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

Research results from the Mountain EbA Project, Uganda

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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 and questionnaires with a wide variety of stakeholders conducted by IUCN at the project site in the Mount Elgon region in Uganda, where soil and water management and tree-planting activities were implemented to help mountain communities adapt to the adverse impacts of climate change.

The report concludes that the project was effective at helping people adapt to climate change impacts such as the drought, landslides, flooding and soil erosion expected in the Mount Elgon region, and produced extensive social co-benefits in the form of improved health and social cohesion, amongst others. A number of improvements to ecosystem service provision were also apparent under the project, although some of these took time to materialise. EbA practices appear to be financially viable for landowners, and one clear lesson from the project is that communities have more interest in economic and social than environmental benefits, so EbA measures must generate short-term economic and social benefits if they are to secure local support.

Acronyms

BMUB	German Federal Ministry for the Environment, Nature Conservation, Building and Nuclear Safety
CRiSTAL	Community-based Risk Screening Tool – Adaptation and Livelihoods
CVCA	Climate Vulnerability and Capacity Analysis tool
EbA	Ecosystem-based adaptation
GFS	Gravity Flow Scheme
GIS	Geographic Information System
IIED	International Institute for Environment and Development
IKI	International Climate Initiative
IUCN	International Union for Conservation of Nature
MWE	Ministry of Water and Environment
PES	Payments for ecosystem services
SDGs	Sustainable Development Goals
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme
UNFCCC	United Nations Framework Convention on Climate Change
VIA	Vulnerability Impact Assessment
UNEP-WCMC	United Nations Environment World Conservation Monitoring Centre

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 adaptation 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 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, Building and Nuclear Safety (BMUB) 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), the 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	Helping local communities to prepare for and cope with climate change in Northern Burkina Faso
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
El Salvador	IUCN	Mangrove ecosystem restoration and responsible fishing

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. It defines effective EbA 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. 2016b). 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 is being applied in 13 project sites in 12 countries, and results from all sites will be collated and compared to draw conclusions that are based on more than single case studies and help answer the question of whether EbA is effective or not. Reid et al. (2017) provide 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.

Research conducted under the project will then be 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?*
1. 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? 2. 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?*
1. 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?*
1. 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? 2. What, if any, opportunities emerged for replication, scaling up or mainstreaming the EbA initiative or for influence over policy, and how? 3. What changes in local, regional and/or national government or in donor policies are required to implement more effective EbA initiatives?

The Mountain EbA project

The 'Ecosystem-based adaptation in mountain ecosystems' project – or the Mountain EbA project – was implemented in Uganda, Peru and Nepal between 2011 and 2015, with funding from the German government. The project aimed to help rural vulnerable communities adapt to the adverse impacts of climate change by conserving, managing, restoring and maintaining ecosystem services and biodiversity, and enhancing adaptive capacities, as part of overall local and national adaptation

strategies. The programme had four main components, the implementation of which was led by different agencies as shown in Table 3 (MWE 2015; UNDP 2015).

Table 3: Components and lead agencies of the Mountain EbA project

Component	Lead agency
1. Development of methodologies and tools for EbA decision making in mountain ecosystems	UNEP
2. Application of methodologies and tools at national and ecosystem level	UNEP
3. Implementation of EbA pilots at ecosystem level	UNDP and IUCN
4. Formulation of national policies and building an economic case for EbA at national level	UNDP

Mountain regions are particularly vulnerable to the impacts of climate change. Globally, mountain people tend to be among the world's poorest and most marginalised populations. The disadvantages of general rural poverty are sometimes compounded by gender, ethnic and geographic discrimination. Mountain communities also tend to face additional challenges of subsistence brought about by elevation, topography and climate. Project countries were selected due to the particularly vulnerable state of their mountain ecosystems to climate change impacts (UNDP 2015; Mumba et al. 2016).

In Uganda, the project was implemented in the montane grasslands and shrublands of the Mount Elgon region. The Mount Elgon landscape is a transboundary ecosystem between Kenya and Uganda, which provides ecosystem goods and services to over three million people and their livestock. The project was implemented on the slopes below the Mount Elgon National Park in the districts of Kapchorwa, Kween, Sironko and Bulambuli in eastern Uganda (IUCN 2016). Approximately 624,000 people live in these four districts, and they are almost entirely rural and depend on rain-fed subsistence agriculture (UNDP 2015). The main source of livelihoods across the Mount Elgon landscape is crop production, supplemented by livestock production. Income from small businesses and other non-agricultural sources is minimal. Formal employment is also minimal. Livelihoods and the local economy are thus very dependent on natural resources. Grain crops, coffee and bananas are particularly important (MWE 2015). In addition to the partners listed in Table 3, key project partner institutions for work in Uganda are listed in Box 2 (UNDP 2015).

Box 2: Main partners in the Mountain EbA project in Uganda

- Ministry of Water and Environment
- Ministry of Finance Planning and Economic Development
- Ministry of Agriculture Animal Industry and Fisheries
- Ministry of Health
- National Planning Authority
- Uganda Wildlife Authority
- Makerere University Institute of Natural Resources
- National Forestry Authority
- National Environment Management Authority
- Members of the Mount Elgon Conservation Forum
- Kapchorwa, Kween, Sironko and Bulambuli District local governments

Predicted climate change impacts for the Mount Elgon region include temperature increases of 0.5–0.6°C over the next 20 to 50 years and an increase in rainfall of 18.7mm over the next 20 years. In terms of seasons, the present drier months of June, July and August are expected to receive even less

rain. This is expected to lead to several climate-related hazards such as soil erosion, flooding, landslides and drought (UNDP 2015; MWE 2013).

EbA measures implemented under the project in Uganda include: improved water retention through roadside drainage bunds and run-off retention drains; a gravity flow engineered irrigation scheme, combined with reforestation, soil and water conservation and riverbank restoration to create a hybrid grey-green solution to catchment-scale water management; and tree-planting using an agroforestry approach to stabilise soil and reduce landslides (UNDP 2015).

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. The Mountain EbA project overall meets all of these criteria, although some activities conducted under the project – such as financial literacy training, the use of solar lighting and fuel-efficient stoves, and the application of inorganic fertilizers – could not, on their own, be classified as EbA as they do not use biodiversity or ecosystem services to help people adapt.

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 Mountain EbA project. Table 4 describes the Mountain EbA project stakeholders interviewed for this paper. In some instances, particularly for the national-level stakeholders, questionnaires were filled in online rather than during a formal interview due to time constraints.

Table 4: Mountain EbA project stakeholders interviewed

Level of interviewees	Those interviewed
National	Key policy and decision makers connected to the Mountain EbA project at the national level, in particular the former project technical steering committee with representatives from all government line ministries, departments, development partners and civil society organisations at the national level. Many of these interviewees did not have detailed project implementation knowledge, but could provide information on the context within which EbA projects operate and on bringing lessons to scale. These seven interviewees were from the Ministry of Water and Environment, UNDP, the Environmental Conservation Trust of Uganda, the Ministry of Agricultural Animal Industry and Fisheries, the National Forestry Authority, the Office of the Prime Minister, and IUCN.
Local authority	Project focal persons from the local governments in the four districts that participated in project implementation (three male and one female). They supervised much of the work of the implementing community-based groups/organisations and therefore had first-hand information on project performance.
Project implementers	Civil society project implementers. Consultations targeted the leadership of the community-based organisations, community groups and also private companies that directly participated in project implementation. These included Kapchorwa Trinity Radio, Eco Development Foundation, Mount Elgon Beekeeping Community – Sironko, Masaba Foundation for Development, Nature Harness Initiatives and Tree Talk Foundation.
Project beneficiaries	Five representatives/members (including two women) from the following community groups: the Kapchorwa Community Development Association, Sironko Valley Integrated Project, Kwoti community group, Sangasana Women's Group, Sanzara community group.

Much has been written and published on the Mountain EbA project, so along with the interviews conducted, this was also used to assess the characteristics of the 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?

Major climate change vulnerabilities in the Mount Elgon region include drought, landslides, flooding and soil erosion (MWE 2013). The Mountain EbA project undertook a number of activities to address these vulnerabilities and improve resilience and adaptive capacity. These are listed below. Perspectives on changes to adaptive capacity, resilience and vulnerability as a result of these activities captured through interviews and in the published project literature are described. In summary, IUCN (2012) argues "[t]here is a clear link between social and ecological resilience, particularly for social groups or communities that are directly dependent on natural resources and ecosystem goods and services for their livelihoods." Local community group leaders that had participated in Mountain EbA project implementation also all reported that adaptive capacity and resilience had improved significantly since the project had begun. Before the project, communities in the target project areas reported that they were particularly vulnerable to soil erosion, river bank erosion, flash floods, the impacts of dry spells, and high levels of poverty. Following the project, most of the respondents reported reduced vulnerability.

- The introduction of fuel-efficient cooking stoves decreased deforestation and improved forest and tree cover due to reductions in fuel wood collection. This decreased landslides, soil erosion, drought and flooding. Communities in Kween (Kapchorwa District), and Bulambuli District reported an improvement in energy use efficiency through the use of Lorena fixed stoves and solar lighting, meaning less time was spent collecting fuel.
- The construction of a gravity flow scheme (GFS) in Sanzara Parish, which feeds a 200 cubic metre storage tank, has provided a secure water source for 1,000 people in Sanzara. This has allowed community members to develop irrigated agriculture and provide for livestock and domestic use during prolonged dry spells. Community members now produce more food in a smaller area over a shorter period, thus providing the 'economic space' in which to consider changing to other more sustainable land management practices (IUCN 2012; UNDP 2015). Farmers who used to incur losses due to crop failure caused by drought can now access water even during the dry season (Rizvi et al. 2014). The clean water will likely improve the health of local people, especially children, and thus improve their resilience (IUCN 2012). Local community group leaders explained how water for domestic use has greatly improved living conditions in some households. For example, in Bugitimwa (Sironko District) and Sanzara (Kapchorwa District), community members no longer travel long distances to fetch water, even in dry periods. Women and children have thus been spared the dangers associated with this.
- The introduction of improved agricultural practices and soil and water conservation activities – such as hillside drainage or trenches, terraces, grass bunds and banks, organic and inorganic fertilizers, improved/drought resistant seed varieties, crop diversification, hedgerows, agroforestry, mulching, farming along the contour lines, and water harvesting and storage in ponds and water tanks (MWE 2015) – have increased yields and thus incomes for those farmers that adopted these EbA-related practices, and have also improved their diets (PFCC-U Secretariat 2016; UNDP 2015). The various soil and water conservation technologies adopted by farmers have reduced soil erosion, flooding and landslides, and increased soil water retention, thus improving soil productivity and nutrient retention (Rizvi et al. 2014). The availability of continuous and clean water to downstream areas

during drought has improved, and the ability to harvest crops during drought periods has improved (UNDP 2015). Villages in Sanzara Parish which were dependent on food aid almost annually during drought periods before the Mountain EbA project are now self-sufficient, have more food security, and earn more income from selling produce (UNDP 2015). Local community group leaders interviewed reiterated that these various soil and water conservation techniques helped the farmers cope with floods and droughts. Irrigation technologies adopted by farmers in Sanzara (Kapchorwa District) and Bugitimwa (Sironko District), for example, have helped people cope with long dry periods and people can now access clean water for domestic purposes and tap water for irrigating vegetables throughout the year. In Kween, Sironko, Bulambuli and Kapchorwa Districts, tree planting, soil and water conservation measures and river bank protection all helped address soil erosion.

