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

Research results from the Adaptation, Vulnerability and Ecosystems (AVE) project, Costa Rica and Panama

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Summary

Ecosystem-based adaptation (EbA) is the use of biodiversity and ecosystem services as part of an overall strategy to help people to adapt to the adverse effects of climate change. Under the 'Ecosystem-based approaches to adaptation: strengthening the evidence and informing policy' project, IIED, IUCN and the UN Environment World Conservation Monitoring Centre (UNEP-WCMC) are working at 13 sites in 12 countries to gather practical evidence and develop policy guidance for governments on how EbA can best be implemented. The project has developed a definition of effective EbA and a framework for assessing EbA effectiveness which has been applied at all 13 sites, and the results will be collated and compared to draw conclusions that are based on more than single case studies. This report presents the findings from a literature review and interviews with a wide variety of stakeholders conducted by IUCN at the project site in the Sixaola River basin in Costa Rica and Panama, where local farms have adopted integrated farming methods, and evidence on the benefits derived from EbA is being collected, synthesised and used to support the adoption of effective EbA in the design of policies, governance structures and decision-making processes. The project has also developed a monitoring and evaluation methodology to understand EbA's contribution to food and water security.

The report concludes that project activities improved community resilience and adaptive capacity, and reduced community vulnerability. For example, some settlements in critical areas affected by floods, gales and frequent rain now have a reduced sense of risk and climate-related vulnerability because of improved ecosystem management, while annual agrobiodiversity and seed fairs, along with tree-planting, have built local capacity to cope with climate change. The project has also improved ecosystem resilience and helped maintain or restore ecosystem services, although it could take time for improvements to the delivery of some services to materialise. Interviewees felt that the project work was cost-effective and compared favourably with other adaptation options. A range of policy, institutional and capacity barriers to implementing EbA were apparent at the local, provincial and national levels, and it is unclear whether activities will be sustainable over the long term without better national environment and climate change policies, more collaboration between different levels of governance and across borders, improved funding and technical capacity, and better knowledge management.

Acronyms

ACBTC	Asociación de Organizaciones del Corredor Biológico Talamanca Caribe
AVE	Adaptation, Vulnerability and Ecosystems project
BMU	German Federal Ministry for the Environment, Nature Conservation and Nuclear Safety
CBD	Convention on Biological Diversity
EbA	Ecosystem-based adaptation
IIED	International Institute for Environment and Development
IKI	International Climate Initiative
iNDC	Intended National Determined Contribution
IUCN	International Union for Conservation of Nature
MAG	Ministerio de Agricultura y Ganadería (Ministry of Agriculture and Livestock)
NGO	Non-government organisation
UNEP	United Nations Environment Programme
UNEP-WCMC	United Nations Environment Programme World Conservation Monitoring Centre
UNFCCC	United Nations Framework Convention on Climate Change

Introduction

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

In Central America, there is a growing tendency to integrate ecosystems into adaptation responses. Central American countries have included EbA approaches in their Nationally Determined Contributions to the United Nations Framework Convention on Climate Change (UNFCCC) (Luna and Pérez de Madrid 2018) and are also considering the protection and sustainable use of ecosystems as part of many field projects (Marín et al. 2018)

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 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. 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 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 (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 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 (Black et al. 2016), 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. According to IUCN, a new governance paradigm is needed to cope with climate change, which considers elements such as flexibility, multidimensionality, participation and an eco-systemic approach (Martínez and Luna 2018).

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

The 'Ecosystem-based approaches to adaptation: strengthening the evidence and informing policy' project was conceived to address the third (and fourth) challenge in the above list. The project aims to show climate change policymakers when and why EbA is effective, the conditions under which it works, and the benefits, costs and limitations of natural systems compared to options such as hard, infrastructural approaches. It also aims to promote and provide tools to support the better integration of EbA principles into policy and planning. The project is supported by the International Climate Initiative (IKI). The German Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (BMU) supports IKI on the basis of a decision adopted by the German Bundestag. The project is being implemented by the International Institute for Environment and Development (IIED), International Union for Conservation of Nature (IUCN) and the United Nations Environment Programme 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 practices in the Paz River, El Salvador

In order to address the weak evidence base for EbA, the project has developed a definition of effective EbA and a framework for assessing EbA effectiveness. Effective EbA is defined as “an intervention that has restored, maintained or enhanced the capacity of ecosystems to produce services. These services in turn enhance the wellbeing, adaptive capacity or resilience of humans, and reduce their vulnerability. The intervention also helps the ecosystem to withstand climate change impacts and other pressures” (Reid et al. 2017, based on Seddon et al. 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 during 2018 to draw conclusions that are based on more than single case studies and help answer the question of whether EbA is effective or not. Detailed guidance on the way that researchers and project managers can use the framework to draw conclusions about the effectiveness of an EbA project or to shape project design or assess the progress of an ongoing EbA project or a project that has ended are provided in Reid et al. (2017).

