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

Research results from the Ecosystems Protecting Infrastructure and Communities project, Burkina Faso

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Summary

Ecosystem-based adaptation (EbA) is the use of biodiversity and ecosystem services as part of an overall strategy to help people to adapt to the adverse effects of climate change. Under the 'Ecosystem-based approaches to adaptation: strengthening the evidence and informing policy' project, IIED, IUCN and the UN Environment World Conservation Monitoring Centre (UNEP-WCMC) are working at 13 sites in 12 countries to gather practical evidence and develop policy guidance for governments on how EbA can best be implemented. The project has developed a definition of effective EbA and a framework for assessing EbA effectiveness which has been applied at all 13 sites, and the results will be collated and compared to draw conclusions that are based on more than single case studies. This report presents the findings from a literature review and interviews with a wide variety of stakeholders conducted by IUCN at the project site in Yatenga and Lorum Provinces in Burkina Faso's northern region, where EbA measures including soil protection and restoration activities, water conservation activities, reforestation and farmer-managed natural regeneration, riverbank and dam bank protection, biodigestors and organic gardening were implemented. A number of capacity building activities were also undertaken at community and technical political partner levels.

The report concludes that local ecosystems at the project site are now more resilient and can better withstand the effects of climate change, and that local communities are now less vulnerable to these effects. Adaptation-related benefits were seen among all social groups in the project area. Local knowledge and expertise, and strong participation, is needed to achieve EbA objectives. A number of social co-benefits emerged from EbA, the most important of which was food security. The costs and benefits from the EbA interventions vary over time, with intense early investment needs diminishing in subsequent years and benefits being seen in the short, medium and long term. Limited technical support, financial resources and organisational capacity and leadership were among the barriers to implementation at the local level, while poor governance and coordination, and insecurity in the region were both barriers at the provincial and national levels. Although sustainability of the project was facilitated by various institutions, governance structures and policies, a number of factors could undermine this, notably the lack of technical and operational capacity for action amongst administrative and civil structures at all levels.

Acronyms

APROS	Association pour la Promotion des Œuvres Sociales
BMU	German Federal Ministry for the Environment, Nature Conservation and Nuclear Safety
CNDD	National Council for Sustainable Development
CONASUR	National Council for Emergency Relief and Rehabilitation
CONEDD	National Council for the Environment and Sustainable Development
EbA	Ecosystem-based adaptation
Eco-DRR	Ecosystem-based disaster risk reduction
EPIC	Ecosystems protecting infrastructure and communities project
DRR	Disaster risk reduction
EPIC	Ecosystems Protecting Infrastructure and Communities
IIED	International Institute for Environment and Development
IKI	International Climate Initiative
IUCN	International Union for Conservation of Nature
NATURAMA	Friends of Nature Foundation
NGO	Non-government organisation
SDGs	Sustainable Development Goals
UNCCD	United Nations Convention to Combat Desertification
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme
UNFCCC	United Nations Framework Convention on Climate Change
UNEP-WCMC	United Nations Environment World Conservation Monitoring Centre
VDC	Village Development Commission

Introduction

The global climate is changing rapidly, and as nations and the international and bilateral organisations and processes that support them plan how best to adapt to climate change, they need evidence on where to focus efforts and direct financial resources accordingly. The main approach to climate change adaptation to date has tended to involve investment in engineered interventions, such as sea walls or irrigation infrastructure (Jones et al. 2012). There is growing realisation, however, that ecosystem-based adaptation (EbA) may sometimes provide the optimal adaptation solution, particularly for poorer countries where people are more dependent on natural resources for their lives and livelihoods. A growing number of organisations and countries are implementing EbA and integrating it into emerging climate change policy responses (Seddon et al. 2016a; 2016b).

EbA is defined by the United Nations 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 part of an overall adaptation strategy" (CBD 2009). This definition was later elaborated by the CBD to 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" (CBD 2010). Examples of EbA include: restoring coastal ecosystems to lower the energy of tropical storms and protect local communities against erosion and wave damage; wetland and floodplain management to prevent floods and to maintain water flow and water quality in the face of changing rainfall patterns; conservation and restoration of forests and natural vegetation to stabilise slopes and prevent landslides and to regulate water flows preventing flash flooding; and the establishment of diverse agroforestry systems to help maintain crop yields under changing climates. Box 1 describes some of the key attributes of effective EbA, derived from a review of relevant literature (taken from Seddon et al. 2016b).

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

1. **Human-centric.** EbA emphasises human adaptive capacity or resilience in the face of climate change.
2. **Harnesses the capacity of nature to support long-term human adaptation.** It involves maintaining ecosystem services by conserving, restoring or managing ecosystem structure and function, and reducing non-climate stressors. 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. Traditional knowledge about how best to do this should thus 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 parameters, and as such should be based on climatic projections and relevant ecological data at suitable spatial and temporal scales.
5. **Can benefit the world's poorest**, many of whom rely heavily on local natural resources for their livelihoods.

6. **Community-based and incorporates human rights-based principles.** Like community-based adaptation (CBA), EbA should use participatory processes for project design and implementation. People should have the right to influence adaptation plans, policies and practices at all levels, and should be involved with both framing both the problem and identifying solutions. EbA initiatives should be accountable to those they are meant to assist and not simply those providing support (ie donors or governments). EbA should consistently incorporate non-discrimination, equity, the special needs of the 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 (eg agriculture, water, energy, transport) and stakeholders. EbA can complement engineered approaches, for example combining dam construction with floodplain restoration to lessen floods.
8. **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.
9. **Integrates decentralised flexible management structures** that enable adaptive management.
10. **Minimises trade-offs and maximises benefits with development and conservation goals** to avoid unintended negative social and environmental impacts. This includes avoiding maladaptation, whereby adaptation 'solutions' unintentionally reduce adaptive capacity.
11. **Provides opportunities for scaling up and mainstreaming** to ensure the benefits of adaptation actions are felt more widely and for the longer term.
12. **Involves longer-term 'transformational' change** to address new and unfamiliar climate change-related risks and the root causes of vulnerability, rather than simply coping with existing climate variability and 'climate-proofing' business-as-usual development.

Sources: Travers et al. (2012); Jeans et al. (2014); Faulkner et al. (2015); Reid (2014a); Reid (2014b); Girot et al. (2012); Ayers et al. (2012); Anderson (2014); Andrade et al. (2011); GEF (2012); ARCAB (2012); Bertram et al. (2017); Reid et al. (2009).

If properly implemented, EbA can meet objectives under all three Rio Conventions (Seddon et al. 2016b). For example, its emphasis on restoring natural ecosystems and increasing habitat connectivity helps countries meet their commitments under the Convention on Biological Diversity (CBD). EbA often involves maintaining the ability of natural ecosystems to control water cycles, or supports effective management regimes for dry areas, and thus aligns with the goals of the United Nations Convention to Combat Desertification (UNCCD). Many EbA activities sequester carbon and some prevent the greenhouse gas emissions that would be emitted from hard infrastructure-based approaches to adaptation thus helping meet mitigation targets under the United Nations Framework Convention on Climate Change (UNFCCC). EbA promotes sustainability across a range of sectors, including agriculture, forestry, energy and water, and as such could help countries meet their Sustainable Development Goals (SDGs) (Seddon et al. 2016b). Lastly, by increasing the resilience of vulnerable communities to extreme events such as flooding and landslides, EbA helps countries to meet the goals of the Sendai Framework for Disaster Risk Reduction (Renaud et al. 2013).

Despite its strong theoretical appeal, many positive anecdotes from around the world and the acknowledged multiplicity of co-benefits, EbA is not being widely or consistently implemented, or sufficiently mainstreamed into national and international policy processes. Relative to hard infrastructural options, EbA currently receives a small proportion of adaptation finance (Chong 2014) There are four major explanations for this (Biesbroek et al. 2013; Ojea 2015; Vignola et al. 2009; Vignola et al. 2013; Seddon et al. 2016b).