- Awareness-raising campaigns have sensitised people to the risks of poor land management and the adverse impacts of this on adjacent water bodies and human health (IUCN 2012). Practical demonstration sites and model farms brought people together for learning. Local community group leaders explained how project beneficiaries have been equipped with climate change knowledge and skills to mitigate risks. Knowledge on issues such as agro-forestry has increased diversification into fruit tree farming.
- Capacity support for local groups in different parishes has strengthened local governance and the people's ability to better manage climate change impacts (IUCN 2012). In Sanzara Parish, for example, interventions have improved cooperation amongst community members (PFCC-U Secretariat 2016) and strengthened the adaptive capacity of leaders (Mumba et al. 2016). Local community group leaders explained how participating communities in Kween, Kapchorwa District, received financial literacy training that has established a savings culture which is benefiting members through the acquisition of soft loans. Respondents reported that income diversification and financial literacy training had greatly reduced vulnerability, as people now have more access to finance in times of stress.
- The development and promotion of the Community Environmental Conservation Fund – a revolving incentives scheme whereby access to micro-credit, markets and irrigation equipment is tied to the communities' agreement to adopt climate smart farming practices (such as farm and river bank agroforestry) that enhance the Sipi River's health, structure and function – mean that landowners in the Sipi River catchment can financially benefit from performance-based actions. A total of 120 landowners covering 130 acres of land along the banks of the River Sipi enrolled in this incentive scheme (IUCN 2012; MWE 2015). Local community group leaders explained how the three river ecosystems that were targeted under the project were better able to tolerate the impacts of run-off which, prior to the project, would break their banks during heavy rains.

Community interviewees in Buyaga Parish and Bulambuli District did not report a reduction in vulnerability. In Buyaga Parish, where vulnerability was reported as unchanged, bee-keeping enterprises had instead become a threat to the community through attacks on humans and livestock as a result of poor hive siting and limited sensitisation of the communities to the dangers. As a result, most of the project recipients had abandoned the enterprise. UNDP (2015) also reports that some Mountain EbA project activities had no discernible adaptation benefits, such as the promotion of unbaked bricks and bee-keeping. These were therefore discontinued, even though it is arguable that they contributed to adaptive capacity through diversification of livelihoods and risk spreading.

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

Globally, mountain people tend to be amongst the world's poorest and most marginalised populations. General disadvantages of rural poverty are often compounded by gender, ethnic and geographic discrimination (UNDP 2015). Some 79% of Sanzara Parish inhabitants, for example, are poor, with 39% in the 'very poor' category (IUCN 2012). In the past, they have relied on food aid from the local district government (UNDP 2015). By working in the Mount Elgon landscape, the project therefore specifically targeted poor people. Interviewees also explained that the Mountain EbA project made a deliberate effort to target the poorest and most vulnerable people. Most project beneficiaries were located near forest or river ecosystems. Interviewees explained that efforts were made to include all vulnerable

groups, such as the elderly, women, indigenous people and children, many of whom are often particularly affected by water stress.

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

Most interviewees felt that adaptation benefits had not accrued to some social groups at the expense of others, but a small number of interviewees felt this was not the case. The project put a number of mechanisms in place to help those with less capacity to access benefits. For example, tree seedlings were provided to those who could not access them. The project also attracted other non-government organisations, which provided seedlings to those who were not beneficiaries under the Mountain EbA project. Gwali (2014) also comments that it was not always easy to target women. For example, tree planting could actually make women more vulnerable because in most cases trees are owned by men, and whilst women are the major users of products such as firewood, men generally prefer to sell firewood for money. Likewise, women do not own land and are thus likely to be more interested in interventions related to medicinal plants and handicrafts as sources of livelihoods. Some interviewees also said that bee-keeping enterprises introduced in Buyaga Parish had costs for neighbouring households due to their incompatibility with livestock. This led to conflict between those managing livestock and beekeeping enterprises.

Interviewees were evenly split on whether adaptation costs or benefits accrued in one area at the expense of another. A project vulnerability impact assessment (VIA) identified three specific river ecosystems as hotspots to specifically target for project activities. So some areas benefitted more than others within the Mount Elgon landscape. For example, not all community members enrolled in and benefitted from the incentives scheme (Rizvi et al. 2014), and the GFS provided water for domestic use and irrigation only in very localised areas.

Interviewees also commented that neighbouring communities benefited from project activities due to improvements in ecosystem service provision. For example, controlling soil erosion improved downstream ecosystems and water supplies. The River Sipi in Kapchorwa District provides water for Sanzara Parish, but water originates from the slopes of Mount Elgon and the river traverses an intensely used landscape that undermines water quality as it travels downstream. Parishes in upstream areas, where the river banks are still reasonably well vegetated, have access to cleaner water compared to parishes in midstream areas. Downstream community adaptive capacity (and vulnerability to floods and landslides) is thus threatened by upstream degradation and contamination from poor farming methods on steep slopes, which cause extensive soil erosion and consequent siltation of the river (Mumba et al. 2016; IUCN 2012). The promotion of integrated watershed management under the project ensured that both upstream and downstream users benefit from the Sipi River's ecosystem goods and services. The project termed this 'no regrets' EbA (IUCN 2012).

Most interviewees agreed that there were both short- and long-term gains from the project, and that at times there were trade-offs or synergies between the two.

Short-term benefits emerged from the early implementation of EbA project activities on the ground following a project VIA. For example, better access to water increased crop yields and provided visible tangible social benefits from the outset (no food aid was needed in Sanzara one year after the project began), and other early 'no regrets' activities generated immediate economic benefits from alternative livelihoods or improvements in agricultural or livestock production. The project adopted a phased approach to planning, which ensured early benefits accrued in order to help make the case for EbA and ensure local buy-in and commitment during later project phases, and to provide a solid foundation on which further planning could build (UNDP 2015). The performance-based incentive scheme operating under the project was expected to be an interim catalytic measure that would help communities see the links between their actions and the ecosystems on which they depend, as well as the value of the goods and services that emanate from a well-managed ecosystem (IUCN 2012).

Longer-term benefits emerged as a result of river bank rehabilitation and the time taken for new knowledge and skills to accrue. Benefits from tree planting projects also to a long time to accrue as trees take time to grow. Due to the scarcity of timber and fuelwood, however, project beneficiaries adopted the project tree-planting activities easily as the need for more wood was pressing. Benefits from leveraging support from other sources, building on Mountain EbA project activities, also took time

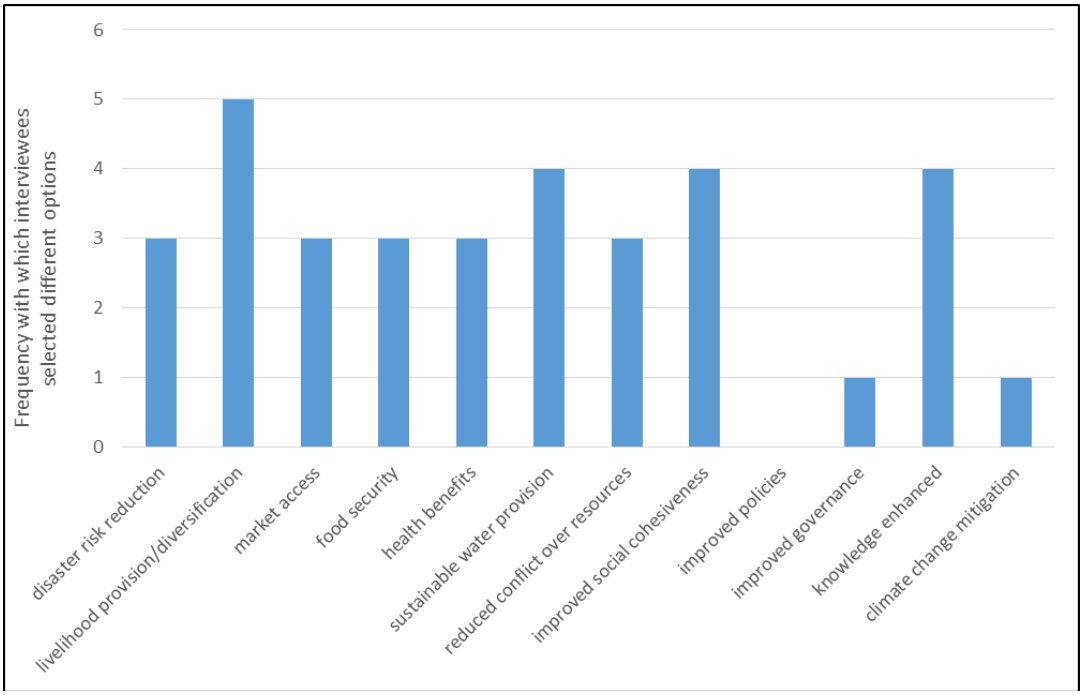
to materialize. For example, the Benet Community in Kapchorwa District sought additional support from other sources to build on project activities. One interviewee argued that the path to resilience is a long one as communities take time to adjust to new realities. For example, communities in Kween and Sironko are finally regaining their resilience after the project has ended. UNDP (2015) anticipates that the benefits emerging from the project are likely to last for the medium to long term, beyond the lifetime of the project. The performance-based revolving incentives scheme was due to be replaced by a revolving adaptation fund that community members could use for micro-credit in perpetuity. The idea was that the scheme would eventually be incorporated into local governance structures, institutions and management systems, thereby ensuring that ecosystems continue to be well-managed beyond the end of the project (IUCN 2012). Discussions with government officials on this are ongoing, but an end to external support and government staff turnover in Kapchorwa District have made this challenging.

