

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

Research results from the Supporting
Counties in Kenya to Mainstream Climate
Change in Development and Access
Climate Finance project, Kenya

Hannah Reid and Victor Orindi



Author information

This report was written by:

Hannah Reid, research consultant to IIED
Victor Orindi, National Coordinator, Adaptation (ADA)
Consortium, Kenya

Corresponding author: Hannah Reid, hannah.reid@iied.org

Acknowledgements

This report presents findings from the International Climate Initiative (IKI) project 'Ecosystem-Based Adaptation: Strengthening the Evidence and Informing Policy', coordinated by IIED, IUCN and UNEP-WCMC. The German Federal Ministry for the Environment, Nature Conservation, Building and Nuclear Safety (BMUB) supports the IKI on the basis of a decision adopted by the German Bundestag. The authors would like to thank Rose Akombo, Irene Karani, Peris Kariuki, Caroline King-Okumu, Jackson Kiplagat, Joab Osumba and Jane Franciscah Wamboi for taking the time to be interviewed. Thanks also to Ced Hesse for supporting this research and to Xiaoting Hou Jones for reviewing this paper. The contents of this paper do not necessarily reflect the views or the policies of the funders, UNEP, or coordinating organisations.

Project website: www.iied.org/ecosystem-based-adaptation

Published by IIED, June 2018

<http://pubs.iied.org/17620IIED>

ISBN: 978-1-78431-598-6

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International Institute for Environment and Development
80-86 Gray's Inn Road, London WC1X 8NH, UK
Tel: +44 (0)20 3463 7399
Fax: +44 (0)20 3514 9055
www.iied.org

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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 a workshop with a wide of stakeholders conducted by the Adaptation Consortium at the project site in Kenya, where a fund was established to finance activities aimed at improving water availability, the provision of climate information, rangeland management and livestock health in an arid and semi-arid region.

It concludes that investments have helped build local resilience to climate change, with pastoralists and agro-pastoralists benefitting in particular, while providing a number of co-benefits that promote wellbeing. Strong levels of participation throughout the process were central to building local resilience. Investments have also helped enhance the capacity of rangeland ecosystems to continue to produce services for local communities and withstand climate change impacts and other stressors. While measuring returns on investment is difficult in a context of highly mobile people and benefits that are difficult to quantify, the investments do appear to have provided value for money. The legitimisation and support of local institutions throughout all stages of the design and implementation of the fund has meant communities are now in control of designing and supporting initiatives to meet their development and adaptation needs. While the fund has brought about short-term as well as long-term improvements in resilience, it requires continued financial inputs from county budgets and possibly external sources.

Acronyms and local terms

ICCCF	Isiolo County Climate Change Fund
CCCPC	Isiolo County Climate Change Planning Committee
Dedha	Boran traditional resource management institutions
DFID	UK Department for International Development
EbA	Ecosystem-based adaptation
IIED	International Institute for Environment and Development
IKI	International Climate Initiative
IUCN	International Union for Conservation of Nature
PES	Payments for ecosystem services
SDGs	Sustainable Development Goals
SMS	Short Message Service
NDMA	Kenyan National Drought Management Authority
UNCCD	United Nations Convention to Combat Desertification
UNEP-WCMC	United Nations Environment World Conservation Monitoring Centre
UNFCCC	United Nations Framework Convention on Climate Change
WCCPC	Ward Climate Change Planning Committee

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

<p>1) Effectiveness for human societies</p> <p><i>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?</i></p>
<ol style="list-style-type: none"> 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?
<p>2) Effectiveness for the ecosystem</p> <p><i>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?</i></p>
<ol style="list-style-type: none"> 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?
<p>3) Financial and economic effectiveness</p> <p><i>Is EbA cost-effective and economically viable over the long-term?</i></p>
<ol style="list-style-type: none"> 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?
<p>4) Policy and institutional issues</p> <p><i>What social, institutional and political issues influence the implementation of effective EbA initiatives and how might challenges best be overcome?</i></p>
<ol style="list-style-type: none"> 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?

Supporting counties in Kenya to mainstream climate change in development and access climate finance

The Isiolo County Climate Change Fund (ICCCF) was piloted by the Adaptation Consortium¹ under the Kenyan National Drought Management Authority (NDMA) with support from the UK Department for International Development (DFID) between 2013 and 2016. The Consortium aims to prepare county governments to access global climate finance in order to support adaptation and climate resilient development, and to mainstream mechanisms that allow communities to prioritise investments in public goods that build their resilience to climate change. It will provide practical experience and a tested model for effective and robust disbursement of funds to promote adaptation to climate change that can be replicated throughout the arid and semi-arid lands of Kenya. Box 2 describes the key results areas for the Consortium.

Box 2: Key results areas for the Adaptation Consortium

- Climate information services integrated into county planning and budgeting.
- County finance and planning mechanisms, that support public good investments prioritised by communities for adaptation, are established and functional, enabling county governments to access global climate finance.
- Monitoring and learning of adaptation success promoted, leading to best practices being replicated in other arid and semi-arid areas.

The Adaptation Consortium operates in five arid and semi-arid counties in Kenya: Garissa, Isiolo, Wajir, Kitui and Makueni, which cover approximately 29% of Kenya's land area. Most people in the five counties are vulnerable to climate change due to heavy reliance on climate-sensitive sectors like agriculture and livestock, and also due to inappropriate planning and land management strategies.

The livestock sector accounts for around 80% of all economic activity in Isiolo and surrounding counties in Northern Kenya (Tari et al. 2015). Improving the availability of, and access to, public goods such as water and pastures in environments characterised by high mobility and variability is a critical aspect of climate change adaptation in the arid and semi-arid lands of Northern Kenya (Hesse et al. 2013).

In Isiolo, the ICCCF supports investments that build climate resilience, selected and managed by the publicly appointed Isiolo County Climate Change Planning Committee (CCCPC) and local-level Ward Climate Change Planning Committees (WCCPCs). Many ICCCF investments promote climate resilience through good governance of natural resources, notably by supporting sustainable pastoralist management strategies (NDMA 2014).

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. Many of the ICCCF investments can be classified as EbA, even though they were not designed as EbA or referred to as such when conceived and implemented.

¹ See <http://www.adaconsortium.org/>

Methodology for assessing effectiveness

Reid et al. (2017) describe the methodology for assessing EbA effectiveness developed under the ‘Ecosystem-based approaches to adaptation: strengthening the evidence and informing policy’ project. This is based around asking a detailed set of questions that can be used to draw conclusions about the effectiveness of an ongoing project or draw conclusions about the effectiveness of an EbA project that has ended. For this study of the ICCCF in Kenya, the research questions detailed in Reid et al. (2017) were integrated into a broader set of questions designed to compare a centrally managed fund and a local fund (the ICCCF) in Isiolo County, Kenya, in the context of delivering finance for resilience. Nyangena et al. (2017) provide more details on this methodology, and it is summarised here.

Kinna and Garba Tula Wards in Garba Tula sub-county were selected because they had ICCCF-funded projects as well as projects funded by a centrally managed fund – the Community Development Trust Fund – for comparative purposes. Projects were picked based on whether they addressed development and resilience needs and adopted EbA approaches. Those interviewed had direct knowledge of four ICCCF-funded projects: the Bibi Water pan, the Boji livestock facility, the Kinna customary rangeland management institution and the Garbatulla customary rangeland management institution. Interviewees with experience of governance, project management and delivery at national, county and local ward levels were selected. Individual and group interviewees were undertaken. Group interviews included men, women and youth participants wherever possible. Most of the interviews were conducted in English, with translations between English and Kiswahili or Boran (Nyangena et al. 2017).

A national stakeholder workshop held in November 2016 discussed the results emerging from this study. A further set of six interviews with a number of national-level EbA stakeholders was held. These included representatives of various key organisations in Kenya with knowledge on EbA, including environmental consultants, the Kenya Wildlife Service, the Kenya Forest Service, WWF, National Museums of Kenya, and the Finance Innovation for Climate Change Fund. Much has been written and published on the Adaptation Consortium and the ICCCF, so along with the interviews conducted, this published literature was also used to assess the characteristics of ICCCF activities that contribute to EbA effectiveness.

Research results

Effectiveness for human societies: did the initiative allow human communities to maintain or improve their adaptive capacity or resilience, and reduce their vulnerability in the face of climate change, while enhancing co-benefits that promote long-term wellbeing?

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

The Isiolo County Climate Change Fund (ICCCF) finances public good investments for improved resilience to climate change, through improved water availability, provision of climate information, rangeland management and livestock health. These are all critical aspects of climate change adaptation in pastoral areas (see Box 3) (NDMA 2014).

Box 3: Ecosystem-based adaptation related activities funded under the first round of the Isiolo County Climate Change Fund disbursements

- Rehabilitation, fencing and/or construction of 11 sand dams, 4 water pans, 2 shallow wells and 1 water tank, with accompanying water governance activities. This improves livestock productivity and the ability of animals to withstand stress. Improved access to clean water also improves human health and resilience to disease. Better water governance facilitates reciprocal resource access agreements based on negotiation, which reduces the risk of conflict and is also critical for building resilience.
- Drilling a borehole in a strategic drought reserve allowing access to pastures during difficult times, thereby reducing livestock mortality and asset loss.
- Sealing off an existing water pan in a dry season grazing reserve, which will leave an existing borehole as the only water source in the reserve. This borehole will be sealed during the wet season to prevent grazing, thereby ensuring the availability of livestock fodder and improved livestock health in the dry season.
- Funding for planning meetings and the operational costs of four customary range management institutions (dedha). Supporting these institutions will improve dryland management while ensuring good social relations with different pastoral groups.
- Workshop to integrate climate change into the Isiolo County Integrated Development Plan 2013-2017.
- Poor access to and use of climate information services has been problematic (Ada Consortium 2015b). The ICCCF, together with Kenya Meteorological Department, has developed a County Climate Information Services Plan and established a community radio station in Garbatulla to enhance access to and use of climate and other development and governance-related information (also critical for building resilience). Information on weather and climate can now reach the whole county. The community radio station is particularly critical for reaching areas that do not have mobile coverage.