1. First, there is uncertainty around how best to finance EbA. International climate finance, through mechanisms such as the Green Climate Fund or the Adaptation Fund, is one possibility, but this will not provide enough to address adaptation challenges at the scale required to meet the needs of the world's poorest. Payments for ecosystem services (PES) is another possibility and may provide an alternative source of funding, or large-scale government social protection, employment generation, or environmental management programmes. However, in the context of providing finance for adaptation, both are in their infancy.
2. Second, many climate change impacts will be long term, but this does not sit well with what are usually short-term political decision-making processes often based on standard electoral cycles. Photogenic engineered adaptation solutions with immediate but inflexible benefits are thus often favoured over the long-term flexible solutions offered by EbA, under which benefits may only be apparent in the future.
3. Third, the evidence base for the effectiveness of EbA (especially its economic viability) is currently weak. Much evidence is anecdotal and comes from single case studies, and often the costs, challenges and negative outcomes of EbA activities are under-reported. More robust quantitative evidence, or at least consistently collated qualitative evidence, on the ecological, social and economic effectiveness of EbA projects relative to alternative approaches is needed (Doswald et al. 2014; Travers et al. 2012; Reid 2011; Reid 2014a; UNEP 2012).
4. The final major challenge to EbA relates to issues around governance. EbA necessitates cooperation and communication across multiple sectors and varying administrative or geographical scales. This is challenging for most models of governance, where decision making is often strongly based on sectors and administrative boundaries, and opportunities for supporting participation and locally-driven approaches are limited.

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

The ‘Ecosystem-based approaches to adaptation: strengthening the evidence and informing policy’ project was conceived to address the third (and fourth) challenge in the above list. The project aims to show climate change policymakers when and why EbA is effective, the conditions under which it works, and the benefits, costs and limitations of natural systems compared to options such as hard, infrastructural approaches. It also aims to promote and provide tools to support the better integration of EbA principles into policy and planning. The project is supported by the International Climate Initiative (IKI). The German Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (BMU) supports IKI on the basis of a decision adopted by the German Bundestag. The project is being implemented by the International Institute for Environment and Development (IIED), International Union for Conservation of Nature (IUCN) and the United Nations Environment World Conservation Monitoring Centre (UNEP-WCMC) in collaboration with 13 in-country partner organisations in 12 countries across Asia, Africa and the Americas (see Table 1). The project runs from July 2015 to September 2019.

Table 1: ‘Ecosystem-based approaches to adaptation: strengthening the evidence and informing policy’ project countries, partners and case studies

Project partner country	In-country partner institution	Project case studies
China	Centre for Chinese Agricultural Policy, Chinese Academy of Science	Participatory plant breeding and community-supported agriculture in Southwest China
Nepal	IUCN	Ecosystem-based adaptation in mountain ecosystems programme (Nepal)

Bangladesh	Bangladesh Centre for Advanced Studies	Economic incentives to conserve hilsa fish in Bangladesh – a supportive research project to the incentive-based hilsa fishery management programme of the Department of Fisheries
Kenya	Adaptation Consortium; Kenya Drought Management Authority	Adaptation Consortium – supporting counties in Kenya to mainstream climate change in development and access climate finance
South Africa	Conservation South Africa	Climate-resilient livestock production on communal lands: rehabilitation and improved management of dryland rangelands in the Succulent Karoo
Uganda	IUCN	Ecosystem-based adaptation in mountain ecosystems programme (Uganda)
Burkina Faso	IUCN	Ecosystems protecting infrastructure and communities (EPIC): strengthening local climate change adaptation strategies in West Africa
Senegal	IUCN	Ecosystems protecting infrastructure and communities (EPIC)
Peru	IUCN	Ecosystem-based adaptation in mountain ecosystems programme (Peru)
	ANDES	Indigenous people biocultural climate change assessment, Potato Park
Chile	IUCN	Ecosystems protecting infrastructure and communities, South America geographical component (EPIC Chile)
Costa Rica	IUCN	Livelihoods and adaptation to climate change of the Bri Bri indigenous communities in the transboundary basin of Sixaola, Costa Rica/Panama

In order to address the weak evidence base for EbA, the project has developed a definition of effective EbA and a framework for assessing EbA effectiveness. Effective EbA is defined as “an intervention that has restored, maintained or enhanced the capacity of ecosystems to produce services. These services in turn enhance the wellbeing, adaptive capacity or resilience of humans, and reduce their vulnerability. The intervention also helps the ecosystem to withstand climate change impacts and other pressures” (Reid et al. 2017, based on Seddon et al. 2016). This definition generates two 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?

By definition, EbA should also be financially and/or economically viable and for benefits to materialise it needs support from local, regional and national governments, and to be embedded in an enabling policy, institutional and legislative environment (Seddon et al. 2016b; Reid et al. 2017). This leads to two further overarching questions:

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

These questions encompass much important detail regarding how to assess and compare effectiveness in ecological, social and economic terms. They lead to a further set of nine more specific

questions (Table 2) that reflect the growing consensus around the key characteristics of effective EbA (Box 1).

This framework has been applied in 13 project sites in 12 countries, and results from all sites will be collated and compared during 2018 to draw conclusions that are based on more than single case studies and help answer the question of whether EbA is effective or not. Detailed guidance on the way that researchers and project managers can use the framework to draw conclusions about the effectiveness of an EbA project, or to shape project design or assess the progress of an ongoing EbA project or a project that has ended are provided in Reid et al. (2017).

Research conducted under the project is being used to help climate change policymakers recognise when EbA is effective, and where appropriate integrate EbA principles into national and international climate adaptation policy and planning processes. An inventory of EbA tools and a 'tool navigator' are also being developed to support this process.

Table 2: Framework for assessing EbA effectiveness

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 the 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 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?

Ecosystems protecting infrastructure and communities (EPIC): strengthening local climate change adaptation strategies using ecosystem-based approaches in Burkina Faso

The Ecosystems protecting infrastructure and communities (EPIC) project aimed to build community resilience by implementing nature-based solutions to disaster risk reduction (DRR) and climate change adaptation. Using pilot projects in six countries (Burkina Faso, Chile, China, Nepal, Senegal and Thailand), EPIC has strengthened the evidence base on the effectiveness of nature as a solution to disasters and climate change. Working with multiple stakeholders, EPIC has informed policy and built capacities for better integration of ecosystems into disasters and climate change management strategies (Buyck 2017; Monty et al. 2017; Rizvi et al. 2014). EPIC was implemented by IUCN and funded by the Federal Ministry for the Environment, Nature Conservation, Building and Nuclear Safety, Germany, through IKI.

EPIC project activities in Burkina Faso, West Africa, ran from 2013 to 2017. They were implemented in Yatenga and Lorum Provinces in Burkina Faso's northern region. The study sites encompassed six villages in four municipalities: Basnéré, Birdininga and Tougou in Namissiguima municipality; Tibtenga in Koumbri municipality; Ramdolla in Barga municipality; and Sillia in Titao municipality. Ecosystems in the project area are mainly dryland and agricultural ecosystems. Key national-level project partners in Burkina Faso included the National Council for Emergency Relief and Rehabilitation (CONASUR), and the National Council for the Environment and Sustainable Development (CONEDD). At sub-national level, Project partners included local governments (regional and municipalities) and associations.

The overall goal of the project in Burkina Faso was to diversify and strengthen the actors (and their strategies) involved in the prevention of, and adaptation to, climate change impacts (drought and floods) on livelihoods and natural resources. Specific project objectives included:

1. Documenting and assessing the risks and/or effects of climate change on poor people and on poverty reduction efforts to the benefit of local decision makers in the rural development, water resources and environment sectors.
2. Demonstrating the economic benefits of adopting an integrated EbA strategy to reduce vulnerability amongst poor rural communities.

Various integrated EbA strategies were implemented (see Box 2). These strategies were assessed and documented along with the impacts of climate change, and best practices were demonstrated. Stakeholders were also trained on mainstreaming EbA tools and approaches, and their awareness of the best adaptation strategies was enhanced. Key intended project beneficiaries were small farmers, who were to benefit from the identification of the best adaptation strategies, and field agents and local non-government organisations (NGOs), whose technical capacities were to be strengthened.