Trade-offs mentioned by interviewees between *when* changes in resilience, adaptive capacity or vulnerability occur include the possibility that with increased water extraction for irrigation, water quantity might be reduced for communities outside the project area in time. River bank rehabilitation also required communities to stop growing vegetables such as tomatoes and cabbages or the fast-growing pines they prefer on the river banks, and instead leave them undisturbed or seeded with indigenous species. Locals thus experienced short-term losses from the reduction in land available for planting vegetables or pines. This is problematic as high population pressures and an acute land shortage has resulted in farming being undertaken in these critical areas, which might otherwise be left undisturbed. The project acknowledged this and tried to offset these short-term costs with support from a revolving incentives scheme for small businesses.

Social co-benefits from the EbA initiative

Interviewees chose a number of social co-benefits from the project from a pre-determined list. Figure 1 shows the frequency with which interviewees selected these different options. Livelihood provision/diversification scored the highest, followed by improved social cohesiveness, knowledge enhancement and sustainable water provision. Market access, food security and health scored the third highest, while mitigation and improved policies scored one and zero, respectively. The benefits of mitigation are long-term and not easily recognised by project beneficiaries except in places where energy saving projects such as Lorena stoves were introduced. Interview results clearly show that EbA interventions have a significant positive impact on community livelihoods in the short, medium and long term. However, many of these benefits are hard to disentangle from the benefits relating to improvements in adaptive capacity or resilience and reductions in vulnerability listed above.

Figure 1: Co-benefits derived from the Mountain EbA project



Published literature also offers some examples of the co-benefits chosen by the interviewees.

- Health benefits emerged from a stable water supply, enough food and better nutrition as vegetable cultivation allowed for a more varied healthier diet. The introduction of fuel-efficient cooking stoves reduced indoor soot/smoke, and the introduction of unbaked bricks also improved indoor air quality (UNDP 2015).
- Improved social cohesiveness emerged as fuel-efficient cooking stoves reduced the time spent collecting firewood and cooking. This left women in particular with more time to spend with their spouses and children. Increased cohesion and social capital also emerged among Sanzara Parish actors, who are usually divided and marred by ethnic and land conflicts, from establishing water groups and jointly planning and implementing activities. Conflict over water use has decreased. Community cohesion has also increased as a result of farmers helping each other more (UNDP 2015).
- Knowledge has been enhanced as more children are being sent to school by their parents compared to the pre-project period.
- Sustainable water provision meant less time was spent in search for water (UNDP 2015).
- The cultural value of upstream forests has increased as fewer people visit the forests to collect forest products (UNDP 2015).

Distribution and trade-offs relating to social co-benefits

No interviewees mentioned any ways in which one particular group accrued more project social co-benefits than another. In fact, some neighbouring communities benefited from project activities due to reductions in downstream siltation levels in the River Sipi. If the high levels of *E. Coli* currently found in the River Sipi as a result of high population densities and poor sanitation (IUCN 2012) fall, this could also benefit downstream communities.

The role of participatory processes and local/indigenous knowledge

All interviewees felt that activities under the project had sought and adopted local and indigenous knowledge to support implementation. They gave the following examples:

- Communities advised project officials on the best trees suitable for their areas during the implementation of tree planting activities.
- Farmers, particularly in Kween and Kapchorwa Districts, provided information on local solutions that were then improved by IUCN in consultation with the district technical staff under the project.
- Local knowledge of crops and indigenous trees was secured during several meetings attended by local communities.

A range of participatory processes were used in designing and implementing the various activities implemented under the Mountain EbA project in Uganda. Interviewees felt most of these could be classified as 'functional' or 'interactive.'[1] Examples given by interviewees and from published literature include:

[1] 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).

- ***Participatory rural appraisal tools were applied during the initial project stages*** with a special focus on marginalised groups within the community (UNDP 2015).
- ***Communities helped identify and prioritise problem areas in four districts*** for implementing EbA options. Sanzara Parish in Kapchorwa District was one of these. A community map of the most degraded areas in the catchment was developed and restoration measures for these areas, as well as those for enhanced river management, were determined. Beneficiaries identified 'no regrets' measures (UNDP 2015) and agreements were reached on collective and individual household actions under the Project (IUCN 2012).
- ***Project measures were selected in part due to the extent to which the local population participated*** in planning and implementation (UNDP 2015).
- ***A range of participatory tools were applied in Sanzara***. The project team helped the Sanzara community undertake a VIA. The Climate Vulnerability and Capacity Analysis (CVCA) tool and the Community-based Risk Screening Tool – Adaptation and Livelihoods (CRiSTAL) were applied (Mumba et al. 2016; Rizvi et al. 2014). These assessed potential climate impacts, the rate of ecosystem services depletion, key risks, what adaptation measures communities were undertaking, and EbA options. Five-year timelines and trends were developed based on national-level climate data. A problem and solution matrix detailed the main climate change challenges, namely, flooding and drought. The matrix showed how these affected livelihoods and different categories of people. A list of 'no regrets' activities was then identified. Based on this, the community prioritised various pro-poor activities and chose the GFS for implementation (UNDP 2015). Regular community project planning and reflection meetings in Sanzara Parish supported ensuing community engagement.
- **The *community contributed to 30% of the cost of the GFS*** in Sanzara Parish through the provision of labour. The scheme was officially launched on 11 April 2012 with construction of 6 kilometres of trenches eventually completed in September 2012 (Mumba et al. 2016).
- ***Participatory monitoring, reporting and verification indicators and an associated database have been established*** to monitor ecosystem changes. A participatory assessment was carried out to develop social baselines in Sanzara. Monitoring, reporting and verification are undertaken by the communities themselves (IUCN 2012; UNDP 2015).

Interviewees and published literature were resoundingly and unanimously clear on the fact that participatory processes supported the implementation of EbA and built adaptive capacity. IUCN staff argued that a key project conclusion was that sustained communication with project beneficiaries is central to implementing a successful EbA intervention. Participatory and interactive approaches are best suited for EbA interventions because placing people at the centre of any intervention is more likely to guarantee success. Such participatory approaches need to be adopted, explored further and developed into best practices for EbA interventions. They stated, however, that management of expectations is critical to help communities work together towards success. Examples of how adaptive capacity increased as a result of the application of participatory processes include:

- ***Understanding of the links between climate change, ecosystems and livelihoods improved***, as well as of EbA and its benefits. This enabled the implementation of early 'no regrets' measures on the ground (UNDP 2015; IUCN 2012). Using tools was an 'eye opener' for communities – it built community capacity and led to behavioural change and promotion of good practice (Mumba et al. 2016; Rizvi et al. 2014; UNDP 2015; IUCN 2012). The likelihood of maladaptation decreased due to wide stakeholder involvement in Sanzara Parish, and the use of local knowledge (Mumba et al. 2016).
- ***Local ownership of the project was enhanced*** as community issues were prioritised in project design and planning, and the project built on community knowledge and skills, used local resources for adaptation and involved communities in bye-law formulation and implementation (IUCN 2012; UNDP 2015; Rizvi et al. 2014).
- ***The project spurred innovation*** by using participatory processes to integrate new technologies (such as project incentives mechanisms) into its activities.
- ***Local institutional capacity increased*** due to participatory tool use (for example, community water groups were formed) (UNDP 2015). Local people summoned and demanded more from their

leaders and some village chiefs were changed. The district chairman always met with technical officers to respond to people's concerns, and the district had to budget for project extension to neighbouring villages as a result (Mumba et al. 2016).

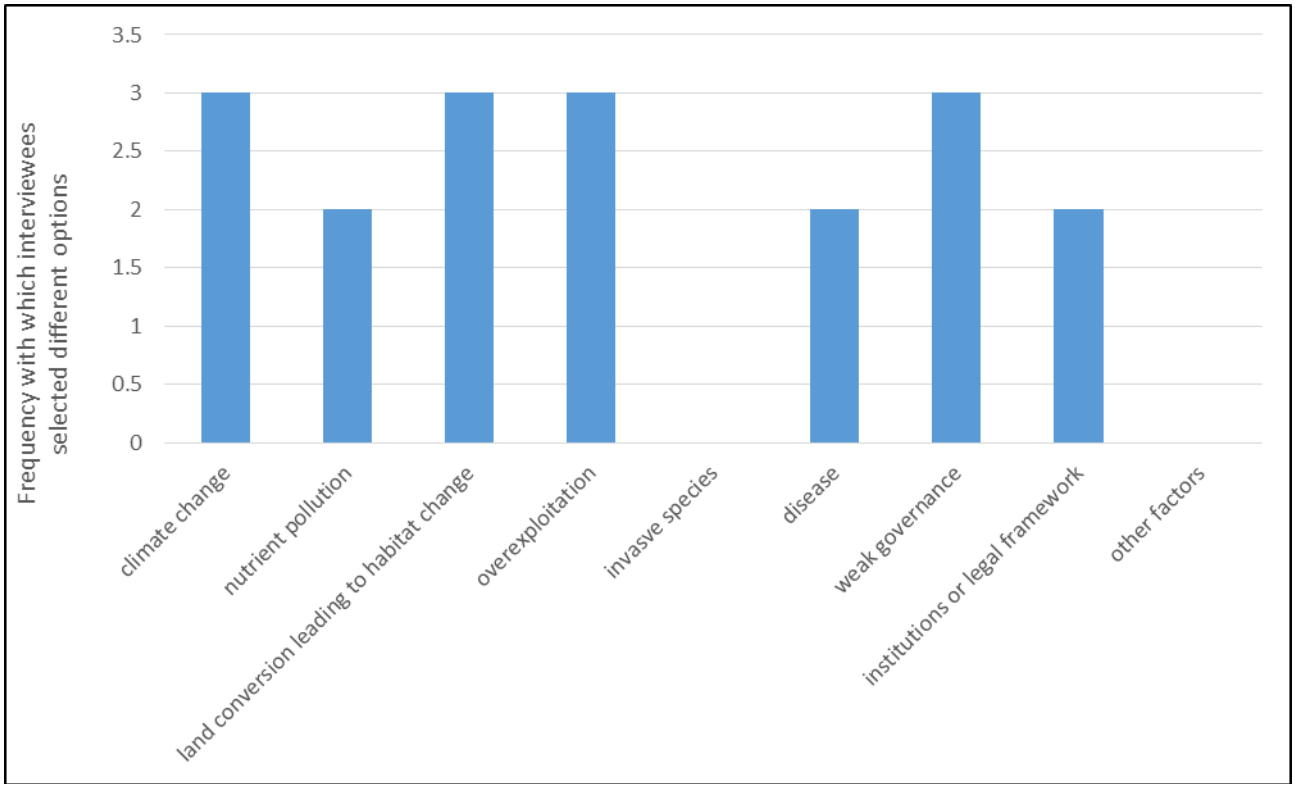
- ***Consensus and cohesion increased*** amongst communities, local government and partners due to participatory processes and tool use. For example, Sanzara Parish used to be divided and marred by ethnic and land conflicts, but the adoption of participatory processes in the context of the GFS promoted unity and community cohesion (IUCN 2012).
- ***Monitoring and adjustment of project implementation improved*** due to participatory tool use (Rizvi et al. 2014).