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

Table 2: Framework for assessing EbA effectiveness

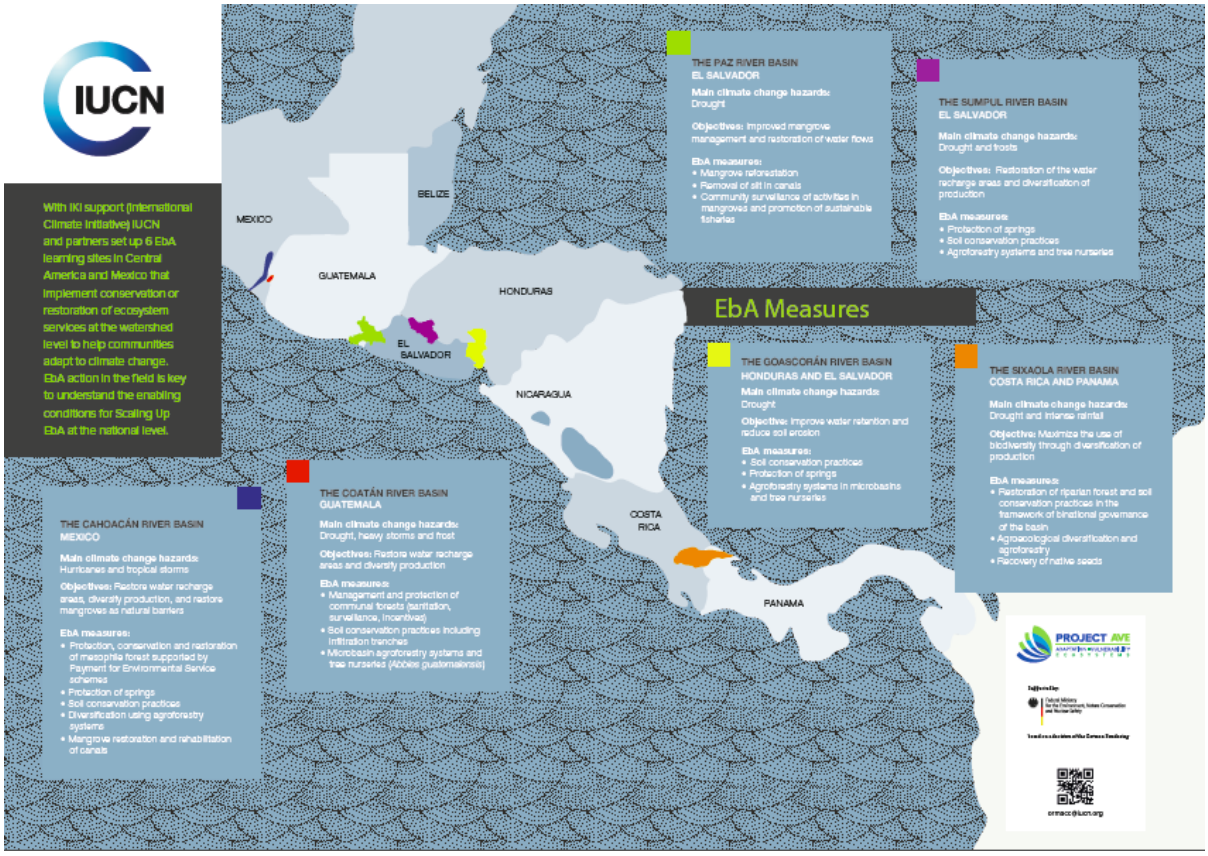
1) Effectiveness for human societies
Did the initiative allow human communities to maintain or improve their adaptive capacity or resilience, and reduce their vulnerability, in the face of climate change, while enhancing co-benefits that promote long-term wellbeing?
1. Did the EbA initiative improve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

Adaptation, vulnerability and ecosystems (AVE) project site: the Sixaola River basin (Costa Rica and Panama)

The Governance for ecosystem-based adaptation: transforming evidence into change project (Go4EbA)[1] operates in Costa Rica, El Salvador, Guatemala, Honduras, Mexico and Panama.[2] The project is running from 2015 to 2018. Its main objective is to scale up EbA in the six target countries through increased understanding and capacity to address climate change, articulated policy and institutional frameworks and based on reliable evidence of its multiple benefits. In each country, the project has established an EbA learning site to enhance local capacities through action learning and to improve – using a bottom-up approach – governance frameworks and institutions. Figure 1 shows the six Go4EbA project learning sites. Support for Go4EbA was secured from BMU through its IKI programme.

In Costa Rica and Panama, the project learning site is located in the middle basin area of the binational Sixaola River basin. At the local scale the project is collecting, synthesising and using existing evidence on the benefits derived from EbA. This evidence supports the adoption of effective EbA in the design of policies, governance structures and decision-making processes in different sectors. The project has also developed a monitoring and evaluation methodology to understand EbA's contribution to food and water security.

Figure 1. The six Go4EbA project learning sites



[1] The project was renamed locally in Spanish, and is known as the AVE project (adaptation, vulnerability and ecosystems).
[2] See https://www.iucn.org/node/594

The IUCN member non-government organisation (NGO) Asociación de Organizaciones del Corredor Biológico Talamanca Caribe (ACBTC) is a key local project partner. ACBTC has a long history of supporting agroforestry with local farmers, as well as environmental education and awareness raising to promote conservation of the biological corridor. Go4EbA local activities also built on work done under a previous Water management for adaptation project (2010-2013) (also BMU-IKI funded).

The Sixaola River basin in Costa Rica (81%) and Panama (19%) is one of the sites under the Go4EbA project and is the focus of the research described in this paper and all ensuing references to the Go4EbA project. The basin's wealth of biodiversity has been internationally recognised and amongst its six protected areas are a World Heritage Site, two Ramsar sites and a biosphere reserve (IUCN 2017b; Porras 2016). The Sixaola basin covers an area of 2,800 km^2 and includes the trans-boundary Yorkín River microbasin. The basin's highest point is on the Talamanca mountain line at 3,700 metres above sea level (Pérez de Madrid and Sánchez 2011). The landscape is characterised by tropical and subtropical moist broadleaf forests, and large and small river ecosystems. The EbA learning site covers actions in Costa Rica and in Panama.