Genuine ecosystem-based adaptation initiatives must meet the following four criteria (Martin 2016; CBD 2009; CBD 2010): they must use biodiversity and ecosystem services; they must help people; they must support human adaptation to the adverse effects of climate change; and they must form part of an overall strategy. Although EPIC was initially conceived of as an Ecosystem-based disaster risk reduction (Eco-DDR)[1] initiative, overall the project meets all of the criteria for EbA. In practice, EbA and Eco-DRR initiatives are highly complementary and many initiatives can be categorised as both. Indeed, a review of EPIC argued that it was accurate to label the project "more as a hybrid Eco-DRR/climate change adaptation project than just Eco-DRR" (Monty et al. 2017).

[1] Ecosystem-based disaster risk reduction (Eco-DRR) can be defined as the sustainable management, conservation and restoration of ecosystems to reduce disaster risk, with the aim of achieving sustainable and resilient development (Estrella and Salismaa 2013). While aiming to primarily address disaster risk reduction, it is recognised that Eco-DRR can contribute to climate change adaptation (Monty et al. 2017).

Methodology for assessing effectiveness

The methodology applied for assessing EbA effectiveness is detailed in Reid et al. (2017). This guidance describes a process – based around asking a detailed set of questions – that can be used to draw conclusions about the effectiveness of an EbA project that has ended, such as the EPIC project.

Table 3 describes the EPIC project stakeholders in Burkina Faso questioned for this case study report. Most discussions were held and questions posed in French. Information sourced from national-level interviewees relates mostly to EbA initiatives generally in Burkina Faso, whereas those with local level experience of the EPIC project (local authority interviewees, project implementers and project beneficiaries) shared perspectives based more on their experiences of this particular project. Informants were interviewed once using an email questionnaire or face-to-face interviews.

Table 3: EPIC project stakeholders interviewed

Level of interviewees	Institutions and communities interviewed
National	Permanent Secretariat, National Council for Sustainable Development (CNDD – which is the new name for CONEDD); Permanent Secretariat, CONASUR; the Friends of Nature Foundation (NATURAMA – an IUCN member NGO); SOS SAHEL (an NGO).
Local authority	High commissariat of Titao (Haut-commissariat de Titao); Provincial Directorate of Agriculture of Ouahigouya; Regional Directorate of Animal Resources of Ouahigouya; Association pour la Promotion des Œuvres Sociales (APROS - an NGO in Ouahigouya); Titao Town Hall officials.
Project implementers	IUCN is the EPIC project implementing partner. One interview with an IUCN staff member was held.
Project beneficiaries	Focus group discussions with the beneficiary communities of Tougou (Yatenga Province) and Sillia (Lorum Province).

Along with the questionnaire results received, focus group discussions held and interviews conducted, published literature was also used to assess the characteristics of EPIC project activities that contribute to EbA effectiveness. The results of this assessment are described in the following results section.

Research results

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?

Did the EbA initiative improve the resilience and adaptive capacity of local communities, and help reduce vulnerability?

The major climate change related risks identified in the EPIC project area are drought and floods, as well as strong winds and high temperatures (IUCN 2015; Monty et al. 2017). Based on the initial project vulnerability capacity assessment workshop, a number of EbA-related technologies were identified and implemented to address these risks (see Box 2).

Box 2: Combined climate smart agriculture and EbA techniques adopted under EPIC to address droughts and floods

- ***Soil protection and restoration, and water conservation techniques***
  - Stone bunds built on 1,045 hectares of cropland. These align with land contours and provide an adaptation strategy against rainfall variability by reducing run-off and water erosion and increasing water infiltration, which reduces crop water stress during dry periods.
  - Zaï implemented 2,122 on hectares. This is a farming technique involving digging pits in the soil before the rains come to catch water and concentrate compost. It reduces the effects of drought by improving soil water infiltration and increasing crop yields.
  - Half-moons were put in place on ten hectares. This is a farming technique which prevents water run-off during rains and holds water in place, allowing it to seep into the soil where it can better nourish crops. Half-moons reduce the effects of rainfall variability and also contribute to land rehabilitation, soil stabilisation and reduction of water erosion.
- ***Reforestation and farmer-managed natural regeneration***. Some 42,022 seedlings produced in five community nurseries were planted in home gardens and farms. Reforestation contributes to adaptation as it protects croplands against wind and water erosion and regulates rainwater flow, leading to better water infiltration and groundwater recharge. It can also protect riverbanks against the effects of flooding. Some 264 hectares of cropland were restored using farmer-managed natural regeneration. This helped improve vegetation cover on degraded croplands, as well as improving forest resources and fodder provision, and protecting soils against erosion following heavy rains and strong winds.
- ***Riverbank and dam bank protection*** (at Tougou and Sillia), for example through waterbody greening and gully treatment. This reduced waterbody siltation by controlling water flow into waterbodies and the erosion of riverbanks induced by heavy rains.
- ***Biodigestors***. 32 biodigestor units were provided to transform domestic waste and cattle dung into biogas for cooking as an alternative to firewood. Effluents from the biodigestors are used to fertilize cropland.
- ***Organic gardening*** was promoted, including the establishment of 56 manure pits. Applying compost increases soil water retention capacity in addition to improving its physical and chemical qualities, and thus helps reduce the effects of rainfall variability.
- ***Artificial pools (Boulis).*** These man-made pools were constructed to collect run-off water in the Bereborn, Birdininga and Tibtenga communities. These structures increase water availability for activities including crop and livestock production. They therefore help reduce the effects of rainfall variability on community livelihood activities.

Source: IUCN (2015); Buyck (2017); Monty et al. (2017); Rizvi et al. (2014); Savadogo et al. (2012).

A number of capacity development activities were also undertaken to address the risks identified in the project vulnerability and capacity assessment (see Box 3).

Local authority interviewees, project implementers and project beneficiaries felt that EbA enabled local communities to improve their adaptive capacity and resilience, and reduce their vulnerability to climate change. Project interventions have made drinking water available for humans and animals, and improved farming conditions through the use of improved agricultural production and natural resource management techniques. Learning about environmental protection techniques has changed behaviour and increased people's capacity to respond to climate change. Local communities are now less vulnerable because they are able to withstand the effects of climate change.

Box 3: EPIC project capacity development activities

Community level

- Six village development committees were established to implement EbA project activities.
- Equipment was made available to each village (carts, wheelbarrows, pickaxes, shovels, ropes, measuring tapes, gloves, etc.).
- Three community training programmes on seed production (involving 30 people), zaï and stone bunds (involving 300 people) and composting (involving 30 people) were held. Capacity building on nursery development was provided.
- Several exchange tours between project beneficiaries in Senegal and Burkina Faso were organised for the project partners to learn from each other about the restoration of degraded lands, and the practices of half-moon farming, manure pits, biodigesters, wooded farms, and so on.

Technical and political partner level

- 30 partners (including ten NGOs, ten local government participants, ten technical partners and one research institution) were provided with training on Eco-DRR using Partnership for Environment and Disaster Risk Reduction techniques.
- 106 participants at the Climate Change Adaptation Day in 2014 were introduced to the concept of Eco-DRR.

Source: IUCN (2015); Monty et al. (2017).

Monty et al. (2017) argue that the innovations described in Box 2 were effective in building resilience. Focus group discussions held in 2017 provided anecdotal evidence that yields had increased where soil restoration practices were implemented. A survey conducted on sorghum production, the main staple food in the EPIC sites, also showed that yields with zaï alone were 1,290 kg/hectare, but when combined with stone bunds were 1,330 kg/hectare (Monty et al. 2017). Savadogo et al. (2012) also detail how these soil protection and restoration practices can reduce the negative effects of climate change in the northern Burkina Faso, particularly recurrent droughts, floods, strong winds/sand storms and high temperatures.

National-level interviewees felt that applying EbA in Burkina Faso more widely has positively affected resilience and local adaptive capacity. Technical, financial and physical capacities have been enhanced due to income generating activities, improved socioeconomic infrastructure and better production conditions. Diversification of activities and sustainable natural resource management has improved productive capacity despite inadequate rainfall. Rehabilitation and restoration of cropland has improved agricultural production, ensured food and nutritional security and improved the incomes of vulnerable people.

Which particular social groups experienced changes in resilience, adaptive capacity or vulnerability as a result of the initiative?