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

Out of a list of suggested options, interviewees rated climate change, land conversion, overexploitation and weak governance as the key factors threatening local ecosystem resilience and service provision. Figure 2 shows the frequency that interviewees mentioned each option.

Figure 2: Factors affecting ecosystems in the Mountain EbA project area



Weak institutions and legal frameworks were deemed less important issues affecting local ecosystem resilience and service provision. One project implementer felt this indicated that whilst local authorities now appreciate the challenge posed by climate change to local ecosystems, the link to governance is not fully appreciated as a critical factor that should concern the local authorities. Understanding the role of institutions in climate change management is arguably poor.

Interviewees and the published literature provided more detail on how some of these issues threaten local ecosystem resilience and service provision, notably climate change, and overexploitation and poor land management.

Climate change

The districts of Kween, Kapchorwa, Sironko and Bulambuli, where the Mountain EbA project is being implemented, are some of the most vulnerable areas to climate change in Uganda (MWE 2013). Mean annual temperature has increased by 1.3°C since 1960, at an average rate of 0.28°C per decade, at the project site (McSweeney et al. 2010) and temperatures are predicted to rise by 0.5–0.6°C over the next 20 to 50 years (UNDP 2015; MWE 2013). Temperature increases will melt glaciers and snow, bringing flooding and then drought. Up to 40% of yield losses for coffee, the leading commercial crop in the area, are expected by 2060. In some landscapes, coffee losses will be as high as 60–100% (Jassogne et al. 2013).

Rainfall is also expected to increase by 18.7 millimetres over the next 20 years at the Mountain EbA project site. More frequent intense rainfall episodes are expected in the short rainy season, whilst the drier months of June, July and August are expected to receive even less rain. Soil erosion, flooding, landslides due to soil destabilisation, drought and problems managing water are expected (UNDP 2015; McSweeney et al. 2010; MWE 2013). Flooding, dry spells, landslides and soil erosion are already pronounced climatic hazards in the Mount Elgon region (UNDP 2013), and interviewees noted how changes to traditional weather patterns are affecting cropping seasons. Roads have been destroyed by extreme weather events, and during long dry spells Sanzara Parish communities have few options but to cultivate the precarious riverbanks to support their livelihoods and productivity. In doing so, they further compromise the quality and availability of water (Mumba et al. 2016). Incidences of floods and landslides are already high. In 2007, for example, the eastern region of Uganda experienced the worst floods in 35 years, and in March 2010 several Mount Elgon districts experienced unusually high rainfall which resulted in landslides in Bududa District. Hundreds of lives were lost when landslides buried three whole villages. Households were displaced, and schools and health facilities were destroyed. In Kapchorwa District, about 300 hectares of wheat were destroyed. Nationally, coffee exports dropped due to disrupted transport systems. Some pumping stations were flooded, damaging the facilities for supplying treated water to affected districts (Mumba et al. 2016).

Additional climate related hazards experienced in the Mount Elgon region include strong winds, lightning, crop pests and diseases, famine and human diseases (MWE 2013).

Overexploitation and poor land management

Population growth is very high in the Mount Elgon Region and poverty levels are amongst the highest in the country, both of which have led to land shortages and unsustainable encroachment on, and degradation of, local natural resources (Mumba et al. 2016; MWE 2013). Several key species have disappeared locally.

Farming in ecologically sensitive areas such as steep slopes and river banks in the River Sipi catchment has led to extensive soil erosion and consequent siltation of the river and increases in landslide risk and flash floods. Reductions in water quantity and quality in downstream areas of Sanzara Parish have resulted (UNDP 2015). Interviewees explained that there is evidence – especially around Sanzara, where wells no longer provide water throughout the dry period – that groundwater recharge is not occurring and water sources are drying up. Intensive farming and a lack of contour ploughing and terracing in midstream and upstream areas have further reduced downstream water quantity and quality (Mumba et al. 2016; MWE 2013). The parish naturally experiences long dry spells each year due to its location in the rain shadow, but with declining water levels and contamination as a result of upstream practices, some of the Sanzara population have begun cultivating quick-maturing crops on the riverbanks during the dry spells (IUCN 2012). Interviewees explained that this has left the river buffers weak, with floods continuously breaking up river banks and washing away fertile top soils.

Poor farming methods have damaged soil ecosystems and reduced soil fertility as a result of constrained nutrient cycling. Soils have become unproductive with crop yields falling as a result, and resilience to climate change has reduced. Pastures have also been managed poorly, and vegetation is now less palatable to animals. The degradation of wetlands has reduced the quantity of water available for both domestic and agricultural purposes.

Deforestation is also a key cause of soil erosion and degradation in the area, and thus of reductions in crop yields. Increases in soil erosion as a result of tree-cutting has accelerated stream nutrient loading and stressed downstream river ecosystems by silting up wetlands and increasing flooding. Deforestation also dramatically increases landslide risks (Rizvi et al. 2014) and the impact of wind storms on households. Over-harvesting has also degraded forest ecosystems that have not been converted to agricultural land (Mumba et al. 2016).

Road construction and mining activities have exacerbated hazards (UNDP 2015).

Interviewees observed that the degradation of local ecosystems has in turn negatively affected the local climate and led to erratic rains that have prolonged droughts and affected crop production.

Boundaries influencing ecosystem resilience

Evidence from Mountain EbA project work in Uganda (and also in Nepal and Peru) suggests that the watershed or catchment scale is a particularly good scale for planning and implementing EbA measures, both in terms of securing EbA benefits in a more comprehensive and sustainable manner and making the case for landscape-scale approaches to district-level governments and protected area managers (UNDP 2015).

Prior to the implementation of the Mountain EbA project, adaptation actions in the area were small disparate efforts offering limited advantages to a small group of farmers aligned to crop value chains such as coffee, or local non-government organisations and community-based organisations. The starting point for the Mountain EbA project was the collation of information on existing practices, and the implementation of 'no regrets' actions in hotspots within the watershed and across the landscape (MWE 2015). Most initial 'no regrets' measures were done at the community scale, but when later VIAs were done, landscape connectivity became a key approach adopted at all sites. Thus, the GFS was nested in a broader catchment and riverbank management plan, and tree planting was integrated into broader landscape management and restoration plans. Particular emphasis was placed on water management at the catchment and riverbank scale in order to regulate water provision, and water erosion and hazards better. New Catchment Management Plans and Parish Adaptation Plans were developed and the project supported platforms such as the Mount Elgon Conservation Forum, initiated in 2012 to promote a landscape approach for addressing critical issues in Mount Elgon. Links with the Uganda Wildlife Authority and Lake Victoria Basin Commission of the East Africa Community have further supported transboundary management of the Mount Elgon region. This shift from stand-alone individual or village-level activities to interconnected EbA measures embedded in ecosystems as a whole and addressing the provision of ecosystem services in an integrated way across the landscape has proven beneficial in terms of addressing climate hazards such as floods, in addition to providing economic benefits such as improved livestock yields and agricultural production.

There were challenges to adopting a landscape-level approach, however. EbA farming practices gained in popularity but were not as widespread as non-EbA practices. Farmers who practiced EbA did so on small farms with an average size of two to five acres. Ngenge sub-county, Kween District, was the exception to this, but even there the average farm size was only eight acres (MWE 2015).

The Mount Elgon ecosystem is an important watershed for both Kenya and Uganda, as well as a key biodiversity area. As a result, it was declared a United Nations Educational, Scientific and Cultural Organization (UNESCO) Man and Biosphere Reserve in Kenya and Uganda in 2003 and 2005, respectively. It serves as a catchment area and a 'water tower' for the drainage system of Lakes Victoria, Turkana and Kyoga, and nourishes a vast array of rivers, including the Nile (IUCN 2016). Changes to the Mount Elgon system thus affect freshwater availability long distances away, as well as regionally, such as in urban areas downstream which depend on the mountain for their water supplies, and locally, for example altering local downstream water supplies and at times causing floods in nearby areas (MWE 2013; PFCC-U Secretariat 2016).