Source: NDMA 2014

The decision-making process for selecting investments prioritised resilience building. The Adaptation Consortium provided support with resilience mapping and resource assessments, and integrated these with climate risk information (from the county's climate information services). ICCCF then supported activities identified in this resilience assessment report, mainly on livelihood and ecosystem improvement (Nyangena et al. 2017). Ward Climate Change Planning Committees (WCCPCs) made decisions about ICCCF investments (Box 7 details this process), selecting those which met seven criteria (Box 4). These criteria promoted climate-resilient development and adaptive livelihoods (Ada Consortium 2015b).

Box 4: Criteria guiding investments that build climate resilience

1. Must benefit many people
2. Must support the economy, livelihoods or important services on which many people depend.
3. Must be relevant to building resilience to climate change.
4. Must encourage harmony and build relations, understanding and trust.
5. Must have been developed after consultation with all potential stakeholders.
6. Must be viable, achievable and sustainable.
7. Must be cost-effective and give value for money.

The number of beneficiaries was significant. From 2010 to 2014, ICCCF investments provided tangible benefits for an estimated 18,825 people. Beneficiary numbers can be assumed to be much higher if indirect beneficiaries are taken into account, particularly given the mobility of pastoral communities in Kenyan arid and semi-arid lands. Additional beneficiaries also stem from the ICCCF engaging local service providers, thus supporting the local economy. The monitoring and evaluation process in March 2014 estimated that ICCCF projects had engaged the services of 430 people in Isiolo, providing 152 new jobs. The ICCCF also leveraged additional government funds to support veterinary services, local radio and weather information services (NDMA 2014). Indeed, up to the period ending 31st December 2014, estimates suggest that the ICCCF had directly and indirectly supported approximately 956,132 persons to cope with effects of climate change (Ada Consortium 2015c).

Customary range management institutions (dedha) were particularly instrumental in building resilience. For example, ICCCF support helped dedha to enforce the rules protecting dry season grazing areas (despite external political pressure) and to prepare better for when rains do not come (NDMA 2014). Improved provision of climate information has supported livestock management strategies, especially those reinforcing the customary rangeland management systems which provide for seasonal grazing areas (wet season grazing areas, dry reserves and drought reserves) (Victor Orindi pers. com. 2016). Capacity building workshops built dedha skills and knowledge regarding integrating climate information into management activities and decisions. Dedha can now combine information from the Kenya Meteorological Department with traditional observations to assess local climate conditions and plan accordingly (Nyangena et al. 2017).

Isiolo had a long dry season in 2014. By July 2014, the neighbouring counties of Marsabit, Garissa and Samburu were classified as being at the 'alarm' level of NDMA drought level warnings and were reporting rapidly declining socioeconomic indicators. In Isiolo, however, although the rainfall conditions had been similar, socioeconomic indicators appeared to be less affected and the 'alarm' level had not yet been reached. This uncharacteristic decoupling of drought and its human impacts was attributed to good practices in local natural resource management (Tari et al. 2015).

Emergency response, however, was less effective. Interviewees felt that the six-month time period between proposal development and funding disbursement was too long, especially if the investment was responding to an emergency need. Disbursement was, however, much quicker than disbursement under a similar nationally managed fund – the Community Development Trust Fund (Nyangena et al. 2017) – and other adaptation funding mechanisms under the United Nations Framework Convention on Climate Change (UNFCCC).

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

A historical legacy of limited and often inappropriate development has left the arid and semi-arid lands of Kenya with weaker governance and planning institutions, less effective social and economic services, and greater levels of poverty than other areas of the country (NDMA 2014). But experiences from the ICCCF show that this funding model can render significant benefits for people in poor and marginalized households (Ada Consortium 2015d).

The ICCCF and Adaptation Consortium work targeted pastoralists, agro-pastoralists and dryland crop farmers. Mobile/transient resource users benefitted most from ICCCF investments (Caroline King-Okumu, pers. com. 2016), while those without livestock benefitted less. Apgar et al. (2017) also note how the provision of improved climate information in Isiolo benefits ultra-poor households with little involvement in pastoralism less. Livestock owners are not necessarily the most vulnerable, as they can be rich or poor (Victor Orindi pers. com. 2016), but livestock is the dominant economic sector in Isiolo County and supports the majority of the population. Indeed, 83% of livelihoods in Isiolo are based on agro-pastoralism (IIED 2014). Pastoralist livelihoods are closely intertwined with broader landscape resilience, so strengthening the latter will particularly benefit those relying on pastoralism for their livelihoods (Nyangena et al. 2017).

Although livestock is traditionally more a male priority, and women may have different priorities to men (for example, preferring water for domestic use rather than for livestock), women also benefitted from ICCCF investments (Victor Orindi pers. com. 2016). Up to the end of 2014, an assessment of the Adaptation Consortium's achievements showed that slightly more women (487,627) than men

(468,505) had been directly and indirectly supported to cope with effects of climate change through ICCCF investments. As of 2015, the ICCCF had directly benefitted approximately slightly more women (40,797) than men (39,197), through various projects (Ada Consortium 2015c). Youth, women and elders attended the community consultations held in 2014 to secure inputs into the county livestock strategy (IIED 2014). Women and youth also had positions on the WCCPCs. This doesn't guarantee equity, but it does indicate that Fund structures can be inclusive (NDMA 2014). Most ICCCF investments also focused on clean water – an issue of particular importance to poor rural women whose role is to fetch water (NDMA 2014; King-Okumu 2016). In Sericho town, for example, with better water access, women were able to keep lactating animals nearer home so they could be milked faster and more easily, and cows continued to give two litres of milk every day during the dry season. With less time spent at boreholes and easier access to water, rural women could engage in other income-earning activities such as selling tea, doughnuts and maize-based dishes (King-Okumu 2016).

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

ICCCF investments specifically targeted those relying on pastoralism for their livelihoods (see Box 3). And amongst pastoralists, outsiders were sometimes excluded or charged more for access to water pans (Caroline King-Okumu, pers. com. 2016).

A March 2014 review estimated that out of 18,825 people, approximately 14,495 young and 4,330 old persons respectively had benefited from ICCCF investments (NDMA 2014). But younger people may feel that other interventions are needed and that traditional pastoralist management practices are the priority of the old (Victor Orindi pers. com. 2016). Many youths have abandoned pastoralism, assuming it is not lucrative (IIED 2014).

Those who rely on wildlife conservancies for their livelihoods also benefit less when customary governance systems are supported in Isiolo. Conflict over natural resources has arisen as a result of this, especially during drought (Victor Orindi pers. com. 2016; Bedelian and Ogutu 2016).

There were no known trade-offs in terms of *where* benefits accrue to due project activities. One interviewee commented, however, that, sometimes the benefits of EbA accrue some distance away from the intervention site, making such benefits less apparent. However, other land uses requiring water extraction upstream can have significant negative effects for pastoralists relying on those water resources downstream (Victor Orindi pers. com. 2016).

More strictly enforced grazing regimes impact *when* benefits accrue. These controlled the times/seasons during which certain waterpoints and areas could be used for livestock and grazing. Such restrictions, however, are part of an improved rangeland management regime, the overall benefits of which were quickly apparent. A total economic valuation of activities in Isiolo also showed that whilst investing in natural resource management had good immediate economic benefits, the full effects of any given investment decision might be anticipated to accrue over a time frame of at least ten years (King-Okumu et al. 2016). Sand dams take time to accumulate water, for example, and benefits from these will only be seen in three years (Victor Orindi pers. com. 2016). One interviewee agreed with this, stating that sometimes the benefits of EbA take time to materialise and are thus less apparent. As such, ICCCF investments provided benefits over short and longer-term time horizons.

Social co-benefits from the EbA initiative

A wide range of social co-benefits emerged from ICCCF-funded rangeland management improvements. Many of these can also be said to indirectly contribute to improving resilience to climate change. Some, but not all, can be quantified (King-Okumu 2016).

Support for dedha and the resultant improvements in rangeland management have empowered local people to participate in decision making and conflict resolution. This has reduced conflict with pastoralists both within and outside the county (Nyangena et al. 2017; Ada Consortium 2015b). Stronger local institutions have also created employment and skill-development opportunities for the youths who were involved in resource surveillance (King-Okumu et al. 2014).

With less need to migrate in search of water and pasture, security risks are reduced and more time can be spent at home with the family and taking care of local businesses (King-Okumu et al. 2014).

Improvements in livestock quality bring better prices, as do improvements in livestock productivity and reduced animal mortality (Ada Consortium 2015b). Such increases in income support spending on local events such as weddings and business development (King-Okumu et al. 2014). Weddings are one of many community ceremonies that require the presence of livestock, and these have become more regular compared to the pre-project period. Such events contribute to community cohesion and a collective feeling of happiness (Nyangena et al. 2017). Another example of benefits from community mobilisation and improved social cohesion is the community organising a petition against an upstream dam proposed for the Ewaso Nyiro river in the county (Victor Orindi pers. com. 2016). Improved pastoral production systems raise protein intake, income, employment opportunities and skill levels for youths. They also increase retirement income for the elderly and marketable assets for 80% of the population of Isiolo (King-Okumu et al. 2016).

Improved water management activities have reduced water-borne diseases near the water pans (Ada Consortium 2015b). Improved access to water has led to cost savings, economic opportunities and improved local capacity (King-Okumu 2016).