The project specifically targeted the northern region of Burkina Faso due to the high levels of vulnerability to climate change, food insecurity and poverty experienced here (Somda et al. 2014; Monty et al. 2017).

The soil restoration and reforestation and farmer-managed natural regeneration activities listed in Box 2 benefitted all 10,181 community members in the six project villages, especially smallholder farmers. The biodigesters brought benefits to around 600 community members and the manure pits brought benefits to over 100 community members (Monty et al. 2017).

Local authority interviewees, project implementers and project beneficiaries felt that changes observed in resilience, adaptive capacity and vulnerability were seen in all social groups. Local communities reported that these changes were felt at the community level irrespective of their social group within the

community, while regional technical services (the regional livestock department and provincial department for agriculture) said that changes had occurred for both men and women. One implementing partner commented that the poorest and most vulnerable people particularly benefitted, along with women and the entire community. Monty et al. (2017) explain how the project promoted gender equity and increased awareness on gender issues by including women in project activities such as meetings, trainings and innovation implementation. For example, an equal number of men and women attended the exchange tour to Senegal (Monty et al. 2017).

National-level interviewees felt that applying EbA in Burkina Faso more broadly had reduced the vulnerability of the most vulnerable actors and groups to erratic rainfall, and provided them with higher incomes. EbA initiatives have the greatest impact on the resilience, adaptive capacity and vulnerability of the most vulnerable social groups who lack secure access to land, inputs, training, and so on. Interviewees felt that it especially benefits those who depend on ecosystem goods and services, women, and poor and very poor households.

Trade-offs in terms of who *experiences changes in resilience, adaptive capacity or vulnerability,* where *changes occur and* when

Survey responses from local authority interviewees, project implementers and project beneficiaries confirm that the adaptation-related benefits of EbA are community-wide, and are not experienced by any particular community social group at the expense of another group. One implementing partner explained that the project worked at the household level, and that although not all households were covered, the hope is that local leaders can share the information acquired (and hence adaptation benefits) more widely. However, agro-pastoralists (those who produce crops and livestock) benefitted most from the project.

National-level interviewees commented that while all groups experience changes in resilience, adaptive capacity or vulnerability in one way or another as a result of EbA initiatives in Burkina Faso, the greatest beneficiaries are those who are directly involved in implementation and those in areas targeted by projects. Vulnerable groups who hold rights to, or are close to, forests have more opportunities than similar groups some distance away from forest resources. Individuals directly involved in projects will accumulate adaptation-related benefits to the exclusion of others. Who accrues adaptation benefits is largely determined by levels of risk aversion, which in turn are conditioned by social norms relating to natural resources management, such as those that give men more power and opportunities, thus ensuring they receive preferential treatment over women. Similarly, an individual's social status – for example, whether they are from an indigenous community or new to the area – and whether they hold land rights or not (which depends on gender) affects whether they accrue adaptation benefits.

National-level interviewees commented that short-term incentives, such as the distribution of 'cash for work' for implementing the climate smart agriculture and EbA measures described in Box 2, tend to have least effect on the most vulnerable groups, who are often 'invisible' and tend to be left at the back of the queue. This is partly because they lack confidence, and partly because rights holders and leaders retain most privileges and leave few opportunities for more disadvantaged actors.

No interviewees noted trade-offs in terms of *where* changes in resilience, adaptive capacity or vulnerability accrue.

In terms of *when* changes in resilience, adaptive capacity or vulnerability accrue, one implementing partner explained that the reduction in vulnerability resulting from EbA is often medium to long term, because some natural solutions – such as tree planting or riverbank greening – take time to yield impacts. There is therefore a trade-off between short-term and medium- to long-term benefits. National-level interviewees felt that the beneficial impacts of EbA initiatives for local people accrued after an average of two to five years.

Social co-benefits from the EbA initiative

Local authority interviewees, project implementers and project beneficiaries felt that EbA provided benefits that supported wellbeing and generated social co-benefits. Food security is particularly important, as climate change affects productivity. Agroforestry and stone bunds control water run-off, and the use of manure and compost as part of an integrated system also improves productivity. Other

co-benefits include disaster risk reduction, livelihood provision/diversification, knowledge enhancement, climate change mitigation, and improvements in natural capital. Respondents noted that young men who had wanted to start small-scale gold-mining initiatives have stayed in the village, families are working together more, people are learning more, communication and solidarity have improved, domestic workloads have lightened, and family situations have improved thanks to lower out-migration. National-level interviewees felt that when EbA is working well, co-benefits include fresh air, shade, produce, and improved local climate. Monty et al. (2017) note that Eco-DRR/adaptation projects have the potential to go beyond disaster risk reduction and climate change, and that communities testify that there is stronger social cohesion within and between villages as a result of the exchange visits organised under the project (Monty et al. 2017).

Distribution and trade-offs relating to social co-benefits

Local authority interviewees, project implementers and project beneficiaries felt that social co-benefits from EbA were felt across communities. One implementing partner explained, however, that some individuals accrued more co-benefits than others. For example, vulnerable communities were targeted by the project so benefited more, and local leaders participate in the project more so naturally end up benefitting more (but not because of elite capture).

National-level interviewees felt that everyone benefits from EbA initiatives when they are working well, as many co-benefits are accessible to the whole community. Co-benefits can multiply, for example when groups are inspired by EbA activities in other locations and replicate them at home. Some individuals accrue more social co-benefits than others, however, such as those with greater financial power, who can gain access to the best land, or particularly vulnerable groups targeted by EbA initiatives.

The role of participatory processes and local/indigenous knowledge

Local authority interviewees, project implementers and project beneficiaries felt that local knowledge and expertise was a key factor in achieving EbA objectives. Local authority interviewees reported that EbA approaches take account of local know-how and techniques to protect trees, grow crops and manage surface water. One implementing partner commented that local techniques for soil and water conservation were adopted under the EPIC project. National-level interviewees also felt that EbA initiatives in Burkina Faso take account of local knowledge and practices, and that they need to do so in order to succeed. In addition to good local practices such as maintaining sacred woodlots and ponds, periodic hunting bans and the use of traditional therapies, work is underway to improve other practices, such as zaï, cropping techniques and contour lines. Buyck (2017) explains that using local knowledge in the project helped make the case for EbA. Savadogo et al. (2012) comment that various endogenous practices already practiced in Burkina Faso can help build adaptive capacity.

One implementing partner explained that participation under the EPIC project could be categorised as 'interactive' as it involved joint planning, monitoring and lesson learning.[2] Various types of participatory approaches were applied:

- A vulnerability capacity assessment helped shape the design and implementation of project EbA measures (zaï, stone bunds and half-moon farming techniques) for community resilience. This was conducted during a five-day participatory workshop convening 52 participants including mostly

[2] Participatory approaches can be characterised according to the following typology: (1) passive, where people are told what is going to happen or has already happened; (2) information giving, where people answer questions posed by extractive researchers (they cannot influence proceedings and research findings may not be shared with them); (3) 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); (4) for material incentives, where people provide resources, for example labour, in return for food, cash or other material incentives; (5) 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; (6) 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); and (7) 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 Adnan et al. (1992) and Dazé et al. (2009).

community representatives from the six targeted villages as well as representatives from local NGOs, local government agencies and a national research institution (Monty et al. 2017).

- The Climate Resilience Evaluation for Adaptation through Empowerment tool helped identify vulnerabilities (Buyck 2017; Monty et al. 2017; Rizvi et al. 2014).
- The participatory Promoting Local Innovation toolkit was used to facilitate mutual learning and knowledge exchange to build adaptive capacity (Buyck 2017; Monty et al. 2017; Rizvi et al. 2014).
- Exchanges between local actors within and between countries were useful learning experiences for different communities, ensuring they became active leaders of change on their land (Monty et al. 2017).
- Survey results from local authority interviewees, project implementers and project beneficiaries showed various instances of:
    - local authority involvement,
    - technical assistance agreements signed with local governmental offices in charge of the environment,
    - new village committees being set up (for example, 'wood farmers'),
    - information, education and training for local populations,
    - workshops organized with local associations,
    - community visits and work efforts, and
    - ongoing efforts to organise and run meetings.

