecosystem services, many of which effectively buffer communities from the adverse effects of climate change. These so-called 'adaptation services'[5] can be provided directly (eg coastal ecosystems protecting local communities against erosion and wave damage)[21] or indirectly (eg agroforestry techniques helping maintain crop yield under drier or more variable climates).[22,23] Despite being used by human societies for millennia, the role of natural infrastructure in buffering communities against climate hazards was only formally recognised recently[6] and our understanding of the impact of different EbA interventions on ecosystem and human resilience is consequently limited. In particular, because much of the published literature on EbA emphasises the benefits, very little is known about the costs and trade-offs.[18,20,24] Trade-offs may exist, for example, where conservation targets clash with human benefits, or where one service (eg carbon sequestration) is more strongly emphasised than another (eg water security).[25] The influence of geographical scale or time frames on such trade-offs is also poorly understood. Ultimately, robust observational and experimental science underpins understanding of ecosystem resilience and the interplay of different services. However, local knowledge can also be extremely important. This is especially the case in communities living in risk-prone environments that have long histories of, and knowledge systems for, managing risk and enhance resilience. Therefore, in this project we will draw on both science and local knowledge to determine the key threats to the local ecosystem's adaptation services; to ascertain how and why the initiative impacts on ecosystem resilience and service provision; to clarify the extent to which these services have long-term benefits to all sectors of society; and to establish whether there are trade-offs when maintaining or enhancing different services at various spatial and temporal scales.

Theme C. Financial and economic effectiveness

Q6. *What are the general economic costs and benefits of the EbA initiative? How cost-effective is it, ideally in comparison to other types of interventions, and are any financial or economic benefits sustainable over the long term?*

Economic justifications for action invariably have most traction with decision-makers, and while there is some evidence to suggest EbA can be cost effective, robust financial and economic arguments for and against adopting EbA approaches are lacking.[26,28,32] After

considering operational costs, avoided losses due to disaster risk reduction, opportunity costs and economic impact, what is the business case for EbA? What effect does inclusion of co-benefits have on this consideration? Clearly, to answer this meaningfully requires a full cost-benefit analysis standardised across multiple sites globally. It is beyond the scope of this project to do this. However, we aim to understand aspects of both local financial and broader economic viability at our sites, and in particular to determine whether they are perceived (or actually calculated) as being sustainable over the long term. This information can help us develop appropriate methods for doing more rigorous cost-benefit analyses of EbA moving forward.

Theme D. Policy and institutional issues

Q7. *What are the key policy, institutional and capacity barriers to, or opportunities for, implementing EbA at the local, regional and national levels over the long term?*

Q8. *What, if any, opportunities emerged for replication, scaling up or mainstreaming the EbA initiative or for influence over policy, and how?*

Q9. *What changes in local, regional and/or national government or in donor policies are required to implement more effective EbA initiatives?*

EbA necessitates cooperation and communication across multiple regions, sectors and levels of government.[11,13,14] The ultimate success of EbA initiatives therefore hinges on the institutional, governance and policy context in which they operate, and how much flexibility there is in the system. This is true both at the local level — where capable local institutions are needed to make decisions and ensure active community participation — but also for high-level institutions.[20] It is possible that "significant changes may be necessary in future governance arrangements and institutions in order to achieve adaptation in a changing world".[33] However, to determine exactly what changes, if any, are needed, we need a much better understanding of whether pro-EbA policies have been created and implemented and which sectors/institutions tend to support them regionally. We also need consolidated information about the influence of EbA on policy development. Therefore, in this project we will identify the local, regional and national institutions involved with the EbA initiative and clarify how they communicate and cooperate; identify any incentives given to people for development of EbA (to compensate for short-term losses); and assess the extent to which EbA projects are being supported by local/national/international policies, such as national adaptation programmes of action (NAPAs) or national adaptation plan (NAP) processes. Where possible, we will also determine the extent to which EbA initiatives have themselves influenced local, regional and national policy development.