Distribution and trade-offs relating to social co-benefits

Livestock owners benefitted more from these social co-benefits than other social groups (Caroline King-Okumu, pers. com. 2016). But given the wide dependence on pastoralism in Isiolo, and how investments in pastoralism have been shown to benefit people in poor and marginalised households (Ada Consortium 2015d), this selectivity seems justified. Men, women, the elderly, the disabled and children in livestock-keeping households all benefitted. For example, investments in better access to water and pasture management increase livestock productivity, providing more milk, more births and herd growth, and fatter animals. This in turn improves food security and wellbeing for various social groups. Women benefit directly from increased milk production, because they can sell the surplus or turn it into butter or ghee for sale. Men benefit by fetching better market prices from the sale of animals, while herders experience less pressure to search for pasture and water. Men also benefit from improved security as they are the ones who tend to fight more. Across the sampled projects, beneficiaries indicated that economic savings are invested in school fees for children. Children also benefit from improved health care services through higher quality diets (meat and milk), access to safe water and better sanitation. Youth benefit from employment in construction work during project implementation (Nyangena et al. 2017).

The resilience assessments produced under ICCCF revealed that households with fewer or no livestock also benefited from a strong pastoral economy. This resulted from abundant and cheaper milk, more animals and cheaper meat (a good source of protein), and more work in the form of digging water points and herding animals. Those relying on wildlife conservancies, however, do not feel the co-benefits as much as others (Victor Orindi pers. com. 2016).

The role of participatory processes and local/indigenous knowledge

Local knowledge of climate, water management and rangeland management was supported by the ICCCF (Caroline King-Okumu, pers. com. 2016), most notably through support provided for the Borana traditional elders system (dedha), which are the repository for much of this knowledge. One interviewee also identified the importance of indigenous knowledge and stated that poor incorporation of this knowledge was a factor limiting the long-term sustainability of EbA in Kenya more generally.

A number of formalised opportunities for community involvement in ICCCF management and decision making also ensured that community participation was central to ICCCF establishment and decision-making processes. Initial community consultations in Isiolo verified community and government support for the ICCCF approach and led to a series of workshops with community and government participants in early 2011 to design the institutional structure of the devolved finance mechanism (NDMA 2014). Selecting and building the capacity of WCCPCs was central to this process (Box 5).

Box 5: The process for selecting and building the capacity of WCCPCs

A comprehensive public information campaign informed the wider public of the need to establish credible and representative committees to determine investments. A public meeting, bringing together several hundred community members, was then held in each ward to establish committee membership. Members were selected through public discussion and consensus. To avoid discrimination against marginalised groups, committee member selection criteria were based not on technical capacity or skills, but on the communities' assessment of the individuals' integrity and commitment.

Each WCCPC has 11 members, which must include representatives from youth, women, a customary local institution and a community-based organisation, each with equal voting rights. Each WCCPC can include relevant government officers, but these members do not have voting rights. In this way, local people, through WCCPCs, retain control of their development and adaptation priorities.

WCCPCs then registered as community-based organisations and opened bank accounts. They then underwent training on natural resource governance issues and policy, implications of the new Constitution and subsidiary legislation for the ICCCF, climate change, committee governance, proposal development, and financial and project management principles needed to design the financial and project management framework.

Source: NDMA (2014); Isiolo County (2014); Ada Consortium (2015b).

The livelihood and local economy resilience assessments conducted by WCCPCs were participatory, thus enabling different groups within the wider community to identify key issues relating to climate resilience. Box 7 provides more details on the financial framework and procedures for selecting ICCCF investments, but one of the conditions for receiving ICCCF funding is that ideas must be developed following consultation with all potential stakeholders (Ada Consortium 2015d). For example, two days of community consultations were held in 2014, prior to a multi-stakeholder workshop to develop county livestock strategies. These brought together community representatives from Isiolo County to identify the issues they felt must be addressed by the county livestock strategy, and to identify five representatives per ward to present their prioritised issues to the multi-stakeholder workshop held later that year. The first draft of the county livestock strategy was used to inform the 2014/15 county budget, with the community's voice and input integrated into this process (IIED 2014).

The Isiolo County Climate Change Planning Committee (CCCPC) must then approve WCCPC-prioritised proposals; it cannot reject these as long as the first five proposal criteria (see Box 4) are met. This ensures ward level committees retain control of how funds are spent (NDMA 2014). Higher levels of government and donors cannot veto, but only work to strengthen, ward-level proposals. There are also rules about youth and women representation on the CCCPC (NDMA 2014).

Strong levels of participation throughout the ICCCF process were central to building local resilience (Ada Consortium 2016; Hesse and Pattison 2013), but this required facilitation and capacity building to ensure success (Victor Orindi pers. com. 2016). The initial community consultations verified community support for the ICCCF approach, which was critical to its subsequent success (NDMA 2014). Involving community members in discussions about resource management and conducting participatory resource mapping exercises built local capacity (Caroline King-Okumu, pers. com. 2016). Incorporating beneficiaries into the Fund's governance framework increased the prospect of meeting their aspirations and improving overall effectiveness (Nyangena et al. 2017).

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

Key ecosystem services in the pastoral economy of Isiolo include: livestock products, such as meat, milk and eggs; agricultural products from irrigated crop production integrated within agro-pastoral systems; wildlife protected in parks and conservancies and in pastoral areas; and dryland products such as gums and resins (King-Okumu et al. 2016). A number of factors threaten local ecosystem resilience and service provision: climate change; land conversion leading to habitat change; weak governance, institutions or legal frameworks; and over-extraction of upstream water resources (Caroline King-Okumu, pers. com. 2016).

Poor governance is a key issue. Pastoralism is perceived by many as a 'backwards' form of land management, and pastoralists have historically been blamed for poor natural resource management and over-grazing. Evidence suggests, however, that desiccation in dryland areas is a result of climatic changes rather than land-use systems, and that pastoralists can in fact manage rangeland resources very effectively with government support. It is neglect by government, for example through transforming tenure systems and undermining communal land management systems, that is problematic (Behnke and Mortimore 2016). For example, policies providing for water points or boreholes during drought times have led to degradation (Victor Orindi pers. com. 2016). Also, modern management systems are often not appropriate for the dynamics of dryland ecology and livelihoods. For example, intensive livestock production systems are increasingly posing health and environmental problems as they are not ecologically sound. Recognition of the comparative benefits and performance of extensive pastoral systems, both from a socioeconomic and an environmental perspective, can provide a powerful justification for conserving and increasing the viability of such systems, particularly in water catchments that are characterised by climatic variability, periodic droughts and complex processes affecting vegetation responses to climate and other stresses (King-Okumu et al. 2015). Government policies, however, have not always supported this approach.

Drought and increases in water scarcity during the dry season are major problems (Caroline King-Okumu pers. com. 2016). Some 65% of Isiolo County is classified as 'very arid' and 30% as 'arid', so securing reliable water resources is already a major challenge. Climate change and climate variability in the drylands causes variations in rainfall. This is the main driver of ecological change, rather than patterns of land use (Behnke and Mortimore 2016). It is increasingly difficult to plan grazing owing to variability in rains within and between seasons, and droughts are recurrent. The extended 2008-2011 drought in Isiolo was estimated to have slowed down the growth of the national economy by an average of 2.8% per year. Livestock disease levels increased and mortality rates were as high as 40-60% (Tari et al. 2015). Recent years have seen reduced flow in most rivers and reduced levels of recharge in wells, in part due to recurrent droughts and reduced rainfall (Wasonga et al. 2016).

Over-extraction of water has also been problematic, and upstream crop cultivation restricts downstream flow (Wasonga et al. 2016). This is despite the fact that a total economic valuation of ecosystem services in Isiolo showed that water can deliver significantly more market and non-market benefits when used to support domestic uses and livestock, as opposed to irrigated agriculture and tourism (King-Okumu et al. 2016). In Kenyan arid lands, agriculture has higher adverse impacts on ecosystem services than livestock pastoralism (Nicholles et al. 2012).

Whilst overexploitation isn't a major problem, the influx of livestock from neighbouring areas in Isiolo is putting pressure on the resource base. In tandem with changing weather conditions, this has reduced pasture availability (Wasonga et al. 2016).

Invasive species are also a problem. *Prosopis juliflora* was introduced to combat erosion, but it is thorny and bad for the teeth of grazing animals. It has no natural predators so is proliferating and taking over many parts of the rangelands (Victor Orindi pers. com. 2016).

Boundaries influencing ecosystem resilience

Effective traditional rangeland management requires jurisdiction over large areas. But seasonal mobility of pastoralists is limited by administrative units and boundaries, which can undermine planning and mobility at a larger landscape scale. Where land is subject to different tenure and different land use systems, this disrupts the mobility pastoralists need to manage their stocks effectively. The need to take stock elsewhere to graze can also be limited by hostile neighbours, banditry and a lack of proper guidelines to help negotiate grazing access with neighbours (IIED 2014; Hesse and Pattison 2013). Whilst using natural boundaries such as the sub-catchment area has advantages in this context, the lack of congruence with administrative boundaries would bring complications relating to where and how the legal framework to support this could be established. It may be that a centrally or nationally managed fund would be better than a county-level fund such as the ICCCF in this context, as it could address the issue at the ecosystem rather than administrative scale more easily and would have the advantage of potentially operating more cross-sectorally (Ada Consortium 2016; Nyangena and Roba 2017).

The water catchment is also important. There is only one major river in Isiolo – the Ewaso Nyiro – plus a few smaller streams. It is therefore important to plan action at the catchment level, which can be difficult as this does not match with county administrative boundaries (Victor Orindi pers. com. 2016).

Thresholds influencing ecosystem service provision

Reductions in rainfall affect whether stock such as cows and sheep can be supported, and Isiolo is already seeing a shift to more drought-resilient camels and goats. Thresholds beyond which cows and sheep can no longer be kept, however, are unknown (Victor Orindi pers. com. 2016). Studies in Spain suggest that a negative feedback cycle of reduced plant cover and soil erosion could result in “irreversible soil degradation in semi-arid regions” (Castillo et al. 1997). One interviewee felt that there was uncertainty about tipping points in the Kenyan drylands and that more knowledge on the capacity of ecosystems to tolerate disturbance is needed. Possible tipping points could relate to a fall in the water table as a result of overdrafting – which could increase pumping costs, reduce water availability and result in land subsidence and salt water intrusion into aquifers (Mati et al. 2006) – or changing temperature patterns limiting plant growth (Victor Orindi pers. com. 2016).