The watershed is inhabited by people from its source to the mouth of the Sixaola River. The total estimated basin population is 33,500 people. Go4EbA works with Bribri indigenous communities from both Costa Rica and Panama, including those of El Guabo, Yorkín and the Shuabb communities, located in the Yorkín microbasin. The Go4EbA project also works with non-indigenous farmers located in the Paraíso (in Costa Rica) and Las Tablas (in Panamá) communities, although they were not the primary focus of the research. The Bribri territory crosses political boundaries, and collaboration in joint decision-making occurs on both sides of the river in Costa Rica and Panama. The government of Costa Rica recognises the Bribri indigenous territory, with its own rules and governance structures, but Bribri territory is not recognised by the government of Panama (Pérez de Madrid and Sánchez 2011). Subsistence agriculture is important for these communities, who also grow bananas, plantains and cocoa for income generation.

Project objectives in Costa Rica and Panama are as follows (Martínez Hernández and Dávila 2018):

- Validating a methodological framework for EbA effectiveness and food and water security.
- Generating knowledge and evidence on the benefits of EbA for food and water security.
- Strengthening binational governance platforms and mechanisms.
- Enhancing leadership, governance and ecosystem management capacities.
- Improving local capacities for water governance.
- Scaling up EbA actions at the national level and integrating EbA into national strategies.
- Transforming the local farms in Sixaola to integrated farming.

Activities are jointly implemented by ACBTC and IUCN (see Table 3). At the local level, Go4EbA project EbA activities involve:

- Design and implementation of integrated farming involving:
    - crop diversification,
    - use of local biodiversity and germplasm with local seeds, basic grains, roots, tubers, forage species, etc
    - restoration of the water basin ecosystem (riparian forest) with timber and local fruit trees,
    - improvement of cocoa production,
    - agroforestry, and
    - improving local capacities for water governance.
- Training for farmers, municipalities, youth groups and binational institutions.
- Establishing local timber and fruit tree nurseries.

Table 3: Activities under the two phases of the Go4EbA project

Previous project phase, 2010-2013	Current phase
Renewal of trees through grafts and clonal orchards, affects the resilience of local communities.	Set up of integrated farms with diversification of crops (recovery of ancestral seeds, basic grains, roots, tubers, forage species, et cetera), incorporation of native trees (timber trees and fruit trees) and forest restoration.
Establishment of community forestry nurseries.	Annual binational reforestation.
Annual binational reforestation.	Strengthening of the binational commission of the Sixaola basin.
Strengthening of the binational commission of the Sixaola basin.	

Genuine ecosystem-based adaptation initiatives must meet the following four criteria (Martin 2016; CBD 2009; CBD 2010): they must use biodiversity and ecosystem services; they must help people; they must support human adaptation to the adverse effects of climate change; and they must form part of an overall strategy. The Go4EbA project was designed as an EbA intervention and clearly meets all of these criteria.

Methodology for assessing effectiveness

The methodology applied for assessing EbA effectiveness is detailed in Reid et al. (2017). This guidance describes a process, based around asking a detailed set of questions, that can be used to draw conclusions about the effectiveness of an EbA project that is ongoing or has ended. Table 4 describes the participatory plant breeding project stakeholders interviewed for this paper.

Table 4: Stakeholders interviewed under the Go4EbA project

Level of interviewees	Stakeholders interviewed
National	Five interviews with officials from the Regional Área de Conservación Amistad Caribe Sistema Nacional de Áreas de Conservación, the Comisión Binacional Río Sixaola, Minsterio de Agricultura y Ganadería and the Talamanca Instituto Nacional de Desarrollo Rural. These interviewees did not have detailed project implementation knowledge, but could provide information on the context within which EbA projects operate and on bringing lessons to scale.
Local authority	Six interviews with officials from the Asociación de Desarrollo Integral del Territorio Indígena Bribri, Alcaldia Municipal de Talamanca and the Asociación de Desarrollo Integrar del Territorio Indigena Cabécar.
Project implementers	Four interviews with IUCN officials involved with the project, and ACBTC officials.
Beneficiaries	Four interviews with local community members from El Guabo, Yorkín, Paraíso and the Bribri community.

Along with the interviews conducted, publications on the Go4EbA project were also reviewed to assess the characteristics of project activities that contribute to EbA effectiveness. The results of this assessment are described in the following results section.

Research results

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

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

All interviewees from all four of the levels listed in Table 4 felt that community resilience and adaptive capacity had improved as a result of the Go4EbA project activities, and that vulnerability had been reduced. One added that ecosystem services reduce the effects of climate change. Central to this was the importance of soil formation as a critical supporting ecosystem service. Some of the settlements in critical areas affected by floods, gales (very strong winds that blow in from the sea) and frequent rain now have a reduced sense of risk and climate-related vulnerability because of improved ecosystem management. For example, excessive tree felling, erosion and bad farming practices previously increased vulnerability to landslides and other risks. Likewise, soil type needs to be taken into account when considering agricultural productivity in order to avoid over-exploitation. Understanding how the ecosystem functions is very relevant for adaptive capacity. The project has also donated tools, organic fertilizer and other supplies relating to farming needs to the community.

Annual agrobiodiversity and seed fairs along with tree-planting have built local capacity to cope with climate change (Cruz Marín et al. 2018a; IUCN 2017b; Pérez de Madrid and Cruz 2018). Social capital in the context of water governance has also improved. Better organisational capacity improves local ability to deal with climate hazards, and transboundary coordination capacity – notably of the Binational Commission for the Sixaola River basin institutions – has been built, so collectively people are less vulnerable to climate change (IUCN 2017b). Pérez de Madrid and Sánchez (2011) describe how similar efforts under a previous project to recover degraded watershed areas with steep slopes using soil conservation and reforestation practices have improved local community adaptive capacity due to improvements in soil fertility and reductions in landslide risk and river sedimentation (and hence floods, poor water quality and transport challenges). Floodplain reforestation also reduces farm flood damage by reducing the destructive power of water currents. Pérez de Madrid and Sánchez (2011) also describe how actions to improve sustainable management of banana and cocoa farms and diversify staple grain production, including training in seed conservation, will contribute to adaptive capacity through improved crops. Agricultural diversification enables producers to have other sources of income to protect against devastating losses, which increases adaptive capacity.