Box 1: Key attributes of effective ecosystem-based approaches to adaptation (EbA)

1. **Human-centric.** EbA focuses on maximising human wellbeing in the face of climate change by promoting the resilience of ecosystems and their capacity to help people adapt.
2. **Harnesses capacity of nature to provide adaptation services to people for the long term.** Includes maintaining adaptation services by conserving, restoring and/or managing ecosystem structure and function, and reducing non-climate stressors, in such a way as to maintain the potential for adaptation to climate change. This requires an understanding of ecological complexity and how climate change will impact ecosystems and key ecosystem services.
3. **Draws on and validates traditional and local knowledge**. Humans have been using nature to buffer the effects of adverse climatic conditions for millennia, and traditional knowledge about how best to do this should be drawn upon when implementing EbA.
4. **Based on best available science**. An EbA project must explicitly address an observed or projected change in climate or climate variability, and as such should be based on climatic projections and relevant ecological data at suitable spatial and temporal scales. Ideally, impacts on ecosystem resilience and adaptive capacity based on robust scientific knowledge.
5. **Targets the world's poorest, many of whom rely heavily on local natural resources for their livelihoods**. The people benefitting from EbA can, however, be relatively affluent. For example, water/flood management measures including EbA may benefit those in an industrialised country such as the Netherlands.
6. **Community-based and incorporates human rights-based principles.** EbA projects should abide by the same principles as those adopted under community-based adaptation (CbA), and as such use participatory principles for project design and implementation. In particular, people should have the right to influence adaptation plans, policies and practices at all levels, with vulnerable communities involved both in framing the problem and identifying solutions. EbA should consistently incorporate non-discrimination, equity, special needs of poor, vulnerable and marginalised groups, diversity, empowerment, accountability, transparency, and active, free and meaningful participation.
7. **Involves cross-sectoral and intergovernmental collaboration.** Ecosystem boundaries rarely coincide with those of local or national governance. Moreover, ecosystems deliver services to diverse sectors. As such, EbA requires collaboration and coordination between multiple sectors managing ecosystems (eg agriculture, water, energy, transport) and those benefiting from ecosystem services, and generally involve teams of multiple stakeholders. EbA may sometimes complement engineered approaches, for example, constructing reservoirs in tandem with restoring forests to manage water supplies, or combining dam construction with floodplain restoration to lessen floods. This approach also prevents EbA interventions from being undermined by less sustainable adaptation efforts.

8. **Involves cross-sectoral and intergovernmental collaboration.** Ecosystem boundaries rarely coincide with those of local or national governance. Moreover, ecosystems deliver services to diverse sectors. As such, EbA requires collaboration and coordination between multiple sectors managing ecosystems (eg agriculture, water, energy, transport) and those benefiting from ecosystem services, and generally involve teams of multiple stakeholders. EbA may sometimes complement engineered approaches, for example, constructing reservoirs in tandem with restoring forests to manage water supplies, or combining dam construction with floodplain restoration to lessen floods. This approach also prevents EbA interventions from being undermined by less sustainable adaptation efforts.
9. **Operates at multiple geographical, social, planning and ecological scales**. EbA can be mainstreamed into government processes (eg national adaptation planning) or management (eg at the watershed level), provided that communities remain central to planning and action.
10. **Integrates decentralised flexible management structures that enable adaptive management.**
11. **Minimises tradeoffs and maximises benefits with development and conservation goals** to avoid unintended negative social and environmental impacts. This includes avoiding maladaptation, where adaptation 'solutions' have unintended negative social or environmental consequences that reduce adaptive capacity.
12. **Presents opportunities for higher level support, scaling up and mainstreaming** to ensure the benefits of adaptation actions are felt more widely and for the longer term. This requires both upstream indicators (evidence of mainstreaming and capacity building amongst higher-level institutions and stakeholders) and downstream indicators (measures of adaptive capacity at household and community level.
13. **Involves longer-term 'transformational' change** to address new and unfamiliar climate change related risks and root causes of vulnerability, rather than simply coping with existing climate variability and 'climate-proofing' business-as-usual development. Adaptation is a long-term issue, so indicators chosen to measure effectiveness must accommodate timescales that are longer than typical project cycles. This is particularly important for EbA because ecosystems themselves are subject to change due to climate change and other stressors, and in some instances there may be a long lag before these changes are apparent.