EbA initiative impacts on ecosystem resilience and services provision

The first round of ICCCF disbursements funded a number of activities that improved ecosystem resilience and service provision. Funding for dedha planning meetings and operational costs improved rangeland governance and management. For example, stringent enforcement of grazing patterns according to seasons has built ecosystem resilience to drought in the county (Nyangena et al. 2017). Improved water governance and regulation of livestock access to water helped avoid over-grazing in some areas. For example, sealing off an existing water pan left only one borehole which could provide water in the dry season grazing reserve. This borehole will be temporarily sealed during the wet season to prevent grazing and over-use of the pasture during this period.

Overall, ICCCF investments slowed land deterioration and led to rangeland regeneration. They have shown that pastoralism combines livestock production and natural resource management in such a way that each reinforces the other as an integral part of the system to deliver ecosystem-wide provisioning benefits (Wasonga et al. 2016). The emergence of new palatable grass species and increased tree cover (perhaps due to a ban on charcoal burning) were cited as indicators of improved ecosystem conditions (Nyangena et al. 2017). Only one interviewee felt ecosystem resilience was unaffected.

Water availability has improved due to water infrastructure improvements – the fencing water pans and the pumping of water into troughs to prevent contamination of the pans and extend dry season clean water availability – and the provision of training and support for water governance. In Oldonyiro, for example, six sand dams have been rehabilitated and five newly constructed (Ada Consortium 2015b). Sand dams are known to improve water access for communities, livestock and wildlife and help recharge groundwater levels, which improves vegetation growth in surrounding areas (Ada Consortium 2015b; Mati et al. 2006).

While work in Isiolo does have a monitoring and evaluation system that uses locally generated indicators, aggregated to county and national levels, for assessing impact (Ada Consortium 2015b), there is no system for quantifying changes in groundwater use, recharge and storage volumes, vegetation distribution, volume and species composition, wildlife habitats and survival rates, seed germination or soil qualities. Such benefits cannot be readily valued and thus included in economic assessments (Tari et al. 2015).

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

ICCCF investments operated at the level of Isiolo County. Livestock mobility is a tested and now increasingly recognised strategy to maximise livestock productivity and minimise asset loss in the arid and semi-arid lands of Kenya, which are characterised by highly variable and unpredictable resources (NDMA 2014). Livestock movement between the wet and dry grazing areas and the drought grazing reserves in Isiolo requires management of large areas. This in turn requires a flexible grazing regime, as some vegetation resources are only found at certain times of year or in specific areas, and some areas need to be left for certain periods in order to support their recovery. Herd mobility is the only way to harness otherwise transient resources and escape stresses and shocks (Wasonga et al. 2016).

Water is a scarce and valued resource in Isiolo. The sand dams built in Isiolo could potentially retain water in the area and reduce erosion from streams below the dam, but they also reduce water reaching the floodplain lower down (Victor Orindi pers. com. 2016). A study of the Rapsu irrigation scheme in Garbatulla showed that using water for irrigated crops upstream significantly reduced water resources available downstream to pastoralists (see Box 6). Alternative land uses – in this instance, irrigated agriculture – do therefore potentially come with significant trade-offs in how ecosystem services could otherwise be used.

Box 6: Benefits of water use for pastoralism or irrigated crops

A study of the Rapsu irrigation scheme in Garbatulla showed that 2,000 persons (330 households) in the Rapsu pastoral community, growing irrigated crops on 176 hectares, were earning US\$23,000 (2 million Kenyan shillings) gross, or US\$130 (11,430 Kenyan shillings) per hectare, per year from crop sales. They were also growing enough for their own consumption. But because they were diverting water from the Ewaso Ng'iro River for irrigation, pastoralists found that the goods and services they were obtaining from the downstream Lorian swamp had been reduced. Pastoralists within a radius of more than 50 kilometres had historically depended on this wetland as a source of water and forage during dry periods. They estimated the value of these goods and services at about US\$125 (10,990 Kenyan shillings) per hectare per year. Since the area of the swamp (231,000 hectares) was far larger than that of the irrigation scheme, the pastoral community did not consider the trade-off between their loss of services and the gain of irrigated production to have been worthwhile.

Source: Niemi and Manyindo (2010).

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

Improvements in ecosystem services provision as a result of ICCCF investments can be seen within a two-year period (Caroline King-Okumu, pers. com. 2016), but investments in strengthening the dedha have benefits that will materialise over the longer term (Tari et al. 2015). Because decision makers often require assessments of the returns on their investments to be available over short time frames but the effects on ecological processes can take longer to appear, King-Okumu et al. (2016) suggest selecting a four- to five-year time frame for measuring impacts on ecosystem services provision. This would be in line with economic decision making under the County Integrated Development Plan, and also national strategic planning (which extends to 2030).

There may be trade-offs in terms of water use from boreholes, because more extraction of water now could reduce the quality and quantity of available water in years to come (Mati et al. 2006). But such trade-offs have not yet been observed (Caroline King-Okumu, pers. com. 2016).

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

How cost-effective is the EbA initiative?

No formal cost-benefit analysis was conducted for this work, but some assessments and studies on value for money, cost-to-investment ratios, cost per beneficiary and returns on investment were undertaken. These suggest that the financial rationale for investing in EbA in Isiolo looks strong.

Evidence suggests the Isiolo model provides value for money. Given the huge development deficit in the arid and semi-arid lands of Kenya (eg investments needed in basic infrastructure), the NDMA (2014) argues that any investment will represent value for money.

The cost-to-investment ratio, whilst high in the first round of ICCCF investments, is likely to drop dramatically in subsequent rounds. The first round saw the ICCCF commit the local equivalent of £355,796 to approved public good adaptation investments. Table 3 shows how the costs of setting up the ICCCF process and running the first round of disbursements equated to £455,687. Total ICCCF process costs were thus 28% higher than the total value of the investments delivered by the process (NDMA 2014). It is assumed, however, that many of the support costs relate to the pilot nature of the project and will thus be reduced when subsequently applied in other areas, due to greater certainty about how to undertake activities and economies of scale from coordination across five counties. Institutional development and support costs can thus be seen as one-off investments. Even the process costs are likely to be less in subsequent investment rounds. When only the costs of the Isiolo project cycle are considered – which serves as an estimate of the ICCCF running costs – the ICCCF process costs drop to 7.5% of the total value of investments delivered. This compares favourably with the 8.5% cap on operational costs under the UNFCCC Adaptation Fund – a potential source of global climate funds (NDMA 2014).

Table 3: The costs of setting up the ICCCF process and running the first round of disbursements

Activities	Total cost (£)
Institutional development in five wards (initial stakeholder consultation and project design, resource mapping and resilience assessment workshops, seasonal forecast meetings, committee formation and vetting meetings, trainings on governance and climate variability, finance design and training, Fund review workshop, community awareness raising events, auditor costs)	161,970
The ICCCF project cycle (WCCPC meetings, CCCPC meetings, monitoring and evaluation support, monitoring visits, inter-ward meetings) in five wards	46,740
Support costs (IIED management and technical support, national secretariat costs, local partner costs)	246,976
Total	455,687

Table 4 provides estimates of the expected cost per beneficiary of each EbA-related investment under the first round of ICCCF funding (NDMA 2014). These are low because the focus on investments in public goods ensures many people benefit. This also implies that ICCCF investments represent good value for money.

Table 4: Expected cost per beneficiary of EbA investments under the first round of ICCCF funding

Location	Investment	Total Cost (£)	Estimated direct beneficiaries	Estimated indirect beneficiaries	Cost per direct beneficiary (£)	Cost per total beneficiaries (direct + indirect)
Oldonyiro	Rehabilitation of six sand dams	11,979	9,100	12,000	1.32	0.57
Oldonyiro	Construction of five new sand dams	19,871	5,300	7,000	3.75	1.62
Oldonyiro	Training of Oldonyiro water management committees	5,189	180	5000	28.83	1.00
Kinna	Support to customary rangeland management institution (dedha)	10,341	26,000	200,000	0.40	0.05
Garbatulla	Support to customary rangeland management institution (dedha)	29,849	20,000	n/a	1.49	n/a
Garbatulla	Rehabilitation/fencing of Harr-Buyo Water Pan	12,792	n/a	n/a	n/a	n/a
Garbatulla	Rehabilitation/fencing of Belgesh Water Pan	15,180	6,300	n/a	2.41	n/a
Sericho	Fencing of Fororsa Water Pan	11,523	15,744	n/a	0.73	n/a
Sericho	Fencing of Manyangap Water Pan	10,082	15,744	n/a	0.64	n/a
Sericho	Rehabilitation of Hawaye Wells	8,549	15,744	n/a	0.54	n/a
Sericho	Support to customary rangeland management institution (dedha)	16,097	15,744	20,000	1.02	0.45
Merti	Support of rangeland user association	9,947	39,000	n/a	0,26	n/a
Merti	Blocking of the inlet to Yamicha water pan	5,899	40,000	n/a	0.15	n/a
Merti	Drilling of Bambot borehole	40,203	39,500	n/a	1.02	n/a
County	CIDP Workshop	10,515	n/a	n/a	n/a	n/a

A participatory assessment of returns on investments from strengthening dedha in four Isiolo wards over the long dry season of 2014 showed that the benefits that could be appraised already outweighed investments made through the ICCCF and by the members of the local institutions. This was despite

the fact that many observed benefits either were not yet quantified, due to the rapid time frame of the assessment, or could not be quantified at all. The ratio of benefits to the local communities that could be included in the rapid economic assessment in comparison to the initial investment through the ICCCF was 402:1. Where the numbers of pastoralists migrating into Isiolo from other counties to benefit from the improved availability of pasture and water could be assessed, the ratio of economic benefits to the initial ICCCF investment was 1,635:1. Dedha members themselves contributed five shillings from their own pockets for every one shilling that the ICCCF provided them with to strengthen their institutions, but they considered that the avoided livestock disease and mortalities and increased milk production had earned a return of around 90:1 on their investment (King-Okumu et al. 2014; Tari et al. 2015).