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

Community-level project beneficiaries felt that everybody benefits from the project, but two said that women benefit the most. Project implementers felt that women particularly benefitted, but one added that people who have migrated to the area are from different religious denominations, and in some families there is little participation by women who tend to work outside agriculture.

Project implementers commented that those involved in agriculture particularly benefitted as production has improved as a result of the project. Local farmers, trained by the project, experienced changes in adaptive capacity due to improved abilities and new skills relating to organic agriculture. Farmers have improved their skills and abilities relating to cocoa production and on the implementation of integrated farming, which has improved their adaptive capacity (in terms of social capital increases). Farmers not supported by the project have not been convinced to implement adaptation measures such as diversification. Experimental farm-based changes under the project were not guided by gender or ethnic considerations, but local indigenous farmers are more open to implementing adaptation measures than people outside Bribri territory. There is more community social pressure to adopt sustainable farming

techniques compared to other farmers who farm their produce using conventional farming techniques motivated more by profits and consumption.

Project implementers also felt that the poorest and most vulnerable people, children, older people and indigenous groups particularly benefitted. One explained how groups of indigenous peoples have become empowered. However, they are not satisfied with acquiring technical knowledge alone – for example through training – and want to see project implementation.

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

Community interviewees did not feel there were trade-offs in terms of *who* experienced changes in resilience, adaptive capacity or vulnerability under the project, and only one of the four project implementers felt that there were trade-offs in terms of the greater ease with which some groups and communities access support due to remoteness and access to transport. For example, the Las Delicias community is a long way from the road, so it is more expensive for them to transport their produce.

Community interviewees did not feel there were trade-offs in terms of *where* changes in resilience, adaptive capacity or vulnerability were experienced under the project, and only one in four project implementers felt that there were trade-offs. As above, this relates to the fact that some communities are more isolated so are harder to reach and less aware of project activities as a result.

Most project implementers felt there were trade-offs in terms of *when* changes in resilience, adaptive capacity or vulnerability occurred as a result of the project. Two felt project benefits were long-term with challenges associated with assessing results immediately. For example, benefits from wood sale may accrue, but these will only become apparent after 15 years. One project implementer also commented that at the start of the project changes occurred at the family level, but the idea is to work at the community level as the project progresses.

Social co-benefits from the EbA initiative

Project implementers and community members listed a number of social co-benefits emerging from the Go4EbA project. Some of these were perceived benefits, with no specific examples provided by interviewees:

- Disaster risk reduction.
- Livelihood provision, for example from the integrated farms (Marín and Cruz 2018; Cruz Marín et al. 2018b).
- Market access, although there were challenges associated with transporting agricultural produce out of the community. This is an indirect co-benefit.
- Food security, for example through the agrobiodiversity and seed fair (IUCN 2017b; Pérez de Madrid and Cruz 2018).
- Health benefits, for example in renewed use of medicinal plants.
- Sustainable water provision, for example making better use of rainwater.
- Security (no examples available, only perception).
- Reduced conflict over resources (no examples available, only perception).
- Improved policies and governance. As a result of the project, the Binational Commission for the Sixaola River Basin drafted a development plan for the Sixaola basin (Plan Estratégico de Desarrolo Sostenible de l'acuenca). Moreover, training was carried out for teachers and an associated manual was delivered.
- Educational benefits. IUCN (2017b) details how more than 500 students from Costa Rican and Panamanian schools in the Sixaola River basin have benefitted from active participation in the reforestation campaigns.

Distribution and trade-offs relating to social co-benefits

Only one community interviewee commented that some social groups accrue more of these co-benefits than others as a result of differential learning opportunities.

The role of participatory processes and local/indigenous knowledge

Local authority interviewees and others provided the following examples of the use and importance of indigenous knowledge:

- There is ancestral knowledge about ways to manage a farm and why. Local communities plant medicinal herbs and plants, trees for timber and fruit trees. There is a natural balance, which is mirrored by the mountains or ecosystems. This sets the pattern for how local communities work. Indigenous customs and traditions relating to agrobiodiversity systems were practiced by the ancestors of local communities, and adjusted over time. This includes knowledge on balanced soil management by planting a diversity of crops, and knowledge about which crops need shade and which do not.
- Local/indigenous knowledge promotes sustainable use and conservation of the forest, for example in the Yorkín microbasin.[3]
- One recent study in the Sixaola basin revealed a total of approximately 221 documented species, subspecies and agricultural varieties or cultivars with known uses within the indigenous livelihood system (Deutsch et al. 2016).
- Indigenous people use the river system for transportation to school, for tourism and to trade agricultural products, including seeds. Rivers are a primary means of transport.
- There is a huge variety of dishes that typify cuisine in the canton and the province and are shared with neighbouring communities in Panama.

Most interviewees agreed that the Go4EbA project had incorporated indigenous knowledge. Implementing partners provided a number of examples of how project activities have incorporated indigenous knowledge and been strengthened in other ways:

- Participation in project activities has helped recover culture and restore traditional ways of managing seeds.
- Indigenous people have management systems that rely heavily on nature, but production is not the same as it used to be. With project support, production is improving.
- Community organisations had stopped functioning, but they have now been renewed and strengthened. As a result, historical knowledge is being recovered; for example, knowledge on how to use medicinal plants has improved.