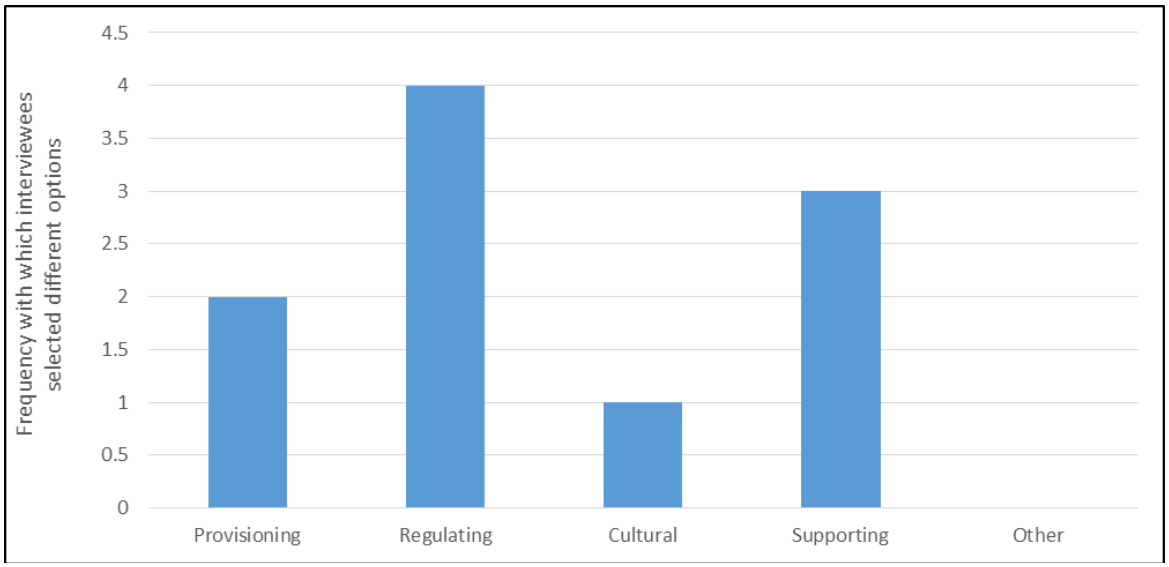
Thresholds influencing ecosystem service provision

Interviewees could not think of any thresholds beyond which the Mount Elgon ecosystems could no longer provide key ecosystem services.

EbA initiative impacts on ecosystem resilience and services provision

All interviewees agreed that ecosystem resilience had improved after the EbA initiative, and that ecosystem service provision had been restored when compared to the extensive degradation that existed prior to the project. Forested and grassland areas are now more resilient to climate change and with less risk of landslides, the ecosystem can cope better with extreme events (IUCN 2012; UNDP 2015). Choosing from pre-set options, selected interviewees picked regulating services as the category of ecosystem services showing greatest improvements (see Figure 3), particularly water purification. This was followed by supporting services, particularly nutrient cycling through agro-forestry practices. Restoration of cultural services was ranked least important, as most project activities were implemented away from cultural sites.

Figure 3: Restored ecosystem services at the project site



Interviewees and the published literature provided more detail on particular ecosystem service improvements observed or expected under the project.

Regulating services

Better water regulation and storage now occurs, with run-off and flooding better controlled, and aquifers recharged. Downstream water flow from upstream areas has increased, enhancing vegetation growth. Water retention has improved through roadside drainage bunds and run-off retention drains to address erosion problems (UNDP 2015). Tree-planting has restored the catchment and planting appropriate indigenous drought-tolerant grass species has enhanced grassland carbon storage. Slopes have been stabilised and landslide risk reduced due to improved farming and agroforestry measures (IUCN 2012; UNDP 2015).

Supporting services

Soil conservation measures (including agroforestry, mulching, grass banks, hedgerows, contours and trenches) enhanced soil productivity, fertility and moisture retention capacity, reduced soil erosion and the influx of nutrients into water bodies, provided a suitable environment for proliferation of fauna, and indirectly enhanced the forest ecosystem by reducing pressure on it from communities (UNDP 2015). Riverbank restoration, agroforestry and soil conservation measures reduced soil erosion and tree-planting also stabilised soils (UNDP 2015; IUCN 2012). Biodiversity overall was enhanced (UNDP 2015).

Provisioning services

The GFS enhanced water provision for crops, and thus increased benefits from agricultural livelihoods and income from crop sales. It also provided a steady water supply for human consumption (UNDP 2015). Soil conservation measures improved agricultural productivity and hence food availability, and together with riverbank restoration led to reduced levels of siltation and improved the quality of

downstream water supplies (UNDP 2015; IUCN 2012). Wood provision has improved from reductions in deforestation and tree-cutting as a result of the introduction of fuel-efficient cooking stoves and the use of unbaked bricks (requiring no charcoal to bake them) (UNDP 2015). Wood provision has also improved from the planting of drought-tolerant indigenous trees grown in tree nurseries in each parish village. To date 20,000 trees have been planted by 100 families (UNDP 2015; IUCN 2012) and three nurseries exist, each with clear management structures and the capacity to produce 50,000 seedlings (IUCN 2012).

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

In terms of spatial scope, interviewees noted that ecosystem services had been restored at the watershed level (at specific hotspots within the watershed) and local village level.

There were no trade-offs in terms of different areas losing out as a result of Mountain EbA project activities, but rather multiple synergies. For example, upstream activities to protect the watershed improved flood control and water quality in lower areas, especially given the 'water tower' role of the Mount Elgon landscape, feeding rivers and lakes downstream. Likewise, the bee-keeping project in Sironko helps to increase crop productivity more broadly due to increased pollination. Soil and water conservation activities in Bulambuli have reduced soil erosion, benefitting coffee growing areas (UNDP 2015).

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

Most interviewees felt that ecosystem restoration requires a medium- to long-term time frame of roughly two to five years, and that restoration should be continuous as ecosystems require time to adjust to new equilibriums. Benefits ranged from being immediate but will last for more than ten years. Certain benefits take longer to materialise than others, however, as some ecosystems take time to recover. For example, newly planted indigenous species take time to grow.

Interviewees could not list any trade-offs between timescales, but they described a number of synergies in terms of how ecosystem service improvements emerge both currently and in the future. For example, long-term provision of wood and poles emerged following tree-planting. Project implementers provided a clear long-term project plan to minimise trade-offs and enhance synergies, however, and tree-planting also provided wood for shorter-term benefits. Indigenous knowledge on trees was used to inform tree-planting plans accordingly.

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

How cost-effective is the EbA initiative?

A natural resource economic assessment was conducted in 12 sites covering upstream, midstream and downstream areas in the four project districts of Bulambuli, Kapchorwa, Kween and Sironko. Data were collected on farm, household, crop and livestock production (inputs, outputs and prices for produce), socioeconomic and EbA practices (such as the application of hillside ditches, grass bunds, bench terraces, contour farming, organic and inorganic fertilisers, minimum tillage, mulching and water conservation practices) and livelihood characteristics. Additional data based on case studies of key agricultural enterprises were also obtained to illustrate the potential of EbA in the landscape. A third set of data on soil erosion as measured by river siltation levels after rain was also obtained for each of the sampled sub-counties (MWE 2015).

The production data were used to explore profitability and inform a cost-benefit analysis. This analysis was conducted using the net present value decision criteria at a 12% discount rate. The results of the cost-benefit analysis showed that EbA practices were financially viable for landowners and that this viability could be sustained over a 15-year projection period even at the relatively high discount rate. EbA practices were shown to be viable throughout the landscape with the exception of the midstream

Kapsinda and Kaptoyoy sub-counties in Kapchorwa and Kween Districts, respectively. The projections suggest, however, that whilst the farm households adopting EbA practices in Kapsinda sub-county would be viable by the 12th year, adopting EbA practices in Kaptoyoy sub-county would not be viable within the projection period. Even in Kaptoyoy sub-county, however, the fact that EbA practices were not viable was more a result of poor application of EbA practices as opposed to the practices themselves. In the sub-county where benefits were highest (Bugitimwa sub-county in Sironko District), projected profitability equated to an average of US$983 per farm household per annum over 15 years. Generally, however, the average profitability improvements per year are more modest and range between US$34–983 per farm household per annum (MWE 2015).

A sensitivity analysis was conducted for the cost-benefit analysis based on a 10% annual increase in soil loss due to increases in annual rainfall expected with climate change, and the subsequent impact of this on the viability of EbA and non-EbA practices due to soil erosion and subsequent decreases in soil nutrient value. Results of this analysis showed that as climate change impacts grow, the viability of EbA practices such as grass bunds, terraces and drainage channels will be more pronounced in all sub-counties studied. Including results from the sensitivity analysis increased the gap between the net present value of EbA and non-EbA practices. Where the current net present value is small, climate change is likely to lead to a loss of top soil and crop productivity, which will affect farm viability. This means adopting EbA practices could be very important for farmers who are experiencing climate change (MWE 2015).

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

Project implementing partners (IUCN, UNDP and the Ministry of Water and Environment) felt that the EbA approaches adopted were more cost-effective than other approaches such as integrated water resources management, community-based adaptation or catchment-based water resources management. This was because under EbA communities proactively participated in and felt ownership of activities, and provided labour and worked with nature. Other interviewees were unaware of the economic assessment conducted so were less able to comment on financial/economic issues.

The natural resource economics assessment described above provides some evidence to corroborate the above perceptions. The assessment was conducted using a targeted scenario analysis framework, which was used to form two scenarios: the business as usual option whereby a hypothetical farmer would not adopt EbA farming practices, and a hypothetical farmer who adopts EbA practices (MWE 2015). Farming activities were divided into two categories: crop and livestock related. Labour costs across the landscape are generally higher for crop famers adopting EbA practices, but these farmers accrued much higher gross revenues and also profits across the landscape than non-EbA farmers (see Table 5). Results showed that investing in EbA was a worthwhile undertaking and generally likely to increase the income of participating crop farmers thus making it worthwhile for them to switch to EbA practices on their farms (UNDP 2015; MWE 2015).

Table 5: Profitability and t-test significance test for EbA and non-EbA practicing crop farmers

Districts	Sub-counties	Gross margins (Ugandan shilling/acre) representing profitability	
		EbA farmers	Non-EbA farmers
Bulambuli	Buginyanya	10,729,395	8,727,038
	Kamu	19,933,236	16,019,824
	Bulegeni	5,492,072	1,576,281
Kween	Benet	9,592,793	9,309,927
	Kaptoyoy	1,858,317	6,372,819
	Ngenge	15,252,965	12,315,995
Sironko	Bugitimwa	24,239,316	9,148,413
	Bukiise	12,249,610	9,909,327
	Busulani	4,989,574	1,670,976

Kapchorwa	Sipi	14,785,421	10,924,162
	Kapsinda	10,607,162	11,887,263
	Kawowo	5,570,847	3,419,845
T-test result		0.028	

The differences in profitability between EbA and non-EbA practicing farmers in the livestock sector were not significant at a 5% level of significance, although a weak correlation did exist (see Table 6). Livestock farming is less important to the local economy than crops, however, and when results from livestock and crop enterprises are combined, farmers with EbA practices showed significantly higher profits than their counterparts without EbA practices when assessed at a 5% level of significance. Investing in EbA was thus generally likely to increase the income of participating farmers with both crops and livestock (MWE 2015).