National-level interviewees also detailed several types of participatory processes used to involve local communities in EbA initiatives in Burkina Faso more widely, such as the ecosystem approach, negotiated stewardship procedures, adaptive management approaches, zoning, diagnostics, targeting particular beneficiaries and intervention zones, and identifying activities to be undertaken with communities.

Local authority interviewees, project implementers and project beneficiaries felt the use of participatory processes supported EbA and strengthened local people's adaptive capacities. They have enabled communities to become actively involved in managing local ecosystems, sharing knowledge, raising awareness and adopting appropriate management activities. Stakeholder engagement plays an important role in EbA, as local actors are involved in implementing activities that improve or create adaptive capacities. Several published papers also describe the main EPIC project lesson on the importance of learning from local people and of participatory mapping and analysis of vulnerabilities to ensure that the nature-based solutions implemented align with local community needs. Involving communities in defining priorities for action (solutions) and not just defining their vulnerabilities (problems) ensured a sense of 'ownership' and a strong commitment to implementation from all project stakeholders. Involving communities in different project stages strengthened community capacities and cohesion, and ultimately achieved community empowerment (Buyck 2017; Monty et al. 2017; Rizvi et al. 2014). Monty et al. (2017) also argues that successful participatory approaches can provide means to address gender issues.

National-level interviewees felt that participatory processes support other EbA initiatives in Burkina Faso, improving peace and social cohesion – for example, preventing and managing conflicts between farmers and livestock breeders – and thereby strengthening adaptive capacities. Similarly, improving the management of community spaces and resources enables local stakeholders to get more closely involved in projects, which makes project outcomes more sustainable and helps disseminate good practices.

Effectiveness for the ecosystem: did the initiative restore, maintain or enhance the capacity of ecosystems to continue to produce ecosystem services for local communities, and allow ecosystems to withstand climate change impacts and other stressors?

Factors threatening local ecosystem resilience and service provision

Interviewees identified a number of threats to local ecosystems and ecosystem service provision. These pressures destroy, fragment or negatively affect ecosystems and landscapes, contribute to desertification, reduce the capacity of ecosystems to adapt to climate change and other sources of stress and make them more vulnerable to climate change. Land degradation in particular is a major problem in Burkina Faso (Monty et al. 2017). These pressures also adversely affect ecosystem services provision, thus undermining living standards and making communities more vulnerable to climate change:

- Inappropriate growing and production techniques and misuse of chemical fertilizers, which destroy ecosystem structure and functions.
- Strong winds lead to treefall and affect ecosystem structure and functioning.
- Run-off water leading to soil erosion and environmental pollution.
- Short and intermittent rainfall.
- Straying animals destroy young trees and slow down ecosystem restoration.
- Global warming, including hazard events and erosion.
- Habitat destruction and destructive practices (such as felling trees to harvest honey).
- Forms of exploitation and overexploitation that degrade land and reduce species diversity, for example, woodcutting and timber harvesting, or small-scale gold mining activities.
- Conversion of natural habitats into agricultural land.
- Plant and animal diseases which lead to the death of trees and animals.

Many of these threats result from anthropogenic pressures such as poverty, demographic growth, energy demands, an inability to implement EbA recommendations, a lack of knowledge or poor governance (for example, tenure insecurity or a failure to respect ecosystem standards) (Monty et al. 2017).

Boundaries influencing ecosystem resilience

Communities targeted by the EPIC project belong to the same catchment area but the project targets the most vulnerable households, rather than all the landscape. More investment would be needed to work at the level of the entire ecosystem.

National-level interviewees explained how an ecosystem's resilience can be affected by its boundaries. For example, isolated forests are less genetically resilient to pest attacks or diseases than linked or continuous forests.

Thresholds influencing ecosystem service provision

It was unclear whether there were important thresholds beyond which the EPIC project site ecosystems could no longer provide key ecosystem services. However, national-level interviewees felt that ecosystems in Burkina Faso are no longer able to provide services once certain thresholds have been crossed in terms of temperature change, degradation, exploitation, and so on. For example, rising temperatures or increased degradation can reduce the density and diversity of species and gradually curtail the variety and scope of possible available services. If a water course or grove no longer exists, for example, the services they provide will disappear.

EbA initiative impacts on ecosystem resilience and services provision

All interviewees felt that EbA has had a positive impact on local ecosystems at the EPIC project site, which are now more resilient and can better withstand the effects of climate change. Ecosystems are recovering their functions again and ecosystem services are being restored and improved. Project interventions have initiated the restoration of soil fertility and improvement of water provision, supported reforestation activities and facilitated behavioural changes such as the willingness to protect ecosystems. Species diversity (flora as well as fauna such as birds and fish) is expected to increase, water points are available almost all year round, soil fertility is better and farming conditions have improved. National-level interviewees explained how the resilience of the ecosystem has changed as a result of farmer-managed natural regeneration, soil protection and rehabilitation or soil and water conservation practices, greater security and less pressure due to increased incomes. There have been noticeable improvements in the rehabilitation of degraded cultivable land, soil water holding capacity, and camping and tourism activities. Savadogo et al. (2012) also mention that reforestation and farmer-managed natural regeneration helps with climate change mitigation by improving carbon storage.

Geographic scale of ecosystem services provision and trade-offs or synergies between geographical scales

Local authority interviewees, project implementers and project beneficiaries felt that ecosystem services have been restored across the whole village territory, especially in forests, cultivated plots and land around dwellings. National-level interviewees explained how ecosystem services have been maintained, restored or improved at the communal, provincial and regional levels as a result of EPIC project activities. No trade-offs at different geographical scales as a result of EPIC project activities were noted.

Time frame over which ecosystem services are provided, and trade-offs or synergies between timescales

Local authority interviewees, project implementers and project beneficiaries felt that service provision has improved in the short and medium term. One project implementer felt that these improvements could last for more than ten years. Interviewees provided no examples of trade-offs at different timescales as a result of EPIC project activities. Some of the natural solutions implemented under the project did, however, take time to yield impacts.

Financial effectiveness: is EbA cost-effective and economically viable over the long term?

How cost-effective is the EbA initiative?

No cost-benefit analysis has been conducted for EPIC project activities. One implementing partner described, however, how EbA techniques have been tested elsewhere in Burkina Faso and have been shown to be cost-effective. National-level interviewees also explained that there is evidence that EbA project interventions in Burkina Faso are financially cost-effective. For example, when an initiative supported initially by a project is sustained and maintained after the project ends, this shows that the investment was worth it and that outcomes met expectations. In some instances, project equipment facilitated more accurate weather forecasting and prevented further flooding in intervention zones, but after initial outlays on equipment, beneficiaries become more financially autonomous.

How did the EbA approach compare to other types of intervention?

No formal studies have been conducted on EPIC project activities. National-level interviewees described, however, how EbA in Burkina Faso is regarded as much more inclusive, creative and dynamic than other climate adaptation, local development or land management approaches. Although projects are put in place to respond to certain (climate-related) realities and follow on from other initiatives, it is often the case that large sums of money are spent to little or no effect.

Broader economic costs and benefits from the EbA initiative

One implementing partner described a number of broader economic benefits emerging from the EPIC project:

- Avoided losses from disaster risks (damage from floods is otherwise huge along the whole river).
- Increases in land or service value due to reduced erosion along riverbanks where people have gardens.
- Local income enhancement due to greater productivity from gardens along riverbanks.
- Income from 'cash for work' when implementing the EbA and climate smart agriculture measures described in Box 2.

National-level interviewees explained that cost-benefit analysis of EbA interventions in Burkina Faso tends to focus on their operational costs and benefits, ignoring the fact that related financial and economic losses/gains may accumulate elsewhere.

Financial and economic trade-offs at different geographical scales

One implementing partner described how without the EPIC project, damage from floods would occur along the whole river, so losses would extend outside project area. Better flood management in the project area thus provides economic benefits outside the project area too.

With reference to EbA interventions in Burkina Faso, national-level interviewees detailed how communities in the immediate vicinity of projects – for example, producers who depend on forests – often end up losing out in some way, while communal and regional leaders or other actors may benefit considerably from orders for equipment. Over time, many parameters (such as accessibility) make it a lottery as to who ultimately benefits.