A range of participatory processes were applied by the Go4EbA project, with most interviewees characterising these as ‘self-mobilisation’ or ‘interactive’ from the typology supplied.[4] Interviewees explained that as the project progressed it became clear that people needed to be more involved, especially representatives from indigenous areas who are directly affected by changes to watershed management because they live or have land in or nearby the watershed, and because they need to ensure their culture and traditions will be sustained over time. The Naso and Bribri people in the area

[3] See https://www.youtube.com/watch?v=2g0JwnLCHYs

[4] Participatory approaches can be characterised according to the following typology: (1) passive, where people are told what is going to happen or has already happened; (2) information giving, where people answer questions posed by extractive researchers (they cannot influence proceedings and research findings may not be shared with them); (3) consultation by external professionals who define both problems and solutions (decision-making is not shared, and professionals are under no obligation to take on board people’s views); (4) for material incentives, where people provide resources, for example labour, in return for food, cash or other material incentives; (5) functional, where people form groups to meet predetermined objectives related to the project. Such involvement tends to be during later project cycle stages after major decisions have been made; (6) interactive, where people participate in joint analysis, which leads to action plans and the formation of new local institutions or the strengthening of existing ones (groups take control over local decisions so people have a stake in maintaining emerging structures or practices); and (7) self-mobilisation, where people take initiatives independent of external institutions, develop contacts with external institutions for the resources and technical advice they need, but retain control over how resources are used. Adapted from Adnan et al. (1992) and Dazé et al. (2009).

struggle with new settlers and action is needed to prevent them from losing their land, associated places of cultural significance, and their agricultural livelihoods. Interviewees stressed that any project has to be based on what people want, what their objectives are, and what they want to develop. It must allow them to redirect project activities. Interviewees provided the following examples of how participation occurred under the Go4EbA project:

- A vulnerability assessment using CRiSTAL[5] was conducted in 2011. Insights from this formed the basis of the ensuing strategy and EbA measures selected and promoted at the site.
- An action learning workshop was held at the start of the Go4EbA project to validate learning from previous activities in a participatory way.
- The Go4EbA project made links with organised groups and the authorities in the indigenous territory; for example, with the municipality, which has carried out projects aiming to strengthen producers, with investments targeting indigenous people. Past projects include the biological corridor project with the Ministry of Agriculture and Livestock (Ministerio de Agricultura y Ganadería, or MAG), and also projects promoting cocoa and breadfruit planting.
- The project has revitalised community organisations, which often adopt highly participatory approaches. For example, there is a group led by women that conducts and leads on social work in a strongly participatory manner.
- The project held several training events related to sustainable and resilient agriculture and tourism. Communities – including schoolchildren and teachers – were organised to do grafting together. Cruz Marín et al. (2018ba) and IUCN (2017a) describe how communities participated in training programmes on integrated farming, and the importance of and techniques for forest conservation. Other training topics included food security, the importance of integrating the family in farm activities, soil degradation and restoration, use of forest resources (wood, water, leaves, etc.), agrobiodiversity and organic farming, green fertilizers, crop rotation, rescue and use of seeds, climate change and other topics. The project also organised training on cocoa production. Knowledge exchange on cocoa has since improved. This includes specific knowledge on the use of shade in cocoa production, and the soil conditions needed for production. Such knowledge is new and does not originate from indigenous traditional knowledge.
- Workshops were held with communities to discuss their future farming plans. People wanted their farms to have trees, plantains and cocoa. They wanted better quality water. They were asked what seeds they wanted, and they drew up a list of fruit trees (cashew, orange, mandarin, avocado, apple, jocote, papaya, sweet lemon, guava and others). Community members and farmers then designed a plan for their farms themselves, identifying which crops were most suitable to grow for sale in the community. They drew a map of what the farm was like and what they wanted it to look like in the future. They participated in decision-making to determine which species would be grown in the integrated farms. Wives, children and nieces/nephews participated. The difference between the maps is clearly visible.
- People shared their experiences on integrated farming and the project also organised exchanges to share experiences on cocoa production. When someone was convinced about the value of a new integrated approach (not involving conventional farming or the use of monocultures), they then convinced other members of their family, and together they implemented proposed changes. Sharing experiences on integrated farming methods has occurred through exchanges between Costa Rica and Panama, and this is motivating other groups to share. Flexible project field work has fostered creativity.

Local authority and national-level interviewees provided some examples of how participation could be improved. For example, more participation by civil society and the private sector is needed to implement the watershed management plan. There is participation in indigenous governance structures, and also local governments, but the quality of participation needs to be improved. Participatory planning processes need to be better integrated into local, provincial and national planning

[5] This tool focuses on projects at the local community level; see https://www.iisd.org/cristaltool/

processes to better align these with what needs to be done. Lastly, indigenous doctors, known as Awa, have asked for an open forum to be organised to share their knowledge because it is being lost.

All local authority, implementing partner and community-level interviewees agreed that the use of participatory processes supported the implementation of EbA and built adaptive capacity. They explained how training and knowledge is a key aspect of adaptive capacity, and that people learn more by 'doing'. Activities on farming practices and diversifying agriculture have ensured learning is a two-way process. Training for producers on integrated farms, fermentation, organic fertilizers, ecosystems, climate change, and reforestation as an EbA measure have all reduced farm vulnerability. Training on governance helps improve management and includes key ideas to guide and improve watershed-level action. With the knowledge gained, communities are now better able to reduce their vulnerabilities and are better prepared to deal with climate change. Some 60% of community-level stakeholders say they are now better prepared, have improved knowledge, and have received training. They feel this knowledge is of great value to them. The recovery of ancestral knowledge has also been reinforced. The project has also involved many families who, through the use of participatory processes, have started to plan their own farming practices and produce their own food (Cruz Marín et al. 2018b). The fact that each family takes responsibility for producing its own food without depending on outside factors is one of the best practical ways to ensure adaptive capacity in the context of the risks they face. Farmers visited other farmers participating in the project, and they learnt together. IUCN (2017a) also describes how "cooperation between farm producers teaches better adaptation to climate change".