Table 6: Profitability and t-test significance test for EbA and non-EbA practicing livestock farmers

Districts	Sub-counties	Gross margins (Ugandan shilling/acre) representing profitability	
		EbA farmers	Non-EbA farmers
Bulambuli	Buginyanya	168,722	- 247,376
	Kamu	795,999	179,010
	Bulegeni	- 117,829	- 160,336
Kween	Benet	-78,105	65,761
	Kaptoyoy	1,016,293	390,646
	Ngenge	- 122,656	37,433
Sironko	Bugitimwa	306,456	699,299
	Bukiise	310,686	- 73,699
	Busulani	228,807	7,838
Kapchorwa	Sipi	- 241,533	6,220
	Kapsinda	- 993,830	886,824
	Kawowo	154,661	- 607,815
T-test result		0.46131	

A broader study of four sectors in Uganda – water, infrastructure, agriculture and energy – concluded that "[t]he cost of inaction is 20 times greater than the cost of adaptation". The study made a clear economic case for adaptation, with many of the proposed measures being 'no regrets' investments, which have a range of development benefits in addition to those relating to adaptation. Considering the co-benefits further strengthened the case for adaptation (CDKN 2016).

Broader economic costs and benefits from the EbA initiative

Interviewees and the published literature confirmed that a number of broader economic costs and benefits from the Mountain EbA project that go beyond project operational costs and benefits were apparent. Benefits included:

- Soil and water conservation activities (including agroforestry, mulching, grass banks, hedgerows, contours and trenches) increased income from enhanced agricultural productivity as a result of increased soil fertility, and reduced dependence on agricultural inputs led to savings (UNDP 2015; MWE 2015).
- Drought-resistant seed varieties led to additional income from increased productivity (UNDP 2015).

- Fuel-efficient cooking stoves and tree-planting reduced household expenditure on charcoal and firewood. Farmers can then shift savings to the health and education of their children.
- Continued water provision from the GFS improved agricultural livelihoods and increased income from the sale of a wider variety of crops.
- Enhanced skills acquired supported income-earning potential.
- Land value increased.
- Local income was enhanced from the project revolving fund.

The only costs mentioned were opportunity costs associated with other land uses not taken up, for example communities could no longer grow vegetables on the riverbanks. UNDP (2015) also argues that income could be increased further with the provision of additional support to access markets beyond the local scale, and that a key Mountain EbA project lesson is that it is important to support appropriate assessments of market opportunities for goods harvested or produced through EbA interventions.

Quantifying and estimating the monetary values of ecosystem services and environmental resources is very challenging. Many environmental goods are extremely difficult to value in practice, or confidence in the values and methodology used may be low. Because of this, one interviewee felt that the cost-benefit analysis could not provide an entirely realistic picture of the situation, as it didn't capture and quantify all the many benefits of the EbA approach. Assessing the multiple benefits of EbA with regards to climate change adaptation can also be challenging when it may not be clear exactly what climate change impacts are expected in a particular locality (UNDP 2015).

Financial and economic trade-offs at different geographical scales

Interviewees did not provide any examples of how economic trade-offs were experienced at different geographical scales.

Changing financial and economic benefits and costs over time

Some short-term losses from no longer being able to grow vegetables on riverbanks accrued, but these were often offset by long-term benefits from improved environmental management, and also short-term project incentives.

Interviewees confirmed that financial and economic benefits and costs changed over time but that benefits were long-term. Some said that tree-planting led to long-term provision of wood and poles, which ultimately reduced household costs. UNDP (2015) also argued that project EbA measures are beginning to demonstrate economic benefits, with additional benefits expected in the medium to long term, past the lifetime of the programme. One clear lesson, however, is that communities have more interest in economic and social benefits than environmental benefits, so EbA measures must generate short-term economic and social benefits if they are to secure buy-in for environmental benefits and to secure commitment to implementing medium to long-term ecosystem conservation, restoration and management measures (UNDP 2015).

The natural resource economics assessment concluded that the viability of EbA farming practices could be sustained in the long term (over a period of 15 years) (MWE 2015). They would, however, only become viable in Kapsinda by the 12th year (UNDP 2015), which is a long time for farmers to wait for sufficient benefits to emerge. The sensitivity analysis showed that the livelihoods of farmers with non-EbA practices will be non-viable earlier because of climate change impacts (MWE 2015).

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 and various reports listed a number of local-level policy, institutional and capacity related barriers to implementing EbA:

- ***Technical skills unavailable***. This is particularly important. Local government extension services no longer function, and people have the knowledge but not the skills they need. For example, local people need training on animal husbandry (PFCC-U Secretariat 2016).
- ***Financial resources unavailable***.
- ***Weak institutions and insufficient implementation capacity***. Government needs to strengthen compliance and the enforcement of existing local bye-laws, regulations, policies and laws on natural resources management.
- ***Insufficient cross-sectoral institutional collaboration***.
- ***Individual customary land ownership,*** which made implementation challenging because some farmers were unwilling to sacrifice shorter-term income for longer-term benefits (for example, from tree-planting). Such land fragmentation meant project activities were dispersed and implemented at different rates, the consistency of land use planning was limited, and securing change at the landscape level was thus challenging. Implementing Mountain EbA project activities in Nepal and Peru on larger areas of communal land was significantly easier (UNDP 2015; MWE 2015). Land fragmentation should be avoided, but if land is fragmented but owned by one family, family members should cultivate it together to improve harvests (PFCC-U Secretariat 2016).
- ***Market access***. EbA practices improved income levels most when farmers chose crops with strong value chains such as coffee, bananas, rice and potatoes. In some places, maize, groundnuts and cowpeas also had good market outlets and prices, although this was inconsistent. EbA practices should be linked to strong commodity value chains to enhance the monetary rewards (MWE 2015).
- ***Poor infrastructure***. Many roads are poor, for example, and some areas such as Teryet Sub County also lack water supply systems (PFCC-U Secretariat 2016).
- ***Mind-set and attitudinal challenges*** related to environmental protection and conservation. Most locals in Kapchorwa District are reluctant to support environmental programmes, for example. Buy-in for river bank protection by planting trees was slow to take root because of community attitudes to land and land ownership (Gwali 2014). Promoting a savings culture is also important, along with an end to the mentality of relying on handouts. Policymakers also need to accept guidance from local people on how to address climate change challenges more (PFCC-U Secretariat 2016).

District-level barriers to implementing EbA

Interviewees and the literature describe a number of policy, institutional and capacity related barriers to implementing EbA at the district level:

- ***Unavailability of knowledge and financial resources***. A decentralisation process has ensured district development plans are in place, which includes budgeted activities, but in practice limited funds are made available for EbA-relevant activities (UNDP 2015). District natural resources officers complain that funding for the environment sector is still low, which has inhibited successful prioritisation of EbA in district work plans (Gwali 2014).
- ***Insufficient implementation capacity and weak institutions.*** Kapchorwa District, for example, lacks adequate capacity to adapt and network with development partners to deal with the adverse climate change impacts, and there are few climate change management interventions, particularly on adaptation (PFCC-U Secretariat 2016). Capacity building should be included and budgeted for in district development plans, and EbA should be better mainstreamed into district level planning.

- ***Insufficient cross-sectoral or institutional collaboration, and weak or no collaborative cross-sectoral legal frameworks***. A plan for managing the Mount Elgon region has been developed, but it lacks funds for implementation. The lack of an existing landscape-level planning system also initially made it more challenging to adopt an ecosystem scale for implementing EbA measures (UNDP 2015). Many donors have initiated activities in the Mount Elgon landscape, but they have tended to work in small areas with scattered and uncoordinated interventions. This was why the Mount Elgon Stakeholders Forum was formed (IUCN 2016).
- ***Poor infrastructure***. Roads in Kapchorwa District are poor, for example, and Teryet Sub County, which harbours the National High Altitude Training Centre, lacks connecting road networks to neighbouring districts such as Kween. Better rural road infrastructure could help link production to market centres (PFCC-U Secretariat 2016).

National-level barriers to implementing EbA

Interviewees and published literature described the following barriers to implementing EbA at the national level.

- ***Insufficient cross-sectoral institutional or inter-ministerial collaboration***. This is a key issue, as different departments (agriculture, trade, environment, etc) don't speak to each other. Implementing the multi-sectoral National Climate Change Policy, with several ministries in charge of delivery, is challenging (UNDP 2015). Better links between the national electorate and institutions such as the Parliamentary Forum on Climate Change are needed, and EbA needs to be better integrated into national planning processes and ongoing policy preparation and reviews.
- ***Financial resources unavailable***. This is also a key issue. In Uganda, budgeted measures are not always implemented in practice, and public financing for climate change remains limited. For example, financial resources for implementing the National Climate Change Policy (approved by the Ugandan Cabinet in April 2015) are inadequate and the Ministry of Water and Environment has insufficient resources to coordinate delivery across all government agencies and levels, from national to community (UNDP 2015).
- ***Insufficient implementation capacity and unavailability of technical skills***. Technological resources for implementing the National Climate Change Policy are currently inadequate, so policy implementation has not occurred (UNDP 2015). Developing the Climate Change Law needs knowledgeable legislators exposed to field situations to develop practical and community-based policy and legal frameworks. Implementation oversight of the Nationally Determined Contribution and other climate change adaptation efforts also requires parliamentarians with sufficient knowledge and field experience (PFCC-U Secretariat 2016). Capacity building should be budgeted for and included in national plans.
- ***Institutional mandates are unclear***.
- ***Weak institutions***. The Second National Development Plan (2015-2020) recognises the need to establish an appropriate institution for coordinating the priority responses and strategies identified in the National Climate Change Policy (UNDP 2015).
- ***Weak or no collaborative cross-sectoral legal frameworks***. Regulatory instruments are weak, and the lack of appropriate institutional and legal frameworks makes operationalising the National Climate Change Policy a challenge. The Second National Development Plan recognises the need to establish an appropriate legal framework for climate change policy implementation and compliance. Likewise, the objectives, results, strategies and interventions identified in the Second National Development Plan need to be integrated into sectoral plans and policy statements, with specific interventions and costings provided. This would provide further opportunities for integrating EbA into the actual delivery of government priorities (UNDP 2015). The Climate Change Law has yet to be developed (PFCC-U Secretariat 2016).
- ***Knowledge gaps.*** Gathering the data needed to quantify and demonstrate the multiple benefits of EbA is challenging, especially with regards to climate change adaptation and ecosystem functions. The lack of such data can mean EbA benefits are undervalued in cost-benefit analysis and the

monitoring of EbA benefits is challenging. Measuring indirect benefits is also challenging (UNDP 2015).