Changing financial and economic benefits and costs over time

One implementing partner described how the economic benefits from the EPIC project are short, medium and long term. Short-term benefits emerge from immediate improvements to food security, and longer-term benefits result from ecosystem restoration.

National-level interviewees explained that the costs and benefits from EbA interventions in Burkina Faso often change over time. Investment can be high in the first year, but would decrease in subsequent years.

Policy and institutional issues: what social, institutional and political issues influence the implementation of effective EbA initiatives and how might challenges best be overcome?

Local-level barriers to implementing EbA

Interviewees described a number of political, institutional and technical barriers and obstacles to the long-term implementation of EbA initiatives at the local level. Technical capacity issues and limited finances were key:

- ***Technical support is limited***. The different organisations that are expected to provide technical guidance on different natural resources management have limited capacity. There is a need to involve more technicians. Government offices in charge of the environment need to be more actively involved. More support is needed from the administration to ensure that the process is sustainable in the long term. Monty et al. (2017) also describe the need for developing a stronger scientific evidence base, particularly relating to quantitative socioeconomic assessments and cost-benefit analyses; this was mostly limited by capacity. Scientific evidence is needed to test whether anecdotal reports of crop yield increases reported as a result of endogenous soil restoration activities supported by the EPIC project are accurate and that vulnerability has in fact been reduced. Effective scientific monitoring of crop yields, however, requires long-term temporal data collection

and a strong presence on site (Monty et al. 2017). National-level interviewees also explained how EbA procedures need to be owned by individual actors and integrated into planning at the local level. People need to implement, perpetuate and evaluate EbA procedures to determine their impacts on ecosystems.

- ***Financial resources are needed***. More investment is needed in the area. The national budget provides finances to lower levels of government, and money also comes from NGOs and projects, but it is insufficient.
- ***There is a lack of local capacity, especially organisational capacity and leadership***. There are no strong local structures, only a few small groups. Township involvement in activities needs to increase, for example beneficiaries could compete to be the best managers. Representation is lacking. Monitoring and management committees need to be established. There is also a lack of equipment.
- ***Synergies between different actors and approaches are needed***. For example, work may be hampered by problems with mayor elections or conflict between the prefect and the mayor. The project will fail if it does not involve both parties. Rizvi et al. (2014) add that building strong partnerships with all EPIC project stakeholders was difficult as the technical services especially are used to working independently.
- ***Greater emphasis on training at the local level is needed***. Training technical agents in partnership with development projects would help. Improvements in policy level awareness levels are needed, as this affects what happens at the local level.
- ***Further local awareness raising is needed*** and attitudes need to change. All actors should own the approach and make it a personal cause. Local people's attitudes determine their motivation. More flexible procedures for technical and financial support to encourage wider dissemination are needed. Opportunities for support go through leaders, and complex procedures can be a barrier to EbA as many producers are illiterate. Illiteracy levels are high. Ecosystem problems occur at the grassroots level and can only be resolved with tools that are accessible to local people.
- ***The condition of local soils is degraded***.
- ***Insecurity*** in the Sahel. Monty et al. (2017) also describe how political instability made policy influence challenging. For example, changes in local government followed the 2015 coup d'état and made influencing policy at the local level very challenging. Staff changes in EPIC partner institutions meant networks and collaborations had to be built anew (Monty et al. 2017).
- ***Inequitable customs need to be addressed***. This includes local-level practices relating to gender or land tenure that concentrate power in the hands of certain individuals and encourage inequitable behaviour.

Provincial- and regional-level barriers to implementing EbA

Interviewees described a number of political, institutional and technical barriers and obstacles to the long-term implementation of EbA initiatives at both the provincial and regional levels. The main barriers described were technical and political:

- ***Dysfunctional governance*** by elected officials at the provincial and regional level. This results in poor planning and a failure to integrate activities into communal development plans. EbA procedures need to be integrated into regional-level planning, then implemented and evaluated.
- ***Limited technical skills*** and a lack of technicians.
- ***Insecurity*** in the Sahel, war, and political interventions that affect activities.
- ***Lack of funding*** and fundraising capacity. There is little provision for EbA in government budgets.
- ***Unsupportive attitudes***, including among the authorities. All actors should adopt EbA approaches. EbA is a low government priority.
- Inadequate synergies between different actors and approaches.

National-level barriers to implementing EbA

National-level interviewees described the following policy and institutional obstacles to the long-term implementation of EbA at the national level:

- ***There is a lack of coordination***, with too many actors engaged in the same activities in the same space. Synergies between different actors and approaches need to be developed and inter-sectoral links need to be improved. For example, CNDD is responsible for implementing adaptation strategies and policies, and CONASUR is responsible for disaster prevention, emergency relief and rehabilitation in Burkina Faso. CONASUR has a national Permanent Secretariat, as well as regional-, provincial-, district- and village-level councils for emergency relief and rehabilitation, through which it seeks to coordinate cross-sectoral disaster responses. Both CNDD and CONSAUR meet during biennial conferences, but there is no formal coordination between them.
- ***Insecurity*** in the Sahel, including the 2015 coup d'état which brought civil unrest for several months and major changes at the national government level, have made it difficult for the project to influence national-level policy processes (Monty et al. 2017).
- ***Country policies need to change*** and to be scrutinised at every level. Box 4 shows the extent of EbA mainstreaming into national policies. Policies related to disaster risk reduction, for example, do not explicitly include EbA or the role of ecosystems in risk reduction. Likewise, the Nationally Determined Contribution (Burkina Faso 2015) and the National Climate Change Adaptation Plan (Ministry of Environmental and Fishery Resources, Burkina Faso 2015) remain sector-focused rather than ecosystem-focused. Legislation that stops the concentration of power in the hands of certain individuals and encourages equitable behaviour also needs to be enforced and monitored more effectively.
- ***There is a lack of support from technical services,*** because the Burkina Faso government is not involved in EbA, political decision makers pay insufficient attention to the issue and there are no technicians or tools in place to provide support to local people. Without this change, donors will be less reluctant to invest in EbA. EbA procedures need to be adopted by individual actors and integrated into planning, implementation and evaluation procedures to determine their impacts on ecosystems.
- ***Knowledge needs to be improved and attitudes need to change***. A major challenge to integrating EbA into national policy processes is the lack of scientific data on ecosystem health and how ecosystem services can be used to adapt to climate change and natural hazards. All actors should champion EbA and make it a personal cause, but most policymakers do not know what EbA is or how it can enhance community resilience. Consequently, EbA is a low priority in policies. The general public and decision makers also know little about the impacts of adaptation planning efforts made by government since the National Adaptation Plan of Action was formulated in 2007, and then replaced by the National Climate Change Adaptation Plan in 2015 (Ministry of Environmental and Fishery Resources, Burkina Faso 2015).
- ***Capacity building is needed*** to better incorporate EbA into national adaptation policy and planning processes and promote tools on EbA integration. This is needed for policymakers, development planning agencies and civil society. CNDD and CONASUR are key strategic partners in this context, along with the Ministry of Environment. Savadogo et al. (2012) also detail how although many local adaptation practices have been documented, capacity building is needed to build real and sustainable strategies to address climate change.
- ***Further funding is needed*** to prioritise EbA, but capturing international opportunities for funding is a major challenge. Savadogo et al. (2012) explain the need for a major effort to mobilise financial partners and new funding mechanisms to help investors and institutions finance EbA practices.
- ***The capacity of institutions and people is weak***, but EbA requires good organisation and good planning.

Donors need to change the way they work in order to support EbA. Local authority interviewees, project implementers and project beneficiaries felt that donors need to help change the policies, institutions and capacities that will support EbA over the long term. Donors need to support more community-level training, fund the first phase of projects for five to ten years, and launch the second phase as soon as

possible. For local authorities, donors must support training to change local attitudes, create budget lines for communes, increase local awareness-raising activities, and finance projects for five to ten years. Regional technical services reported the need for donor support with increasing consultation, harmonising approaches, increasing local authority involvement, establishing partnerships with outreach services, and setting up long-term monitoring structures.