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

Local authority, implementing partner and community-level interviewees listed a number of factors threatening local ecosystem resilience and service provision:

- ***Climate change and extreme climatic events***, for example lowland floods, hurricanes, droughts and changes to rainfall patterns. The rains are now very heavy, leading to more landslides, soil erosion and loss of topsoil for crops. The climate is more variable these days. Many fruit trees no longer bear fruit as a result of climate change, so livestock, poultry and the farming of other animals is increasing. Floods affect banana plantations and fruit trees roughly every 30 years and because there is only one species, there is no alternative income. Hurricanes require the banana plants to be propped up and shielded with trees to prevent them falling down.
- ***Land conversion*** leading to habitat change, for example tree-felling and deforestation for cattle farming on the Yorkín River and the River Escuy, or for growing rice, maize and beans. This reduces water availability. Deforestation causes landslides and a lot of erosion and river siltation (Pérez de Madrid and Sánchez 2011). Growing bananas and mono-cropping also leads to land use changes. Mono-cropping reduces the diversity of seeds for food crops. Many people in the Yorkín area are very concerned about water availability and quantity, and consequent changes to river transportation, because those owning the upstream part of the watershed are changing their land use practices. Communities are also afraid of future plans for dams in the area and threats from deforestation in the upper part of the basin. There is less use of chemicals upstream, but the ecosystem is still not very well managed there and the perception exists that community activities upstream are leading to deforestation.
- ***Overexploitation and bad agricultural practices***, for example, farming on fertile riverbank land, and a reduction in rotation periods and decreases in the length of time land is left fallow as the population has increased. Agriculture and cattle farming occurs without any soil protection measures on land that should be protected, mainly on hillsides. This causes more erosion and leads to loss of forest cover. People use palm trees (chonta) to build farm buildings, but this leaves wildlife without a habitat.

- ***Habitat fragmentation and loss of connectivity***. The ecosystem is now more fragmented, and wild animals are looking for food downstream on the farms. People are suffering crop losses and harvesting less maize and rice now because forest animals (such as parrots and rabbits) come to eat the crops due to forest fragmentation.
- ***Invasive species,*** which bring problems relating to transmutation. Produce that is not from the local area can bring in disease, for example a virus is affecting citrus fruit trees. An invasive fish called joturo (*Joturus pichardi*) is eliminating river species such as the bobo
- ***Weak governance, institutions or legal framework***. For example, an ambitious government programme called '100% drinking water - zero latrines' is conducting studies on water catchment area management and protection and agroforestry, but this needs appropriate government and institutional support. Many activities are proposed, but organisation, follow up work, plans for supervision or monitoring, legislative support, and involvement of all the relevant government agencies is lacking. Without strong policies, watershed governance will not be effective. The Ministry of the Environment and Energy should be monitoring and controlling tree-felling but it is understaffed, leaving the ecosystem more fragile. State policies are poorly implemented. There are decrees on indigenous territories, but they are not respected. Upstream communities have a higher capacity to react to threats (such as hydroelectric dams), but they need to link up better with other communities and institutions.
- ***Pollution.*** Sanchez and Roberts (2014) explain that one of the most significant problems in the basin relates to poor water quality, which is directly related to the use of chemical pesticides. Large farming corporations produce agrochemical pollution, including nutrient pollution in water bodies. Using a lot of chemicals to grow bananas pollutes the water and thus affects the communities along the river. Chemical use is also damaging soil structure and biodiversity. For example, oil and chemicals are used in banana plantations to prevent a disease called sigatoka. Pollution reduces biodiversity. The accumulation of domestic and agro-industrial waste also creates an eyesore, and rubbish is burnt.
- ***Hydroelectric power plant construction***. For example, one such plant is rumoured to be built in the Yorkín area and the location has been identified without prior consultation. This will affect the river if it draws on river water. It will also lead to deforestation because of the need to clear land for the pylons.
- ***Sedimentation***. The Yorkín River has been clogged with sediment since 2008. This is compounded by an increase in runoff, because there is no tree cover at the top of the watershed. The river is going to rise because sediment that flows down from higher sections of the watershed is accumulating; it is already very muddy. Pérez de Madrid and Sánchez (2011) also describe problems relating to sedimentation in the lower Yorkín River basin due to deforestation and erosion at higher levels.
- ***Market pressures*** lead to land use change and use of agrochemicals. People are switching crops because of economic rather than environmental considerations. For example, organic bananas are being replaced by conventional bananas. Population growth is a concern, as it affects the demand for and availability of land. Tourism can be dangerous if it turns into a dominant land use activity.
- ***Cultural changes***, leading to less appreciation of the environment. People are no longer looking after the mountain, and cultural shifts are leading to deforestation.

Boundaries influencing ecosystem resilience

Interviewees described the importance of watershed-level management, because changes upstream (such as deforestation, or water removal due to hydroelectric dam construction) will have downstream consequences. This particular watershed crosses a national boundary.

Interviewees also described how breaking up ecosystems affects their functionality. This reduces production and resilience, and increases vulnerability and exposure to climatic events or variability.

Thresholds influencing ecosystem service provision

Two implementing partner interviewees described possible thresholds beyond which ecosystems could perhaps no longer provide key ecosystem services:

- Hydroelectric dam construction could reduce the strength of the Yorkín River by more than 50%. The river is the communities' livelihood, and a dam and open-cast mining will both take away the local supply of food.
- The use of agrochemicals has already reached unhealthily high levels, which could leave the community without water and the river dead.