Local-level opportunities for implementing EbA

Interviewees listed a number of policy, institutional and capacity related opportunities for implementing EbA at the local level.

- ***Appropriate incentives in place to motivate action***. A key project lesson is that EbA projects need to be designed to balance short-term livelihood needs with the long-term needs of the ecosystem. The project provided incentives such as support from a revolving fund for EbA activities and help for small businesses, local procurement of project services (Rizvi et al. 2014), 19 water stands for agricultural and domestic use across the area (PFCC-U Secretariat 2016) and water provision from the Sanzara Parish GFS (Mumba et al. 2016). These incentives helped secure local support for EbA, which in turn helped secure wider support for EbA in other areas and helped foster a sense of ownership (UNDP 2015).
- ***Government prioritisation***. An Environmental Impact Assessment conducted by the National Environment Management Authority demonstrated government leadership, commitment and support to address the communities' challenges. Technical local government leaders saw this as delivering on their mandate, while political leaders saw this as being responsive to their constituency (Mumba et al. 2016). One local leader provided three acres of land in Kapchorwa to support community transformation and development in Sanzara (PFCC-U Secretariat 2016), and the Kapchorwa District Water Office was a key partner in the Sanzara Parish GFS, initiated in 2012 (IUCN 2012).
- ***Strong and fair local governance and bye-laws***. Bye-laws with clear structures embedded in village environment plans inform performance monitoring and hence support from the revolving fund, and incentivise meeting communally agreed restoration targets. This facilitates good governance of natural resources, which, together with the social cohesion emerging from self-organisation and mobilisation at this level, is key to building social resilience (Rizvi et al. 2014). Despite the challenges associated with fragmented land ownership, UNDP (2015) argues that secure rights to and responsibilities for land (ownership, sustainable use and management) also facilitates successful EbA.
- ***Strong local institutions***. Project activities have often built on and strengthened existing structures and institutions, or in some instances worked with local communities to create new ones. This is essential for effective EbA and securing long-term benefits (beyond the lifetime of the project or of political terms). Incorporating EbA into existing local structures and plans can strengthen the case for EbA in addition to strengthening institutional capacities (UNDP 2015). For example, management of the GFS has been linked to community governance structures, and the GFS's operations and maintenance committees also oversee and coordinate catchment management and restoration actions through a River Sipi catchment management committee. The idea was that this would eventually be linked with upstream parishes to promote and facilitate better management of the entire catchment from Sanzara to the national park, where the river emanates (IUCN 2012). The committee still operates and spearheads GFS operation and management, but this wider catchment management has not materialised. There are many farmers' associations and local community-based organizations that work together to reduce the costs of hiring labour and coordinating farming activities. Some of the groups have their own village savings and loan associations, or are associated with Savings and Credit Cooperative organisations. Many of these farmers choose to implement EbA practices independently (MWE 2015). Every water stand provided by IUCN has a water management committee to ensure maintenance (PFCC-U Secretariat 2016). Organisations such as the Environment Conservation Trust and private sector stakeholders, including coffee processing and exporting firms (Kawacom and Kyagalanyi), are also supporting farmers implementing EbA practices, for example by planting indigenous trees in coffee plantations for shade and restoring landscapes (MWE 2015).
- ***Working with government technical and extension services*** has strengthening links between communities and local government and allowed the project to make the case for integrating EbA measures into local government plans and action. Local government officials have also provided technical expertise on issues such as forestry and soil and water conservation. The project worked

at the village level in Kapchorwa and Kween through elected leaders. Village-level Community Environment Action Plans have been developed in collaboration with district government, setting environmental targets and activities for implementing EbA at both the communal and household levels. Parish Adaptation Plans have been developed that provide plans for implementing EbA measures, and parish adaptation committees have been set up to oversee the implementation of these plans in the districts of Sironko and Bulambuli (UNDP 2015).

- ***Farmer-to-farmer learning.*** UNDP (2015) mention the importance of equipping farmers with knowledge through structured learning in the form of farmer-to-farmer exchange visits. These increased farmers' understanding of modern farming techniques and their ability to implement what they learned.

District-level opportunities for implementing EbA

Interviewees listed a number of policy, institutional and capacity related opportunities for implementing EbA at the district level. Of particular importance is strong district-level governance, with the necessary mandates and policies in place to implement EbA. District-level government prioritises EbA, and a national decentralisation process enables district authorities to make decisions on use of funds in line with national policies and priorities, through Local Government Development Programmes and unconditional grants. To integrate EbA into district development plans and planning tools, which include all budgeted activities, the project signed Memoranda of Understanding with the District Local Governments of Sironko and Bulambuli. District-level EbA Action Plans were developed, which were taken on board by the districts for follow-up and mainstreaming into their planning activities. This was particularly important as sectors such as public works and health have more funding available than sectors such as environment, which could potentially be channelled to EbA. Working with district-level officials has strengthened district-level institutional capacities to plan for EbA, and district-level officials also participated in and supported the farmer-to-farmer structured learning opportunities arranged by the project, thus strengthening community capacities (UNDP 2015).

Strong institutions were also mentioned. For example, the Mount Elgon Stakeholders Forum was established in 2012 with support from IUCN under the Mountain EbA project to provide a platform for coordinating ecosystem-based activities and related efforts in the Mount Elgon ecosystem. Members include government bodies, development partners, civil society organisations youth groups, and cultural and religious leaders. They met for the third time in November 2016 after the project had ended (IUCN 2016). The Mount Elgon landscape has also received support from a wide array of donors to ensure the ecosystem is productive and sustainably managed. In addition to government agencies, major actors include IUCN, Nature Harness Initiatives, SNV, World Vision, Environment Conservation Trust, UNDP, the East African Community, The World Agroforestry Centre, International Development Research Centre, Catholic Relief Services, local community-based organisations and the Albertine Rift Conservation Society (IUCN 2016).

National-level opportunities for implementing EbA

Interviewees listed government prioritisation, strong national institutions, and strong national policy and legislation as key national-level opportunities for implementing EbA. These are detailed below.

Government is prioritising climate change through the creation of policies and institutions designed to put the issue centre stage in planning and development. Climate change adaptation and mitigation is amongst the government's strategic priorities, while climate change mainstreaming is ongoing in many government programmes, plans and policies (MWE 2015). For example, the Ministry of Finance Planning and Economic Development has made an elaborate directive to all accounting officers, accompanying the budget circulars, to ensure that climate change is integrated into development plans and budgets. There are standard national climate change indicators as references (Climate Action Network Uganda 2015).

Uganda has a number of strong national policy and legislative instruments that support EbA.

- The ***Second National Development Plan*** identifies climate change as a key threat to Uganda's development and identifies and promotes EbA as a priority intervention in the environment and natural resources sub-sector (UNDP 2015).

- Uganda's development agenda is articulated in ***Uganda Vision 2040***, the country's long-term development blueprint. Vision 2040 aims to achieve a green economy and a clean environment in the context of sustainable development and poverty eradication (CDKN 2016).
- The ***National Climate Change Policy*** (2012) is the main climate change policy instrument in Uganda. It provides direction for the key sectors affected by climate change (water, fisheries, transportation and public works, forestry and wetlands, biodiversity and ecosystems, health, energy, human settlements and social infrastructure, disaster risk management, gender issues and child welfare, and vulnerable groups). It aims to harmonise climate change action across all sectors and levels of governance and to ensure that adequate attention is paid to capacity requirements and the development of the financial mechanisms and tools required to respond to climate change. Adaptation priorities in the policy include biodiversity and ecosystem health, and provision of ecosystem services is listed as crucial to sustainable and resilient development. To fast-track policy implementation, government has put in place guidelines for integrating climate change into existing sectoral and local development plans and budgets. The government has worked out a ***Costed Implementation Strategy*** (2013) for the policy, which estimates that 30% of the costs identified over the next 15 years can be met from national sources (CDKN 2016). This strategy is very strong on EbA, with costed EbA implementation strategies in, for example, fisheries management, wetland management and overall sustainable land and natural resource management components.
- Uganda submitted its ***Intended Nationally Determined Contribution*** to the United Nations Framework Convention on Climate Change (UNFCCC) in late 2015. The Government of Uganda is working to mobilise resources locally and internationally for its implementation, and recently applied for accreditation to the Green Climate Fund, which if successful could unlock a vital new source of financing for Uganda's climate action (CDKN 2016).
- Uganda developed its ***National Adaptation Programme of Action*** in 2007, and it contains pilot projects which emphasise EbA as an important approach for adaptation.
- The ***Land Policy*** (2011), although not yet implemented, highlights the issue of climate change and acknowledges that deforestation, wetland degradation, land degradation and poor settlement planning are of concern. The policy lays down climate change mitigation and adaptation strategies.
- EbA is integrated into the ***National Biodiversity Strategy and Action Plan***, which has a full chapter on climate change.
- Uganda is also a party to the implementation of the ***East African Community Climate Change Policy Framework***, 2010, which requires member states to initiate and develop consistent and harmonised policies and plans to address climate change and provides guidance accordingly. The ***National Climate Change Policy Costed Implemented Strategy*** for Uganda was developed based on guidance from the ***East African Community Climate Change Policy, 2010.***

Support for EbA from a number of strong national institutions is also apparent in Uganda.

- To address climate change at the national level, government created a ***Climate Change Department*** in 2014 to improve the coordination of climate action across economic sectors. The department is fully institutionalised under the Ministry of Water and Environment. This gives climate action a stronger legal basis as well as greater human and financial resources (CDKN 2016).
- The ***National Climate Change Policy Committee***, chaired by the prime minister, coordinates policy implementation and ensures information flow on resource allocation for implementation of the National Climate Change Policy.
- A ***National Climate Change Advisory Committee,*** chaired by the Ministry of Water and Environment, provides technical input to the above-mentioned National Climate Change Policy Committee. It brings together, and ensures working-level coordination between, technical representatives from the various government sectors at the national level, along with representatives from private-sector associations, civil society, academia and district authorities.
- The ***Parliamentary Forum on Climate Change*** promotes awareness and climate change actions within the Ugandan Parliament.