Local-level opportunities for implementing EbA

Interviewees from the local authority and regional technical services identified the availability of human resources, the openness of local people to awareness-raising efforts, and their willingness to learn and enthusiasm for EbA as key opportunities for implementing EbA initiatives. The potential for local development is huge. Monty et al. (2017) stressed, however, that a key EPIC project lesson was that to incentivise community engagement, non-ecosystem-based approaches and livelihood development related interventions may need to be integrated with Eco-DRR/adaptation approaches.

National-level interviewees described the following policy and institutional opportunities for the long-term implementation of EbA at the local level:

- ***Decentralisation***. This already occurs (for example, with planning tools such as communal development plans). Communities are starting to become better organised, and they have demonstrated know-how and capacity. NGOs are also present. It is expected that further decentralisation will facilitate the emergence of new leaders who can contribute to wider EbA implementation.
- ***The existence of an institutional framework for implementation***. Village development commissions (VDCs) and strong local institutions, local governance and bylaws are present. Technical training services are being decentralised, and there are local development tools and regional and communal development councils. Some enlightened leadership and EbA 'champions' exist.
- ***Policies that provide frameworks for consultation***. For example, local and communal structures such as local water committees are present.

Provincial- and regional-level opportunities for implementing EbA

National-level and implementing partner interviewees described the following policy and institutional opportunities for the long-term implementation of EbA at both the provincial and regional levels. Regional involvement consists primarily of coordination rather than implementation:

- ***Autonomous regional structures***, such as regional and communal development councils, regional tools (such as regional development plans) and other master plans, VDCs, governors, and tests that facilitate project implementation. Decentralisation is strong in Burkina Faso (for example, with planning tools such as regional development plans).
- ***Supportive regional policy/legislation***, for example, regional policies that provide frameworks for consultation.
- ***EbA 'champions'***.

National-level opportunities for implementing EbA

National-level and implementing partner interviewees described the following national-level policy and institutional opportunities for the long-term implementation of EbA:

- ***National policy and legislation*** for sustainable development, agricultural and environmental issues is in place (see Box 4). The National Programme of Social and Economic Development details lines of action through projects that support sustainable development objectives, decentralisation, and so on. Legislative texts and other action plans and master plans are in place.
- ***Different institutional structures provide support***, such as CONASUR. Monty et al. (2017) also describes how close collaboration between the EPIC project and CONASUR provided a good entry-

point to leverage policy commitments, continued efforts and more actions on the ground. There is a strong national support, for example from the national climate change committee.

- ***EbA 'champions'*** are key.
- ***Several large EbA and DRR*** projects have been implemented in Burkina Faso (see Table 4). Burkina Faso has made significant efforts to promote planned adaptation since the formulation of its National Adaptation Plan of Action in 2007 and the National Climate Change Adaptation Plan in 2015, and a number of climate adaptation initiatives that use ecosystem services have been implemented. These provide opportunities to share experiences and learn.

Box 4: Key national-level policies and strategies supporting EbA and EPIC project activities in Burkina Faso

- ***National Adaptation Plan of Action*** (2007). Activities include the identification of existing climate change coping mechanisms and cataloguing of grassroots initiatives requiring support.
- The ***National Climate Change Adaptation Plan*** was adopted in 2015 (Ministry of Environmental and Fishery Resources, Burkina Faso 2015). It acknowledges the importance of protecting and improving the functioning of natural ecosystems. Proposed measures include: developing environmental education in both formal and non-formal education systems; implementing reforestation projects and programmes using local species; disseminating anti-erosion techniques; rehabilitating and preserving wetlands; rehabilitating silted basins and redeveloping catchment areas; planting woody and herbaceous species to prevent gully erosion; and developing research programmes on the resilience of fish, wildlife and forest species.
- The ***National Programme of the Rural Sector*** (2011-2015) has improving food security in the context of climate change as a key objective. A focus on land tenure and rural land-use rights, with implicit DRR components, supports EPIC activities.
- The ***Strategy for Accelerated Growth and Sustainable Development*** (Burkina Faso 2011) promotes the transferal of power and resources to local councils with the intention of promoting grassroots development. This strategy was followed by the ***National Programme of Social and Economic Development*** 2016-2020 (Burkina Faso 2016), which also emphasises the role of decentralised governance in the context of sustainable development and natural resources management in Burkina Faso.
- A number of strategies also support natural resource management:
  - ***National Programme Against Desertification*** (1986)
  - ***National Programme for Land Management*** (1992)
  - ***National Environment Action Plan*** (1991)
- The ***National Biodiversity Strategy and Action Plan*** (2011-2015) recognises the importance of ecosystem protection and biodiversity conservation. It promotes dynamic management and sustainable use of natural resources by empowering all actors, particularly local communities.

Table 4: Climate adaptation initiatives that use ecosystem services in Burkina Faso

Lead organisation	Project title	Objectives	Implementation period	Intervention zones
IUCN	Participatory management of natural resources and wildlife	Sustainable and participatory natural resource management that benefits communities	1996-2001	Around the old classified forests of Lagognèrè and Dïéfoula
	Improving the management of natural resources	Sustainable and participatory natural resource management that benefits communities	2002-2007	Waterfall, high basins (hippo pools), Sahel, Central/South region (Kaboré Tambi park)
	Participatory management of Gonsé classified forest	Sustainable and participatory natural resource management that benefits communities	2001-2002	Around Gonsé classified forest
	Support for increasing the adaptive capacity of local communities to climate change	Strengthening or enhancing the resilience of the ecosystem and neighbouring communities	2010-2015	Central east and central west areas
	Project to support populations dependent on forest resources	Strengthening or enhancing the resilience of the ecosystem and neighbouring communities	2016-2020	Central west, central south, southwest/east areas, Boucle du Mouhoun
CNDD	Ecosystem-based adaptation project	Four components: a geoclimatic information system; ecosystem protection and rehabilitation activities; climate-sensitive management of agro-ecological and hydrological systems in the Boucle du Mouhon forest corridor, and wetlands; project administrative oversight	2015-2021	Central west region, Boucle du Mouhoun, Sahel
CONASUR	Project to strengthen human security and community resilience in Burkina Faso	Ensure that communities in two zones are disaster resilient	2014-2017	North and Sahel
	Project to support women and youth following natural disasters	Help populations re-establish themselves and avoid repeated disasters	2014-2017	North and Sahel

	Climate information and early warning system	Climate information facilitates adaptation to change	2014-2018	Nationwide
NATURAMA		Improve local livelihoods and the state of the environment	2017-2018	Sourou (Boucle du Mouhoun), Oursi (Sahel)
SOS SAHEL	Let's plant a million trees together programme (Phase 3)	Combatting desertification in the Sahel	2014-2016	Gnagna, Komandjari, Loroum and Houet
	Food and nutritional security support project for poor and very poor populations in the central north and northern regions	Improving food security in households affected by the 2012 food crisis	2012-2014	Central north (Bam), and north region (Loroum)
	Project to reduce the effects of climate change and improve local living conditions in the commune of Boala	Improving local living conditions through sustainable natural resource management and reducing factors that contribute to food insecurity and risks associated with climate change	2013-2015	16 villages in Boala commune, Namenteng Province, central north region
	Support project to enhance the resilience of poor and vulnerable rural households in eight communes in the provinces of Yatenga and Loroum, in the North region	Contribute to sustainable improvements in the food and nutritional security of poor and vulnerable rural households by increasing their resilience to crises	2013-2017	Yatenga, Loroum
	Project to disseminate improved production techniques and support sustainable increases in agro-pastoral productivity	Significantly increase agro-sylvo-pastoral production by the most vulnerable communities through appropriate techniques to improve soil	2012-2015	East (Gnagna and Komendjarie)

Is the EbA initiative sustainable?

Interviewees felt there were a number of local policies, institutions and capacity-related issues that could support the long-term sustainability of EbA implementation in Burkina Faso:

- Local-level financial shortages will not affect sustainability as the EPIC project will continue due to household-level implementation after the project has ended.
- The institutions and governance structures that facilitate EbA are in place. For example, decentralised state structures at the local, provincial and regional levels (such as local authorities at

communal and regional levels) have been created by decree and are supported by other services. There are synergies between local authorities, between provincial and regional authorities (for example, provincial and regional directorates and councils), and at the national level, where CONASUR brings together all ministries.