Results from a similar study in Garissa County, which neighbours Isiolo, provide an unequivocal economic justification for financing community-based adaptation based on pastoralism. This study took into account not only economic returns under different intervention scenarios but also social impacts (eg reciprocity structures and gender equality) and ecological impacts (eg key ecosystem services). It showed that under the most realistic scenarios, investing \$1 in adaptation generates between \$1.45 and \$3.03 of wealth accruing to the communities. Even when using a high discount rate, the costs of intervention were 2.6 times lower on average than the costs of not intervening to address climate change and extreme weather events (Nicholles et al. 2012).

More devolution in Isiolo is likely to improve cost-effectiveness. For example, implementation costs are likely to be much lower when local institutions are used. When built by communities, sand dams cost roughly half the price that a contractor would charge (Victor Orindi pers. com. 2016). Comparisons between the ICCCF and the nationally managed Community Development Trust Fund also showed that monitoring costs were likely to be much higher compared to when this function is not devolved (Nyangena and Roba 2017).

Measuring value for money or returns on investment is difficult in Isiolo. First, counting direct and indirect beneficiaries in a pastoral region is difficult. Populations are highly mobile and often move across one or several counties on a seasonal basis. Establishing beneficiaries on the basis of census data fails to capture this dynamic as, in any given season or year, population figures may double or halve (NDMA 2014).

Most of the national-level stakeholders interviewed in Kenya under this research felt that at a general level EbA is economically viable, with the net benefits outweighing costs over the long term. They noted, however, that quantitative evidence is scarce, with what documented studies that do exist largely categorised as payment for environmental services initiatives promoted by various actors. For example, the 'Pro-poor rewards for environmental services in Africa' project involves the Nairobi City Water and Sewerage Company paying upstream farmers to adopt soil and water conservation measures in the Sasumua dam catchment area in order to secure Nairobi City water supplies. Such measures have been shown to reduce vulnerability to climate change (van de Sand et al. 2014).

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

The initiative was not specifically compared to other adaptation options, but research on the total economic value of pastoral production systems suggests the economic justification for investing in EbA by supporting traditional pastoralist livelihoods is strong (King-Okumu et al. 2015). Research from Garissa County comparing bottom-up ecosystem and community-based adaptation approaches based on pastoralism with top-down approaches involving macro investment in infrastructure and productive transformation showed that investing in community-based adaptation was a wise investment, with its environmental, social and economic benefits outweighing the costs in virtually all modelled scenarios (Nicholles et al. 2012).

Water availability in Isiolo is increasingly limited due to climate change, and comparisons with other potential uses for water resources indicate that pastoralism provides the greatest opportunities to secure a return on investment for each cubic metre of water utilised. A study of the Rapsu irrigation scheme in Garbatulla showed that the financial benefits of using water for pastoralism vastly outweighed the benefits of using the same volume of water for irrigated agriculture (see Box 6). In Isiolo County, a total economic valuation study showed that the direct use value of a cubic metre of water for domestic uses was US\$0–17 (market value) or around US\$90 (non-market value), whereas the same

volume used for livestock water provisioning would generate a direct use value of US\$13–22 (market value from meat and milk production). The values per cubic metre of water in the case of direct use for irrigated agriculture were US\$0–4 (market value), and even less for tourism enterprises (King-Okumu et al. 2016; King-Okumu 2016). A further study in Garissa suggests that pastoralism combined with modest diversification to drought-resistant agriculture would deliver the best economic outcomes in the face of climate change. The study acknowledges, however, that if diversification in this way leads to competition over scarce resource use, then its sustainability must be questioned (Nicholles et al. 2012).

Wildlife conservancies provide an alternative land use and an opportunity to diversify community livelihoods and spread risk as the climate changes. Bedelian and Ogutu (2016) found that the Kenyan conservancies they looked at provided an important source of income from lease payments throughout the year, along with access to good quality forage during droughts. However, they reduce access to large areas of grazing land and restrict livestock mobility, and the income from the leases is not more than that which livestock could provide. Also, income is based on land ownership, which means women and other marginalised groups are excluded from the economic benefits that conservancies can provide. Another study on conservancies in northern Kenya (Glew et al. 2010) found that they enhanced the livelihoods of participating communities compared to what would have been the case without them, but that a focus on wildlife and tourism alone is unlikely to meet many of the real needs of local people.

Broader economic costs and benefits from the EbA initiative

Quantifying the broader economic benefits of ecosystem services and pastoral production systems is even harder than quantifying the immediate direct benefits. Often either environmental goods are extremely difficult to value in practice, or confidence in the values/methodology used may be low (UNDP 2015; King-Okumu et al. 2014; Tari et al. 2015). As a result, the true value of pastoral systems is often overlooked and they have historically been undervalued as a land use choice (King-Okumu et al. 2015; Wasonga et al. 2016). A total economic valuation of climate-dependent ecosystem service values produced in Isiolo County during 2013–14 showed they were worth almost US\$0.25 billion per year (King-Okumu et al. 2016; King-Okumu 2016). It is difficult to attach an exact monetary value to all the vegetation resources in Isiolo – many have a social, medicinal, energy, forage and spiritual importance that goes beyond market value. Many plant species are managed and conserved for various or multiple uses. Only a few of these uses involve destructive harvesting, and in most cases, various parts of the plant are used for different purposes. This makes total economic valuation of the vegetation resources complex and indicates that plants are often undervalued when their value is based on the market price of only one of their products (Wasonga et al. 2016).

Interviewees agreed that the benefits of EbA were spread across different sectors, making it hard to appreciate their full value. Some of the formally and informally natural resource-based traded goods and services that provide broader economic benefits in Isiolo include:

- The direct economic value of livestock, including for formal commercial meat and milk production (King-Okumu et al. 2015).
- The camel milk trade through Isiolo Town generates a rough gross monthly turnover of up to 10.58 million Kenyan shillings and supports 1,046 people, including traders and labourers as well as their spouses, children and relatives. In the production areas of Isiolo Central and Kulamawe, 10,532 people benefit directly and indirectly from camel milk production (King-Okumu et al. 2015).
- The local trade in goats supports (either directly or indirectly) well over half of the population in the rural towns of Isiolo County (King-Okumu et al. 2015).
- People use livestock products for food security, income, income substitution for reduced expenditures, insurance for disaster, capital for investment in other sectors, access to credit, social heritage and other uses (King-Okumu et al. 2015).
- Livestock has an option value, meaning it can be accessed like a savings account or insurance policy in times of need (King-Okumu et al. 2015).
- Livestock has a bequest value (King-Okumu et al. 2015).

- The livestock and meat trade generates more than 17 million Kenyan shillings per year for the local authorities in Isiolo County through medical certificates, business permits and other fees and licences from meat shops, butcheries and offal dealers. Contributions to local and national economies through taxes and other fees paid to public institutions were therefore significant (King-Okumu et al. 2015).
- Livestock draught (pulling) power and transport (King-Okumu et al. 2015).
- Fuelwood (King-Okumu et al. 2016; King-Okumu 2016).
- Opoponax (a resin) (King-Okumu et al. 2016; King-Okumu 2016).
- Irrigated crops (King-Okumu et al. 2016; King-Okumu 2016).
- Tourism (King-Okumu et al. 2016; King-Okumu 2016).

There may also be avoided costs and avoided losses from EbA implementation. For example, the costs of bringing in water by tanker and other forms of relief when it can no longer be secured naturally (as in the 2011 drought) are high (Mati et al. 2006; King-Okumu et al. 2014). De Leeuw et al. (2012) also explain how Lorian Swamp provides water and forage to people and livestock in Isiolo, especially during the dry periods. Without it, drier uplands would have limited value because herders would not have sufficient access to food and water during the dry season to accommodate their needs. The swamp's continued provision of environmental services is threatened, however, by dam construction and water abstraction for irrigation.

Financial and economic trade-offs at different geographical scales

As part of the improved rangeland management strategy, a water pan in a drought reserve was closed in a particularly dry area, leaving boreholes as the only source of water for livestock. This provided the community with more control over who was accessing the reserve. Neighbouring communities from Wajir and Garissa Counties have, however, suffered losses as a result (Victor Orindi pers. com. 2016).

Interviewees also felt that the benefits of EbA were spread across different geographical scales making it hard to appreciate their full value. Most were not clear on the financial and economic trade-offs between management at different geographical scales, but one respondent felt that costs were lower when considered at wider geographical scales. An economic assessment of the proposed Isiolo Dam also reflects this view (Vilela and Bruner 2017). The assessment found that whilst the National Water Conservation and Pipeline Corporation justified dam construction on the basis that it would provide water for livelihoods, livestock, irrigation and urban development, many of the costs to downstream herders, ecosystem health, wildlife and wildlife tourism had not been sufficiently considered. Elsewhere in Kenya, Nyongesa et al. (2016) identify a number of trade-offs for upstream smallholder farmers in the context of promoting more sustainable land use practices to improve water quality in the Lake Naivasha watershed, and hence downstream horticultural operations.

Changing financial and economic benefits and costs over time

A participatory assessment of returns on investments showed that investments in local customary institutions for community and ecosystem level adaptation can pay off rapidly and also over the medium term and future decades (Tari et al. 2015). King-Okumu (2016) notes that benefits from investments in ecosystem services in Isiolo County could accrue over a time frame of at least ten years, and one interviewee felt that EbA initiative costs were lower the longer the initiative lasted. One interviewee also commented that benefits can take time to accrue. For example, sand dams take a year or more to accumulate enough sand and water beneath them (Victor Orindi pers. com. 2016).

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

The first phase of the ICCCF process highlighted various difficulties faced by communities in under-developed dryland areas. First, investments in appropriate communication, transport, infrastructure and financial services are needed to facilitate local climate resilience (Ada Consortium 2015b). Many areas in Isiolo have a poor transport network and no mobile phone coverage.