Is the EbA initiative sustainable?

Interviewees felt that the available policy, institutional and capacity support at local, district and national levels was sufficient to ensure the project was sustainable over a long period. Issues supporting sustainability are detailed below at each of these levels. At all levels, demonstrating the multiple benefits of EbA to government planners and policymakers, and thereby making the case for EbA, has increased interest in implementing EbA measures, which has led to the incorporation of EbA into relevant governance structures, plans and policies, as well as budgeting processes (UNDP 2015).

At the local level, sustainability was ensured because government was committed to promoting EbA. Parish Adaptation Plans were developed, and village-level Community Environment Action Plans were developed in collaboration with district local government. These established monitoring and evaluation frameworks, to be followed-up by communities and local leaders (UNDP 2015). Planning is long-term, for example Sanzara Parish communities had developed a ten-year catchment plan to restore the degraded landscape on which the River Sipi depends (Mumba et al. 2016). Securing post-project funding was challenging because in general climate change policies in Uganda are still to be translated into budget allocations and expenditures, but some district government co-financing was secured to provide access to water from the Sanzara GFS to a third village not covered by project funding, and the revolving Community Environmental Conservation Fund established under the project continues to provide funds for EbA activities in the Kaptokwoi River catchment (UNDP 2015; IUCN 2016). Local ownership and the building on community knowledge supported sustainability (Rizvi et al. 2014; IUCN 2012), as did the fact that most project service providers were locally sourced.

At the district (or sub-national) level, the Mount Elgon Stakeholders Forum has prioritised EbA and is linked to existing inter-district committees. The forum is still active even though the project has ended. District development plans prioritise efforts to address climate change impacts and nature-based solutions, which helps ensure sustainable delivery (and funding) of EbA at the ecosystem scale. Plans are underway for integrating the VIA process into existing district development plans for Mount Elgon to ensure sustainability of EbA measures. There are also district-level climate change committees and disaster risk management committees. Catchment Management Plans were also developed under the project and various water management and climate change committees were established. Incentives put in place under the project remain in place even though the project has ended. For example, the revolving Community Environmental Conservation Fund is still functioning and continues to support EbA options (UNDP 2015). The project has also worked to secure further financing by bundling watershed and carbon services into credits and selling these to international or national buyers through voluntary markets, demonstrating that payments for ecosystem services is a relevant model for EbA financing. There is potential for the government-owned public service provider National Water and Sewerage Corporation of Uganda to contribute to these payments for ecosystem services, and it is hoped that the continued sale of watershed and carbon credits will eventually allow the scheme to become self-financing (UNDP 2015)

At the national level, sustainability is ensured because the National Climate Change Policy clearly prioritises EbA options and climate smart agriculture. The Climate Change Department, various climate change policy committees and the parliamentary forum ensure the issue has institutional support.

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

Interviewees noted a number of opportunities for replication, scaling up or mainstreaming, many of which had already occurred under the project. These relate to influencing or responding to national policies, capacitating national policymakers, and replicating and applying EbA through new fields or new initiatives (such as proposed transboundary Mount Elgon management structures) and through United Nations agencies.

Lessons from the Mountain EbA project are informing the reviews of the National Environment Policy and the forthcoming Climate Change Bill that are underway and will be presented to parliament in early 2018. Links between EbA and other high-profile policy priorities, such as disaster risk reduction and natural resources, could provide additional opportunities for mainstreaming EbA. EbA has already been integrated into the Second National Development Plan, the National Climate Change Policy, the

Intended Nationally Determined Contribution, the revised version of the National Environment Action Plan and the National Biodiversity Strategy and Action Plan. The project helped mainstream EbA into the multi-sectoral Costed Implementation Strategy of the National Climate Change Policy. Mainstreaming EbA into district development plans has helped ensure broad-reaching cross-sectoral policy change (UNDP 2015). Findings from the natural resource economic assessment also showed that EbA practice in the Mount Elgon ecosystem was able to respond to the policy priorities in the National Land Policy 2013, which was specifically targeted by the assessment for inclusion of project land use planning and management interventions. The assessment also provides information that can inform the Second National Development Plan and the long-term development strategy of Vision 2040 (MWE 2015).

Policymakers have been trained and knowledge materials and tools have been developed. Cost-benefit analysis results were particularly useful for making the case for EbA to the government through meetings and review processes. There has been a noticeable increase in understanding and support among policymakers in the country regarding EbA resulting from the project. With project support, the Ministry of Water and Environment is also developing guidelines on how to integrate EbA into national and district-level planning and policies. A specific training package on implementing EbA in Mount Elgon has been developed (UNDP 2015).

The approach has replication potential in other fields such as those relating to payments for ecosystem services and the Community Environment Conservation Fund, which were promoted in the context of EbA under the project. Government should adopt these incentive schemes and integrate them better into policies and plans.

The platforms created by the Mountain EbA project and lessons learned are being used to support the transboundary management of Mount Elgon, which is being spearheaded by Uganda Wildlife Authority and Lake Victoria Basin Commission of the East Africa Community (UNDP 2015).

The Government of Uganda used project lessons to advocate for an EbA resolution at the United Nations Environment Assembly (the governing body of UNEP), thereby prioritising EbA as a key topic in UNEP's global agenda from now on, in addition to empowering governments to include EbA in their national plans and policies (UNDP 2015).

Lastly, project experience has contributed to the UNFCCC Nairobi Work Programme process in a number of ways. This has fed practical experience on EbA into the UNFCCC policy process through its Subsidiary Body for Scientific and Technical Advice, thus enhancing support for EbA from a range of stakeholders, including other governments (UNDP 2015).

Interviewees did make suggestions for improving opportunities for replication, scaling up or mainstreaming of EbA interventions more generally, however. The Director, Environmental Affairs, Mr Paul Mafabi, mentioned that the short-term nature of donor-driven EbA projects meant they were insufficient to inform replication. Nature conservation initiatives require long-term financing for proper results. The Climate Change Department should have a budget for EbA actions, in part to help popularise the issue. Improving the business case for EbA is also essential for better lobbying and advocacy. UNDP (2015) reiterates this, calling for more quantitative evidence on EbA and arguing that measuring EbA impact is essential.

Conclusions

Experience from the Mountain EbA project in Uganda demonstrates that EbA can be effective when assessed against the framework criteria detailed in Table 2. It has proved an effective way to help people adapt to climate change impacts such as the drought, landslides, flooding and soil erosion expected in the Mount Elgon region. The social co-benefits from the Mountain EbA project were also extensive. A key project lesson relates to the importance of adopting highly participatory and interactive approaches to ensure EbA project success. Involving local communities in decision making, planning and implementation was central to implementation and building adaptive capacity. Success required a high level of flexibility that took into consideration community needs, time, resources and local knowledge.

Soil erosion, flooding, landslides due to soil destabilisation, drought and problems managing water are already apparent in the Mount Elgon region, and are likely to become more pronounced with time.

Overexploitation and poor land management also occur. The project helped address these challenges by restoring, maintaining and enhancing the capacity of the local ecosystem to continue to produce ecosystem services for local communities, and to withstand climate change impacts and other stressors. A number of improvements to ecosystem service provision were apparent under the project, although some of these took time to materialise.

The watershed proved a particularly good scale for planning and implementing EbA measures, both in terms of working with district-level governments and protected area managers and securing sustainable landscape-wide EbA benefits.

As with social benefits, neighbouring areas experienced a range of improvements in ecosystem resilience and service provision as a result of the EbA project. For example, upstream watershed activities improved flood control and water quality in lower areas, and bee-keeping activities in Sironko may have increased pollination and thus crop productivity more broadly.

Ecosystem benefits ranged from being immediate to long-term. For example, some ecosystems take time to recover, and indigenous tree species take time to grow. One clear lesson, however, is that communities have more interest in economic and social benefits than environmental benefits, so EbA measures must generate short-term economic and social benefits if they are to secure local support.

The project cost-benefit analysis showed that EbA practices were viable and that this viability could be sustained over a 15-year projection period even at a relatively high discount rate. A comparison of the hypothetical 'business as usual' option (non-EbA farming practices) with EbA farming practices showed that investing in EbA was a worthwhile undertaking and generally likely to increase the income of participating crop farmers. Results of a sensitivity analysis that assumed a 10% annual increase in soil loss due to climate change-exacerbated erosion further increased the viability of EbA farming practices. For some farmers, failure to adopt EbA practices could result in their farming activities becoming non-viable.

As with social and environmental benefits, a number of broader economic costs and benefits from the Mountain EbA project that go beyond project operational costs and benefits were apparent. Similar to EbA initiatives elsewhere, the cost-benefit analysis conducted didn't capture and quantify all the many economic benefits of the EbA approach. These are likely to have been underestimated.

Economic costs were few but did include the opportunity costs associated with other land uses not taken up. For example, communities could no longer grow vegetables on the riverbanks.

Various local, district and national-level policy, institutional and capacity-related issues provided support for EbA project implementation. This support was sufficient to ensure the project benefits could be sustained over a long period. Particularly important issues included the provision of incentives to motivate community action, government prioritisation of EbA-related issues, the incorporation of EbA into strong existing local governance structures and systems, collaboration with government technical staff and extension services, embedding EbA into national policy and legislation, and strong local, district and national institutions.

A number of local, district and national-level policy, institutional and capacity-related issues made EbA project implementation challenging. Key issues included a shortage of financial resources for EbA-related work, insufficient institutional capacity to develop policy, implement EbA and monitor results, insufficient cross-sectoral institutional or inter-ministerial collaboration, poor collaborative cross-sectoral legal frameworks, limited market access, fragmented land ownership, poor infrastructure and entrenched mindsets.

Opportunities for expanding benefits from EbA could emerge from better integration of EbA into emerging national and district-level policies or policy responses, such as the forthcoming Climate Change Bill, the Review of the National Environment Policy that is underway, and responses to other high profile policy priorities, such as green growth, disaster risk reduction and natural resources. Capacitating national policymakers is needed, along with the development of funding models and incentive schemes, for example those relating to payments for ecosystem services and the Community Environment Conservation Fund, which could provide opportunities for funding and replicating EbA practices more broadly in Uganda. Government budgetary allocations for EbA actions are needed, along with improvements to the evidence base on why investing in EbA makes financial sense.

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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 Mountain EbA Project, Uganda. 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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