- National-level policies relating to disaster risk reduction policy, climate change adaptation and mitigation, reducing emissions from deforestation and forest degradation, and economic and social development are in place.

Interviewees also described a number of factors that would undermine sustainability. Some of these are described in the sections above on local-, provincial-, regional- and national-level obstacles to the long-term implementation of EbA. National-level interviewees emphasised how administrative and civil structures at all levels lack technical and operational capacity for action. To ensure sustainability, community beneficiaries felt that ongoing meetings, more community monitoring of actions and knowledge sharing (training), and organising of community works was needed. Regional technical services called for new management committees, better monitoring of initiatives (by agents and functional producers organisations, and through new platforms to monitor biodigester activities remotely) and projects that can provide working capital.

Opportunities for replication, scaling up or mainstreaming the EbA initiative or for influencing policy

Some opportunities for EPIC project replication, scaling up or mainstreaming have already occurred:

- Exchange visits organised by the project provided an opportunity to export project approaches to other communities, which have since adopted or shown great interest in the practices they have been shown (Monty et al. 2017).
- The final EPIC project workshop in 2017 showed that local authorities recognised the relevance of Eco-DRR approaches. The governor of the region has committed to supporting any project upscaling (Monty et al. 2017).
- The project worked with CONASUR on a national action plan for strengthening risk reduction capacities and emergency preparedness and response (Monty et al. 2017). This plan was adopted in 2016 to serve as a framework for implementing the national emergency strategic plan.

Interviewees also described a number of opportunities for duplicating or scaling up EbA implementation, primarily by integrating it into government or donor policies:

- EbA can be integrated into new climate change policies (such as the reducing emissions from deforestation and forest degradation plus process, the National Adaptation Programme of Action, and the National Climate Change Adaptation Plan), Sustainable Development Goal processes, land degradation neutrality strategies, and responses to demographic changes in Burkina Faso and other African countries.
- Eco-villages also constitute an emerging opportunity. The eco-villages project is supported by UNDP and aims to support the process of setting up eco-villages by formulating and validating a national eco-village strategy.
- Integrating EbA into communal, regional and national development plans. National development plans in particular include projects to implement major government policies.
- Funds could be mobilised through donors. A change in donor policy could increase in-country funding, along with co-financing from and synergies with partners working in the same area. For example, co-financing was secured from a partnership with the World Food Programme in 2014 and 2015 (IUCN 2015).
- Attitudes to EbA amongst policymakers and planners are changing. An EbA advocacy programme could further assist with this.
- New tools should be developed to support country-wide EbA replication.

Conclusions

The EPIC project aimed to build community resilience by implementing nature-based solutions for DRR and climate change adaptation in six countries. In Burkina Faso, activities implemented in Yatenga and Lorum Provinces included various integrated and combined EbA and climate smart agricultural strategies, the assessment and documentation of climate change and of these strategies, and the demonstration of best practices. Stakeholders were also trained on mainstreaming EbA tools and approaches, and their awareness of the best adaptation strategies was enhanced. The major climate related risks identified in the EPIC project area are drought and floods.

Effectiveness for human societies

A number of EbA innovations were identified and implemented to address climate change risks. These included soil restoration activities, reforestation and farmer-managed natural regeneration, riverbank and dam bank protection, biodigestors, organic gardening and boulis (artificial pools). A number of capacity-building activities were also undertaken at the community and technical political partner levels. These innovations and capacity building activities were effective at increasing resilience and adaptive capacity and reducing vulnerability.

Within the project target area, which was characterised by high levels of poverty and vulnerability, changes observed in resilience, adaptive capacity and vulnerability were seen in all social groups, and no particular social groups benefited at the expense of another. Some interviewees commented, however, that adaptation benefits in Burkina Faso tend to be felt by those individuals involved in projects who accumulate these benefits to the exclusion of, or at the expense of, other individuals. Experiences in Burkina Faso suggest EbA can particularly improve the resilience, adaptive capacity and vulnerability of the most vulnerable people. It can, however, take time for natural solutions to yield impacts.

A number of social co-benefits emerged from EbA, the most important of which was food security. These were felt across communities in project target areas and beyond, although some individuals did accrue more social benefits than others.

Local knowledge and expertise are needed to achieve EbA objectives. Local knowledge and a number of local practices were applied under the EPIC project. Various types of participatory approaches were also applied, most of which were interactive. These were central to supporting EbA and strengthening local adaptive capacity.

Effectiveness for the ecosystem

Climate change was one of a number of threats to local ecosystems and ecosystem service provision. Many of these threats result from anthropogenic pressures such as poverty, demographic growth, demand for energy and poor governance.

EbA resulted in a positive impact on local ecosystems at the EPIC project site, which are now more resilient and can better withstand the effects of climate change. Ecosystems have started functioning again and ecosystem services have been restored and improved. Service provision improved in the short to long term and no trade-offs between different timescales were apparent, although some of the natural solutions implemented under the project did take time to yield impacts.

Financial effectiveness

No cost-benefit analysis was conducted for EPIC project activities, but interviewees felt that EbA techniques applied elsewhere in Burkina Faso were cost-effective. Financial benefits from EbA were viewed more positively when compared to other adaptation approaches. A number of broader economic benefits also emerged from the EPIC project. Cost-benefit analysis of other EbA interventions in Burkina Faso often fails to capture these broader benefits.

There are trade-offs and synergies in terms of where financial/economic benefits accrue. Better flood management in the EPIC project area provided economic benefits outside the project area, but

communities close to EbA projects in Burkina Faso often lose out in some way, with economic benefits from EbA accruing elsewhere (with local leaders or with service providers).

Economic benefits from the EPIC project are short, medium and long term. Costs and benefits from EbA interventions in Burkina Faso can also change over time, with intense early investment needs diminishing in subsequent years.

Policy and institutional issues

A number of policy, institutional and technical barriers hindered the long-term implementation of EbA initiatives at the local level: limited technical support and financial resources; a lack of capacity, especially organisational capacity and leadership; the weak synergies between different actors and approaches; low levels of local training and awareness raising; degraded local soil conditions; insecurity; and the need to address inequitable local customs.

Policy, institutional and technical barriers to the long-term implementation of EbA initiatives at both the provincial and regional levels included dysfunctional governance; limited technical skills; insecurity; lack of funding; and the need for a change in attitudes and better synergies between different actors.

National-level barriers included a lack of coordination; insecurity; the need to improve national policies, improve attitudes and knowledge levels, and build capacity; the lack of support from technical services; funding needs; and weak institutional capacity.

Local-level policy, institutional and technical opportunities for implementing EbA initiatives include the availability and willingness of local people; decentralisation; emerging local leadership and organisation; and institutional and policy frameworks that support aspects of implementation.

Provincial- and regional-level policy, institutional and technical opportunities for implementing EbA initiatives include autonomous regional structures; supportive regional policy/legislation; and EbA champions.

National-level opportunities include some supportive national policy and legislation and institutional structures; EbA champions; and experience from several large EbA and DRR projects.

Sustainability of the EPIC project was facilitated by various institutions, governance structures and policies that facilitate EbA. However, a number of factors could undermine sustainability, notably the lack of technical and operational capacity for action amongst administrative and civil structures at all levels, and the need for ongoing monitoring.

Some opportunities for EPIC project replication, scaling up or mainstreaming have already occurred, and a number of opportunities for duplicating or scaling up EbA implementation, primarily by integrating it into national policies and development plans, are also possible.

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Ecosystem-based adaptation (EbA) is the use of biodiversity and ecosystem services as part of an overall strategy to help people to adapt to the adverse effects of climate change and promote sustainable development. This report presents the results of using our Framework for Assessing EbA Effectiveness at the Ecosystems Protecting Infrastructure and Communities project, Burkina Faso. The findings will be combined with those from 12 other sites in 11 other countries to help show climate change policymakers when and why EbA is effective.

Project Report

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