Another key challenge is mismanagement of water and grazing resources. Dedha are mandated to regulate access to pasture and water in pastoral systems, yet they continue to be weakened and undermined by formal systems of governance (NDMA 2014) and, in some instances, donor and non-government organisation interventions (Mati et al. 2006). Not everyone adheres to prescribed customary regulations, and customary institutions are sometimes weak and disregarded. Regulatory mechanisms are sometimes absent (Wasonga et al. 2016) and government staff need to better understand how dryland economies and livelihoods can thrive in circumstances of climatic variability (Ada Consortium 2015b). The devolved system of government in Kenya can also favour rural elites (Ada Consortium 2016).

Wards and sub-county levels still lack discretionary authority over planning and budget allocations (Ada Consortium 2015b), and ward-level stakeholder capacity to apply the project monitoring and evaluation framework remains low (Ada Consortium 2014b). One interviewee commented that the sustainability of some pilot EbA projects in Kenya more generally was compromised at times because the structures were not always in place to provide continued technical and financial support. In the context of a payments for ecosystem services project in Sasumua watershed, north of Nairobi, Van de Sand et al. (2014) found that even though local farmers are aware of strategies that could enhance their adaptive capacity, they lack the knowledge, finances and technologies to implement soil conservation measures that would control erosion, increase water recharge and regulate flow.

County-level barriers to implementing EbA

Kenya's devolved system of government places considerable responsibility and authority for governance at the county level. Isiolo County government engagement is thus central to ICCCF management, and there are a number of challenges to overcome here.

First, there is a general lack of knowledge amongst government staff on the dynamics of arid and semi-arid ecosystems. Widespread misunderstanding of the rationale underpinning pastoralist management systems is also problematic (NDMA 2014; Ada Consortium 2015b). The true value of pastoralism has been underestimated and thus undervalued. Data 'blind spots' in capturing the total economic value of pastoralism versus 'modernised' agriculture and intensive farming techniques need to be filled. For example, none of the value of household camel milk consumption is captured in conventional agricultural production statistics in Isiolo (King-Okumu et al. 2015). The Isiolo County Integrated Development Plan (2013-17) recognises the importance of the livestock sector but shows that it is poorly supported and faces many challenges that prevent it from attaining its full potential, such as poor natural resource management, limited veterinary coverage, inadequate livestock marketing, and poor links with wildlife conservation (IIED 2014). Information on local natural resources in the Plan is also weak; this was provided later by the Adaptation Consortium but was not available at the time the Plan was published (Victor Orindi pers. com. 2016). Pastoralism is the dominant economy of Isiolo County, but county government budgets are low overall, and investment in this sector has paled in comparison to investments made in crop farming (IIED 2014).

County-level stakeholders have limited capacity to track the impact of adaptation interventions (Ada Consortium 2015b), and Apgar et al. (2017) comment on the "minimal capacity of technical officer[s], especially at the county level" to use climate information when it is made available to them. The county government must enhance its systems for mapping and monitoring the full contribution of ecosystem services to the Isiolo economy. Such systems should be iterative and fully participatory (King-Okumu

2016). County-level stakeholders also have little capacity to apply the project monitoring and evaluation framework (Ada Consortium 2014b).

Seasonal mobility for pastoralists – essential for effective rangeland management – is hindered by a number of factors. Fear of resource related to conflict, banditry and cattle rustling limits pastoralist movement. Other land use systems, such as extensive agriculture, use scarce water resources and hinder pastoralist mobility. Settlements increasingly occupy pasture land. Different land tenure systems also hinder pastoralist mobility. Community management of grazing and water resources – for example by *dedha* – has been weakened over the years, leading to open and non-regulated resource access. Legislation supporting traditional grazing rules and regimes is needed, through enactment in county law to ensure enforcement. Corrupt administration officers weaken enforcement of grazing patterns, which can lead to an influx of pastoralists from neighbouring counties and grazing in drought reserves at the wrong time (IIED 2014).

Securing and sustaining the interest and commitment of key senior county government officials to mainstream project activities into county planning and budgeting systems has been challenging (Ada Consortium 2015c). Staff turnover has been problematic, more so with the general election in August 2017, which saw the majority of elected leaders and top officials being replaced. Support from top county officials to those involved with implementation has been limited, partly due to the many competing interests and a limited understanding and lack of appreciation of EbA benefits to the economy (Victor Orindi pers. com. 2016).

Multi-sectoral coordination needs to be improved at the county level. Various sectors (health, livestock, wildlife, domestic) rely on the limited county water supplies, but allocations are limited compared to sectors such as agriculture. Coordination across sectors, and indeed between counties, is currently poor and there is a disconnect between community and government planning (Ada Consortium 2015b).

Donor coordination has also been problematic. Many donors do not wish to follow the county plans but rather wish to support their own agendas, making it difficult to coordinate with stakeholders working in the same space (Victor Orindi pers. com. 2016).

National-level barriers to implementing EbA

A historical legacy of limited and often inappropriate development has left the arid and semi-arid lands of Kenya with weaker institutions of governance and planning, less effective social and economic services, and greater levels of poverty than other areas of the country (NDMA 2014). Understanding of the value of pastoralism has been limited, and policies have instead pressed for ‘modernisation’ (King-Okumu et al. 2015) and have over-ridden customary decision-making structures such as the *dedha*. The Kenyan school curriculum is not pro-pastoralism and its delivery system is not adapted to pastoralist mobility. Likewise, administrative units and boundaries undermine planning and mobility at a larger landscape scale, and national planning processes don’t support traditional pastoralist land management strategies (IIED 2014; Wasonga et al. 2016). Although pastoralism is the dominant economy of Isiolo County, national government has invested much more in farming (IIED 2014).

Investment in and capacity building of WCCPCs has put ward-level community committees in control of their development and adaptation priorities, but this process of devolution requires careful management and continual support from existing government institutions and local communities. A variety of government policies and processes have helped address the historical disconnect between communities and formal centralised government planning systems, and have supported devolution, but whether attitudes and behaviours will change in line with the new policies remains to be seen (Hesse and Pattison 2013). The bottom-up approach to development planning exemplified by WCCPCs can be seen as controversial. A key challenge will be negotiating the politics of integrating bottom-up planning in the context of entrenched top-down planning approaches in Kenya (NDMA 2014).

Other weaknesses of the centralised planning system include poor coordination, poor communication, inflexibility and poor use of climate information (Nyangena et al. 2017). National government has a very limited local presence in Isiolo, just like in other dryland counties, and there has been confusion about devolution and who does what at the national and county levels (Victor Orindi pers. com. 2016). More coordination between the National Climate Change Directorate in the Ministry of Environment, Water and Natural Resources and other national climate change actors is needed (Ada Consortium 2014a). One interviewee commented that EbA in Kenya requires cooperation between institutions, communities

and the private sector, but that this is not currently happening to the level desired. Some conservation areas in Kenya are of interest to, and managed by, many institutions with different mandates and priorities (eg the Kenya Wildlife Service, Kenya Water Towers Agency, and Kenya Forest Services), and some cross national boundaries. Stronger collaboration and coordination amongst institutions and countries is required in these places for EbA to be effective.

The absence of a quantitative valuation of ecosystems was problematic. Interviewees commented on the importance of such valuations to influence politicians and decision makers, particularly in the context of big infrastructure projects, and the need for a better understanding of economic costs and benefits relating to EbA. They also identified unclear mandates and institutional resistance to doing things differently as key barriers to implementing EbA, as well as limited understanding of EbA amongst policymakers and little capacity to include EbA in planning processes.

Local-level opportunities for implementing EbA

Central to the ICCCF approach is the role of WCCPCs, and considerable effort was expended by Adaptation Consortium project partners to ensure they had the capacity to fulfil their role (see Box 5). WCCPCs are now strong and very engaged. Much work also occurred with communities, local government and finance specialists to set out the financial framework and procedures for approving investments (see Box 7). This investment in and capacity building of WCCPCs puts ward-level community committees in control of their development and adaptation priorities in keeping with the provisions of the Constitution and the County Governments Act.

Box 7: The financial framework and procedures for selecting ICCCF investments

WCCPCs conducted livelihood and local economy resilience assessments with support from government planners and local organisations. Based on findings from these and judged against seven criteria (See Box 4), the WCCPCs prioritise and design investments that will promote climate resilient growth and adaptive livelihoods.

The proposed investments are submitted for review to the CCCPC, made up of representatives from the ward committees, local government and other stakeholders. The CCCPC must approve WCCPC-prioritised proposals if the first five proposal criteria (see Box 4) are met. The CCCPC is expected to provide additional technical support to the WCCPCs and work with them to ensure the proposals meet the last two criteria. The CCCPC also underwent training on committee governance and procedures.

Once the CCCPC approves a project, the WCCPCs conduct a public procurement process, requiring competitive tendering and public analysis of bids (requirements are based on Kenyan public procurement legislation). This minimises the risk of political/economic abuse by higher level interests and ensures committee members are accountable for the good use of funds. WCCPCs then negotiate and sign contracts with service providers, and payments are made accordingly.

One of the conditions for receiving funding from the ICCCF is that activities must be cost-effective and provide value for money. A procedure manual (certified as being in accordance with Kenya public finance legislation) ensures fund use is effective and fiduciary standards are met. This manual is based on the principle that WCCPCs are empowered to make their own decisions, carry out activities and direct funds. Accounts are certified by an auditor to ensure value for money, and periodic documentation spot checks and project field visits occur whereby an independent auditor and CCCPC members, accompanied by the ICCCF monitoring and evaluation officer from the NDMA, visit sites.

Source: NDMA (2014); Isiolo County (2014); Ada Consortium (2015b); Ada Consortium (2015b). Source: Niemi and Manyindo (2010).