Sources: [19, 29, 30, 32, 33, 38, 40-44]

Glossary of key technical terms

Term	Definition / Details
Adaptive capacity (human)	Ability to shape, create or respond to longer-term change in addition to recovering from shocks. Strengthens resilience and reduces vulnerability to a wide range of hazards. Requires information plus the capacity and opportunity to learn, experiment, innovate and make decisions. The amount, diversity and distribution of human, social, physical, financial and natural capital facilitate alternative strategies. Adapted from [38, 39].
Biodiversity	"The variability among living organisms from all sources including terrestrial, marine, and other aquatic ecosystems and the ecological complexes of which they are part; this includes diversity within and among species and diversity within and among ecosystems."[34]
Community-based adaptation (CbA)	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.[31]
Ecosystem functions	"Ecological processes that control the fluxes of energy, nutrients and organic matter through an environment. Examples include: primary production, which is the process by which plants use sunlight to convert inorganic matter into new biological tissue; nutrient cycling, which is the process by which biologically essential nutrients are captured, released and then recaptured; and decomposition, which is the process by which organic waste, such as dead plants and animals, is broken down and recycled."35
Ecosystem services	"The benefits people obtain from ecosystems. These include *provisioning* services such as food and water; *regulating* services such as flood and disease control; *cultural* services such as spiritual, recreational, and cultural benefits; and *supporting* services such as nutrient cycling that maintain the conditions for life on Earth. The concept 'ecosystem goods and services' is synonymous with 'ecosystem services'."[34]
Participatory approaches	Can be *passive*, where people are told what is going to happen or has already happened; *information giving*, where people answer questions posed by extractive researchers (they cannot influence proceedings and research findings may not be shared with them); by *consultation* by external professionals who define both problems and solutions (decision making is not shared, and professionals are under no obligation to take on board people's views); for *material incentives*, where people provide resources, for example labour, in return for food, cash or other material incentives; *functional*, where people form groups to meet predetermined objectives related to the project (such involvement tends to be during later project cycle stages after major decisions have been made); *interactive*, where people participate in joint analysis, which leads to action plans and the formation of new local institutions or the strengthening of existing ones (groups take control over local decisions so people have a stake in maintaining emerging structures or practices); or via *self-mobilisation*, where people take initiatives independent of external institutions, develop contacts with external institutions for the resources and technical advice they need, but retain control over how resources are used. Adapted from [36, 37]
Resilience (ecosystem)	The capacity of an ecosystem to tolerate impacts of drivers without irreversible change in its outputs or structure.[34]

Resilience (human)	Ability to absorb shocks or ride-out changes, but also to move beyond short-term coping strategies and a return to the *status quo* to long-term development in spite of (or in light of) climate change. Important components of resilience include a diversity of assets or livelihood strategies to reduce vulnerability to a wide range of hazards, good connectivity between institutions, and the degree of social inclusion and social capital.[38,39]
Vulnerability	Vulnerability to climate change is assessed in reference to a particular hazard, such as flooding, and considers underlying human and environmental factors. Vulnerability is affected by exposure to a hazard (often related to geographic location, such as living in a flood-prone area) and the sensitivity of the community affected (for example, a community dependent on rain-fed agriculture will be more sensitive to changes in rainfall).[38,39]

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‘Ecosystem-based approaches to adaptation: strengthening the evidence and informing policy’ is a four-year project coordinated by IIED, IUCN and UNEP-WCMC as part of the International Climate Initiative (IKI). It aims to test the effectiveness of ecosystem-based approaches to climate change adaptation, determine the obstacles to their implementation, and influence policy. This background paper presents the overarching questions that the research component of the project is setting out to address.

Project Materials

Biodiversity, Climate change

Keywords:
Ecosystem-based approaches to adaptation (EbA), climate change adaptation, policy, capacity building

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