EbA initiative impacts on ecosystem resilience and services provision

Interviewees agreed that ecosystem resilience improved after the project, and ecosystem services were maintained or restored. They provided a number of examples:

- The concept of integrated farms provides guidelines that help people to understand the importance of soil management. Project farms are more diversified, with more nutrients available and a recirculation of resources. The farms do not use chemicals and are more efficient in their use of resources, which benefits the ecosystem, in particular the soil.
- Traditional ways of farming – with a combination of trees and biodiversity – are supported by the project, but new varieties and techniques have also been added. For example, local communities have been taught a new grafting technique and provided with new crop clones, which are unrelated to their knowledge and traditions. Many have already been growing cocoa but now their knowledge has improved. This approach ensures efficiency in addition to sustainability, and it can support biodiversity and deliver services such as carbon storage.
- A strategic watershed development plan was drawn up for the Sixaola River basin. Plan implementation includes forest restoration and reforestation, which will support related ecosystem services provision.
- The annual agrobiodiversity and seed fair is an eagerly awaited event by participants (Cruz Marin et al. 2018a; Pérez de Madrid and Cruz 2018).[6] The Bribri want to return to the virus-free species they used before, and to maintain their culture. They want to prioritise seeds from native species, which are best able to resist climatic changes.
- Ecosystem management has improved, including diversification and reforestation. This should reduce erosion, which will benefit lower parts of the watershed. IUCN (2017b) describes how project support has enabled the planting of 7,500 native trees since 2015 during the annual 'binational reforestation days' with the active participation of local organisations. This has improved the connectivity of riparian forests.
- Basins with restored riverbanks and forest cover help minimise the impact of flooding (IUCN 2017a).

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

Interviewees felt ecosystem services were maintained or restored at the watershed and the local village/area level. None could list any trade-offs between the delivery of ecosystem services at different geographical scales.

The Binational Commission for the Sixaola River Basin helps ensure transboundary management of the watershed occurs to ensure EbA activities are coordinated across the basin (Sanchez and Roberts 2014).

[6] See the IUCN film on this event in 2018 at https://youtu.be/TI4VqD-MLmU

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

Interviewees felt that ecosystem services would be maintained or restored over a range of time periods, but mostly over ten years or more. In the long term, integrated farm systems are more sustainable and improvements to biodiversity will be long-term. Two interviewees commented, however, that it could take time for improvements to ecosystem service delivery to materialise. Effects are not seen in the short term and raising awareness as well as adopting new behaviours takes time. For example, improvements in soil health brings economic benefits from increased production of bananas and plantain, but these benefits will only be felt in time.

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

How cost-effective is the EbA initiative?

One national-level interviewee said that there was evidence that the project was cost-effective, and that costs are considered in all projects where the Ministry of Agriculture is involved. One implementing partner and one local authority stakeholder, however, said that no studies on cost-effectiveness had been done. Pérez de Madrid and Sánchez (2011) point out that many of the economic transactions of the Bribri in the Yorkín River sub-basin are not done with cash. This complicates cost and benefit calculations.

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

Some interviewees felt that the project intervention has been compared to other types of adaptation interventions, and two said it was more cost-effective. One implementing partner explained, however, that it is impossible to put a value on the project activities, and one local authority interviewee explained that the geography of the area and the isolation of, and lack of road access to, some communities means alternatives are not possible.

In response to the increasing damage from floods in the middle Middle Sixaola microwatershed area (near to Paraíso and Las Tablas), iron, dirt and stone structures were built in Panama to contain floods. On both sides of the river, however, this has only caused more damage when floods occur (Pérez de Madrid and Sánchez 2011).

Broader economic costs and benefits from the EbA initiative

Some interviewees felt there were broader economic costs and benefits to the EbA project, but two said no studies had been done. Examples given included the following:

- A lack of diversification on farms can lead to cop losses, which has economic impacts.
- When farmers provide for their family's own consumption, they incur fewer off-farm expenses.
- Cocoa agroforestry systems hold much potential because there is demand from the market. For example, ecotourism – such as 'chocolate tours' – is starting to contribute to the economy of the communities of Yorkín and El Guabo.

Financial and economic trade-offs at different geographical scales

Only one interviewee said there were economic trade-offs between different geographical scales, and these related to a reforestation incentives programme. The remote location of communities that can only be reached by boat or a long hike up the mountain hinders the development of ecotourism ventures (Pérez de Madrid and Sánchez 2011).

Changing financial and economic benefits and costs over time

No interviewees provided examples of where financial or economic benefits had changed over time. Ecotourism has taken many years of preparation for economic benefits to emerge (Pérez de Madrid and Sánchez 2011).