Dedha were supported through the ICCCF process, strengthening the customary systems of planning, use and management of natural resources (NDMA 2014). Dedha were able to review their institutional

functions and procedures and to hold strategic meetings, including cross-border meetings with resource users from neighbouring counties. This provided significant benefits (improved pastoralist income from livestock sales, improved livestock survival, health and milk production) to local pastoralists and also to pastoralists migrating into the county from neighbouring resource-insecure areas (Tari et al. 2015). Tari and Pattison (2014) argue that legitimising and supporting customary institutions in this way can be a more successful and sustainable approach to addressing the 'development deficit' in Kenya's drylands than projects that focus on technical fixes or work in parallel to customary institutions.

County-level opportunities for implementing EbA

Kenya's current constitutional and legal framework provides structures by which local climate change adaptation planning and funding can be institutionalised at the county level. The Constitution of Kenya (2010) and Public Finance Management Act (2012) provide legal provisions for county governments to set up and raise revenues for their own public funds, including for climate change adaptation funding. The Second Medium-Term Plan (2013-2017) recognises that, according to the Constitution and the County Government Act (2012), county governments are required to prepare County Integrated Development Plans as the basis for developing their budgets. The Adaptation Consortium has been working with county governments in Isiolo, Garissa, Wajir, Kitui and Makueni to mainstream climate adaptation into these County Plans and to set up mechanisms to access climate finance (Ada Consortium 2014a). Climate adaptation has been successfully mainstreamed into Isiolo's County Plan and the ICCCF was established accordingly (Ada Consortium 2015c). As a result of these engagements, county-level governance and coordination is quite strong, and climate change is prioritised as an issue (Victor Orindi pers. com. 2016).

Most community interventions on livelihoods and ecosystems – which are candidates for adaptation – are coordinated at the county level, so engagement with the county government is needed to deliver adaptation projects (Nyangena et al. 2017). Indeed, a comparison between the ICCCF and a nationally managed fund in Kenya – the Community Development Trust Fund – shows that thanks to the proximity of the fund administrators to the community, the ICCCF was able to ensure greater interaction with the beneficiaries at every phase of the project value chain. This is critically important for EbA effectiveness and sustainability. The ICCCF is also cross-sectoral and compatible with the governance and institutional structures that manage dryland ecosystems, and can operate at scale. The ICCCF was able to provide project funds faster, and monitoring is cheaper and easier because of proximity to project sites. This leads to better quality outputs (Nyangena and Roba 2017).

Weather forecasts and climate information are being shared throughout Isiolo (and other counties) via radio, seasonal outlook forums and SMS messaging systems (Ada Consortium 2015c). The Ada Consortium has supported this process by holding workshops for local communities and county planners on the relevance and accessibility of weather and climate information (NDMA 2014).

National-level opportunities for implementing EbA

Kenya has a number of policies and institutions that support climate change planning. These include the National Climate Change Response Strategy (2010) and the National Climate Change Action Plan (2013), developed to operationalise this strategy. Strengthening EbA is a priority in the Action Plan. The Action Plan also recommended developing a standalone climate change policy and law. The Climate Change Bill (2014) was finally signed into law in May 2016, while the draft Climate Change Framework Policy is still under discussion by the cabinet. The National Adaptation Plan (2016) proposes EbA approaches (MENR 2016), and the Intended Nationally Determined Contribution (2015) calls for enhancing ecosystem resilience to climate variability and change.

The National Climate Change Directorate in the Ministry of Environment, Water and Natural Resources is the lead technical agency on climate change issues. This ministry also contains the National Environment Management Authority, which is the National Implementation Entity for the global UNFCCC Adaptation Fund and the Green Climate Fund (Ada Consortium 2014a; MENR 2016). The NDMA coordinates matters relating to drought management in Kenya and oversees adaptation and resilience building in Kenya's arid and semi-arid lands.

Article 174 of the Constitution states the objectives of devolution as being to enhance the participation of the people in decision making, to protect the interests of minorities and marginalised communities

and to promote social and economic development. Various acts support devolution and amplify the objectives stated in the Constitution, notably the County Government Act (2012), the Public Finance Management Act (2012), the Intergovernmental Relations Act (2012) and the Coordination of the National Government Act (2013) (Hesse and Pattison 2013). The Community Land Act (2016) aims to ensure that communities have legal recognition, that their ownership rights are strong and permanent, that the principles of devolution are not undermined by national or county-level powers, and that decisions about community land should be made by community institutions according to clearly stipulated procedures that benefit the entire community (Ada Consortium 2015a). One interviewee also commented on the importance of devolution for EbA in Kenya.

Although there is little support from government, national land policy and the national policy for the sustainable development of northern Kenya and other arid lands both recognise the role of customary institutions in land and natural resource use planning (Wasonga et al. 2016).

Is the EbA initiative sustainable?

One of the conditions of receiving ICCCF funding is that activities must be sustainable (see Box 4) (Ada Consortium 2015b), and investment in dedha institutional strengthening has certainly brought short-term as well as long-term improvements in resilience (Tari et al. 2015).

The policy, institutional and capacity support available may not be enough to ensure benefits from ICCCF investments will be sustainable over the long term. Continued provision of support from both the community and from higher levels is needed. Continued benefit accrual depends on the maintenance of project activities, with the associated cost implications that this entails (Caroline King-Okumu, pers. com. 2016). A review of ICCCF projects in 2016 showed that meeting the costs of repairing and maintaining projects was challenging. Fees paid by users were inadequate, and there was no way of enforcing payment for pan use by users from outside the County. WCCPC involvement ends after project implementation and there are no systematic ways of pooling finance for maintenance and repairs (Nyangena et al. 2017). Nyangena and Roba (2017) argue, however, that these challenges to securing sustainability relate to implementation rather than concept failure.

Integration of ICCCF institutions – the WCCPCs and dedha – into Isiolo County policies and planning systems would improve project sustainability, and reduce the risk that political change following the elections will put project activities off track. At present, WCCPCs operate without a legal basis and therefore remain informal in nature, with limited involvement after project implementation (Nyangena et al. 2017).

Better monitoring and evaluation and more consistent stakeholder engagement throughout the project cycle would also improve project sustainability. Monitoring and evaluation baselines and indicators were developed to measure changes in resilience (NDMA 2014; Isiolo County 2014), and lessons from the first round of ICCCF disbursements were fed back into the procedure manual to strengthen the second round of investments, but project monitoring levels remain low because of insufficient funds allocated to this activity. There are also few government technical officers to support ICCCF activities (Nyangena et al. 2017).

In terms of financing, whilst donor funding largely ended in 2016, county-level climate change fund management legislation commits counties to providing a certain percentage of their development budget to climate change finance (Ada Consortium 2015d). Wajir and Makueni have earmarked 2% and 1% of their development budgets to climate change work, respectively. A climate change fund bill currently in the County Assembly will allow the ICCCF to mobilise resources from the county budgets. The bill proposes that the County Assembly should allocate 2% of development expenditure annually to the ICCCF (Nyangena et al. 2017). New sources of climate finance, for example from the Green Climate Fund, Adaptation Fund and National Climate Fund, are also being sought.

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

A number of opportunities for replication, scaling up or mainstreaming emerged from the Isiolo ICCCF initiative. First, the institutions for managing the ICCCF are all in place, which means they are available

to channel funding into a multitude of further EbA investments should this become available (Nyangena and Roba 2017).

ICCCF institutions and systems have been, or are being, integrated into county-level planning and management. ICCCF supported a workshop to integrate climate change into the Isiolo County Development Plan 2013-2017 (NDMA 2014). Following this, climate resilience-building activities and the ICCCF project monitoring and evaluation framework have informed the Plan as well as several related sector plans such as the County Livestock Strategy, which subsequently informed the county's livestock sector budget for 2014-15. The county government is also incorporating the ICCCF planning committees into its planning and financing structures, most notably through a climate change fund bill currently in the County Assembly (Ada Consortium 2014b; Nyangena et al. 2017; Ada Consortium 2015b). This will enable the county planning and financing structures to access climate finance to complement their development budgets (NDMA 2014).

Initially piloted in Isiolo County, the ICCCF approach is now being implemented in four other arid and semi-arid counties (Garissa, Kitui, Makueni and Wajir). These cover approximately 29% of Kenya's land area and support a population of over four million. As a result, some 2.5 million people are expected to be able to cope better with climate change through provision of climate, with 800,000 people benefitting directly from adaptation investments (Ada Consortium 2015d). The Kitui and Makueni County Climate Information Services plans are in place, and Wajir, Isiolo and Garissa County Climate Information Services plans are in process (Ada Consortium 2015c). Climate change is being included in County Integrated Development Plans for the first time, and counties are now better prepared to access and invest climate change funds. County livestock strategies now also have a strong emphasis on climate change (Ada Consortium 2015b). One interviewee explained that Wajir and Makueni now have progressive legislation on climate finance that supports participation and community prioritisation of adaptation investments, building on work in Isiolo.

In other counties, the Kenya Meteorological Department has adopted and is using the climate information services framework developed under this project to provide information to other counties across the country, including an additional four counties in western Kenya under the WISER project (Victor Orindi pers. com. 2016).² One interviewee also commented on opportunities to feed project lessons into the review of the 2013-17 process and development of the 2018-22 process (in late 2017) for all 47 five-year County Integrated Development Plans and subsequent sector plans in Kenya.

Lessons from Adaptation Consortium work have already informed national-level climate change planning, including the Kenyan National Adaptation Planning process and the Intended Nationally Determined Contribution. The project has also become a key component of the NDMA's strategy (NDMA 2014). Interviewees also saw opportunities for mainstreaming EbA implementation as the National Adaptation Plan and the Green Growth Strategy and Implementation Plan are rolled out (both are operational until 2030). Indeed, the Climate Change Act (2016) expressly calls for public consultation to inform decision making, which provides an opportunity for Adaptation Consortium lessons to inform planning. EbA could also be incorporated into the draft Climate Change Framework Policy and the National Wildlife Climate Change Adaptation Strategy, which are nearing completion, and into plans for their implementation.

Work in Isiolo has helped leverage more investment for adaptation activities. Operational funds in 2014 came from the UN Adaptation Fund, the UK Department for International Development's International Climate Fund, and the World Bank's Special Climate Change Fund (Ada Consortium 2014a). Various county- and national-level government institutions have since provided additional support for ICCCF-related projects. Plans are underway to engage with national implementing entities, such as the National Environment Management Authority, to access funds from the Green Climate Fund and the Adaptation Fund and to channel this to counties like Isiolo and the other four pilot counties with devolved climate finance frameworks in place. The Adaptation Consortium is working to support the NDMA to become a national implementing entity of the Green Climate Fund (Ada Consortium 2015c). The Green Climate Fund is interested in accrediting multiple national and sub-national entities as Fund implementing agents, which could include county governments. If successful, NDMA accreditation could provide opportunities for scaling up funding for sub-national level adaptation planning and implementation (Ada Consortium 2015d; NDMA 2014). With Kenya's Constitution providing improved

² See <https://www.metoffice.gov.uk/about-us/what/international/projects/wiser/cis-kenya>

opportunities for county governments to take responsibility for development and climate resilience building activities, the NDMA (2014) argues that the ICCCF model can be replicated, allowing county governments to potentially access global climate finance for adaptation. Interest from development partners and donors such as USAID has also grown (NDMA 2014).

The work in Isiolo is also informing a similar UK-funded project in Longido, Ngorongoro and Monduli Districts in Tanzania, and proposals for devolved adaptation finance in arid areas of Mali and Senegal (NDMA 2014).

Greater levels of national and county government officer engagement followed the second round of ICCCF funding dispersal. This led to a number of opportunities for scaling out and building on ICCCF investments. For example, the Agriculture Sector Development Support Programme expressed interest in supporting natural resource governance activities, the Ministry of Environment, Water and Natural Resources committed to fund eight water related projects, and the Kenya Meteorological Service promised to install three automatic weather stations.

Summary and conclusions

This research has shown that ICCCF investments have helped build local resilience to climate change while providing a number of co-benefits that promote wellbeing. They have also helped enhance the capacity of rangeland ecosystems to continue to produce services for local communities and withstand climate change impacts and other stressors. ICCCF investments are cost-effective for both community and external investors. So, in summary, we can say that as an EbA initiative, the ICCCF was effective (Nyangena and Roba 2017). A number of social, institutional and political issues influenced the implementation of the ICCCF, however, and these provided both challenges to overcome and opportunities to realise benefits.

Effectiveness for human society

The decision-making process for selecting ICCCF investments was specifically designed to improve local resilience to climate change. Natural resources, climate information, and enhancing resilience are all criteria for selecting investments. By the end of 2014, ICCCF had directly and indirectly helped around 956,132 people to cope with effects of climate change (Ada Consortium 2015c).

ICCCF support was able to provide significant adaptation benefits for people in poor and marginalised households. Pastoralists and agro-pastoralists particularly benefitted, which is important as livestock is the dominant economic sector in Isiolo County and supports the majority of the population. Women benefitted no less than men. The young and those whose livelihoods did not rely on pastoralism – for example, people who rely on wildlife conservancies for income – benefitted less, as did pastoralists outside Isiolo County. However, there appeared to be few trade-offs in terms of where and when benefits materialised.

A wide range of social co-benefits emerged from ICCCF-funded rangeland management improvements. These included improved local natural resource management, conflict resolution, community cohesion, more employment opportunities, enhanced natural resource management skills, improved diets and improved health. Trade-offs in terms of who benefitted and also where and when these social co-benefits materialised appeared to be minimal.

Community involvement and participation has been actively sought throughout all stages of ICCCF design and implementation, and has been formalised in management structures and decision-making processes. This has allowed local people to retain control of responses to their development and adaptation priorities. Participatory livelihood and local economy resilience assessments helped identify possible investments. Supporting WCCPSs' customary range management institutions (dedhas) was an integral part of the ICCCF, and by supporting traditional management institutions, local knowledge was also prioritised. The strong levels of participation throughout the ICCCF process were central to building local resilience.

Effectiveness for the ecosystem

Effective rangeland management requires jurisdiction over large areas, but administrative boundaries and the imposition of different tenure and land use systems can disrupt pastoralist mobility and their ability to manage stock effectively. Catchment-level planning is also important to ensure pastoralist access to water in this dry area. Continued provision of ecosystem services from the rangelands for pastoralism thus requires landscape-level management approaches. ICCCF investments operated at the level of Isiolo County, so whilst the scale of operation was large, the area was still limited by administrative boundaries.

Little is known about the thresholds that could influence ecosystem services provision in the Kenyan drylands, but there may be tipping points related to the ability of the rangelands to support less drought-resistant stock, and also a fall in the water table.

ICCCF disbursements supported projects that improved ecosystem resilience and services provision. Most notably, investments in traditional rangeland governance and management systems slowed land deterioration and led to rangeland regeneration. Investments may have reduced ecosystem services in other locations – for example, sand dams may have reduced downstream water availability – but considerably less so than other land uses, such as irrigated crops, could have done.

Financial and economic effectiveness

Measuring value for money or returns on investment is difficult in Isiolo because the people are highly mobile and many benefits are difficult to quantify. Pastoral production systems have historically been undervalued as a land use choice, in part because it is not easy to measure and quantify the full benefits they provide. The financial rationale of investing in the ICCCF, however, appears to be strong. In terms of returns on investments from strengthening dedha in four Isiolo wards over the long dry season of 2014, the ratio of local community benefits to ICCCF investment was 402:1. The ratio of benefits for local and non-local community members to ICCCF investments was 1,635:1. Dedha members contributed some of their own money to dedha management, and the ratio of returns on their investment was 90:1 (King-Okumu et al. 2014; Tari et al. 2015). The costs of establishing the ICCCF were 28% greater than the total value of the investments delivered by the first round of disbursements, but these costs are likely to drop dramatically in subsequent rounds. At 7.5%, the ICCCF running costs compared favourably with similar mechanisms (NDMA 2014). Comparisons with other potential uses for water resources, and research from a neighbouring county comparing EbA approaches with doing nothing at all or adopting top-down adaptation approaches, indicate that no other land uses would provide better returns.

Quantifying the broader economic benefits of ecosystem services and pastoral production systems is even harder than quantifying the immediate direct benefits. As a result, their true value is often overlooked. There are, however, a great number of broader economic benefits emerging from ICCCF investments in Isiolo, such as insurance for disasters, option value (similar to insurance or having savings), income substitution for reduced expenditure, capital for investment and access to credit. There may also be avoided costs and avoided losses from EbA implementation.

Economic benefits look likely to materialise fast and last for a long time. Possible financial trade-offs included losses suffered by neighbouring communities with reduced access to water, and by extension pasture.

Policy and institutional issues

A number of social, institutional and political issues influenced ICCCF implementation. Key challenges at the local level related to basic infrastructure and services provision in Isiolo, the historical mismanagement of water and grazing resources, and the disconnect between communities and formal governance systems. A general lack of arid and semi-arid land ecosystem knowledge amongst government staff at the county level proved challenging. This has led to under-investment in pastoralism. Poor access to climate information and limited capacity to track the impact of adaptation interventions has also been challenging at the county level, as has securing county-level government support and the necessary multi-sectoral coordination. At the national level, a historical legacy of limited and often inappropriate development in Kenya's drylands has left them impoverished and with weak

institutions for governance and planning. Centralised planning systems have also meant that coordination and communication have been poor, and planning inflexible. The true value of ecosystems is also poorly understood.

There are, however, a number of social, institutional and political opportunities that have supported ICCCF implementation in Isiolo. Local institutions (ie WCCPCs and dedha) are now strong, empowered and heavily engaged in adaptation planning. This required considerable investment at first, but legitimising and supporting local institutions in this way has meant communities are now in control of designing and supporting initiatives to meet their development and adaptation needs. County-level support for addressing climate change and supporting ICCCF processes is apparent. Governance and coordination is strong at the county level. At the national level, Kenya has a number of policies and institutions that support climate change planning. A national commitment to devolution has also provided opportunities to enhance community participation in decision making and support community land ownership, both of which are cornerstones of ICCCF effectiveness.

ICCCF funding has brought about short-term as well as long-term improvements in resilience, but some projects funded by the ICCCF showed that benefits were not sustained as the costs of repairing and maintaining the projects weren't met. Integrating ICCCF institutions into Isiolo County policies would improve sustainability, along with better project monitoring and evaluation. The ICCCF also needs continued financial inputs, which looks likely from county budgets and possibly external sources such as the Green Climate Fund and National Climate Fund.

A number of opportunities for replication, scaling up or mainstreaming emerged from the ICCCF initiative. First, the institutions for managing the ICCCF are all in place, which means they are available to channel funding into a multitude of further EbA investments should this become available. ICCCF institutions and systems are being integrated into county-level planning and management. The ICCCF model can be, and is being, replicated in other Kenyan counties and is informing various national climate change planning processes in Kenya and other African countries.

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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 Supporting Counties in Kenya to Mainstream Climate Change in Development and Access Climate Finance project, Kenya. 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.



International Institute for Environment and Development
80-86 Gray's Inn Road, London WC1X 8NH, UK
Tel: +44 (0)20 3463 7399
Fax: +44 (0)20 3514 9055
www.iied.org

Supported by:



Federal Ministry for the
Environment, Nature Conservation,
Building and Nuclear Safety

based on a decision of the German Bundestag

This report presents findings from the International Climate Initiative (IKI) project 'Ecosystem-Based Adaptation: Strengthening the Evidence and Informing Policy', coordinated by IIED, IUCN and UNEP-WCMC. The German Federal Ministry for the Environment, Nature Conservation, Building and Nuclear Safety (BMUB) supports the IKI on the basis of a decision adopted by the German Bundestag.



Project
Report

Biodiversity, Climate Change

Keywords:

Ecosystem-based adaptation (EbA),
Climate change adaptation, Resilience,
Kenya