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

Local-level barriers to implementing EbA

Interviewees from all levels provided a range of policy, institutional and capacity barriers to implementing EbA at the local level:

- ***Insufficient knowledge and technical skills***. Some guidance on integrated farming is available, but people need more technical advice and support to apply this guidance in the water basin. Some people had never worked with trees before and awareness levels are low. Pérez de Madrid and Sánchez (2011) explain how communities do not possess enough of the appropriate technologies for the conservation of seeds, putting them at risk of agrobiodiversity genetic erosion with each extreme climatic event. Training processes need strengthening, for example people need to better understand climate change and small-scale farmers need capacity building to help them stop using agrochemicals. More training (for local government, young people, etc) on indigenous worldviews and ancestral knowledge is also needed. A communication strategy to raise awareness in key institutions is needed, because they have the resources for implementation.
- ***Insufficient implementation capacity***. Despite political support, if resources are not provided to implement policies, then priorities like tackling the marginalisation of vulnerable groups such as indigenous and local communities remain unrealised. MAG does not have enough staff to meet all the communities' demands for advice and resources (such as seeds and nurseries). MAG also lacks sufficient personnel to monitor the investments it does make in communities.
- ***Institutional weakness and a lack of continuity.*** There are excellent laws in Costa Rica, but they are not always implemented, at times due to pressure from powerful business sector actors such as those in the agro-industry (Sanchez and Roberts 2014). Decision making at the official local authority level is disconnected (Pérez de Madrid and Sánchez 2011). Sometimes the municipal government staff attending meetings change, inhibiting continuity. Job stability for the staff involved is important to avoid repeated training processes. Sustained communication and outreach strategies are needed that have legal support and that are not subject to changes associated with political cycles, or to changes in authorities or top officials.
- ***Poor collaboration and communication.*** Communication needs to improve between local government and other institutions to avoid repetition of activities. With increasing global interest in climate change, there are many workshops and training activities on adaptation, and considerable political support for sustainable family farming, food sovereignty and adaptation-related work. More collaboration between these initiatives is needed, along with the associated commitment and oversight.
- ***Lack of local government authority to take action***. Mayors often delegate to municipal government staff who go to meetings but do not have the power needed to make decisions. Greater participation and interest on the part of the municipality mayors is needed, along with more decentralisation from national units. Similarly, some MAG staff cannot make the decisions they need to make. Delays in the provision of government resources or authorisation can occur, and a reduction in bureaucracy is needed.
- ***Insufficient financial resources for implementing EbA***. There are good technical people at the local level, but resources are not available for implementation. More direct investment is needed. Funding using a payments for ecosystem services model was explored in a 2008 study, but did not find traction in the mayors' offices.

- ***Low community motivation to participate***. Some communities lack initiative and do not sufficiently value natural resources and the ecosystem. It is difficult to do project work with them because a love of the environment and a sense of local ownership is needed to ensure adaptive capacity improvements, sustainability at the family level, food self-sufficiency and economic independence. Local-level agricultural practices and market development need to be strengthened to improve local participation. Improving links with the community tourism sector, including farms as attractions, could also motivate sustained engagement.
- ***Difficult market access***. Intermediaries in the sale of produce need removing to prevent producers from being exploited. Road access to some areas is also poor (IUCN 2017b) and the River Sixaola is suffering from sedimentation, which inhibits transportation or goods to market and people between different segments of the water basin (Sanchez and Roberts 2014).

Provincial-level barriers to implementing EbA

Interviewees described a range of policy, institutional and capacity barriers to implementing EbA at the provincial level:

- ***Insufficient knowledge, financial resources and implementation capacity***. More technical support from the relevant municipal and regional authorities is needed. Provincial government staff numbers are low. Local-level actions and experiences relating to integrated farming, reforestation, cocoa farming, community forest nurseries and binational basin management should be scaled up. There are guidelines for implementing good agricultural practices but they are not realised, and short-term planning relating to implementation is insufficient.
- ***Environment and indigenous people are a low priority for the regional government.*** More advocacy work with institutional authorities such as MAG and the Institute for Rural Development (the Instituto de Desarrollo Rural – which manages provincial resources) is needed so they accept that the indigenous territory is a priority. Institutions in the region must value indigenous peoples' ancestral cultural practices in order to agree on work to do, coordinate with indigenous communities and achieve impact. Similarly, the government does not see the environment as a priority at the moment. The Institute for Rural Development needs to be convinced to take over the work that the Go4EbA project has been doing to date, and include this work in its mandate.
- ***Insufficient cross-sectoral institutional collaboration***. Inter-institutional linkages – for example, between MAG, the Institute for Rural Development and local government – at the regional level need to be improved. There is not much collaboration between public sector institutions. Institutions are not weak, but they are unconnected. Relationships between institutions can be bad, and sometimes one institution does work that another institution is already doing. The concentration of resources in one institution (such as the Institute for Rural Development) also represents a barrier.
- ***Unsupportive provincial policies and inappropriate incentives,*** which need to be reviewed***.*** Policy reform to support integrated farm implementation is needed. Models involving payments for ecosystem services provide opportunities that merit further exploration.
- ***A low level of development.*** This means that supporting initiatives that raise the human development index score is a priority, especially in the context of improving employment and prospects for income generation.

National-level barriers to implementing EbA

Interviewees described a range of policy, institutional and capacity barriers to implementing EbA at the national level:

- ***Insufficient implementation capacity***. Mechanisms to channel resources to benefit communities are inadequate. For example, the government's national cocoa programme is understaffed.
- ***Inadequate cross-border collaboration***. The Binational Commission for the Sixaola River Basin lacks sufficient knowledge as well as human and financial resources to fulfil its mandate (Porras 2016). It has no formal decision-making authority and also lacks its own separate legal capacity (Sanchez and Roberts 2014). Local representatives – especially those from more vulnerable and marginalised groups – sometimes struggle to attend Commission meetings because they are unable

to take time away from activities that secure their livelihoods. This has allowed more powerful interests to dominate meeting agenda items at the expense of less powerful interests (Sanchez and Roberts 2014). Pérez de Madrid and Sánchez (2011) describe how institutional weaknesses in Panama undermine the effectiveness of binational local governance structures and hence the realisation of the operational plans to manage the water basin. For example, the Costa Rica–Panama Agreement on Cooperation for Border Development incorporates activities under the Binational Commission for the Sixaola River Basin, but the human and financial resources assigned to the agreement's implementation are very limited (Porras 2016). Similarly, despite an international agreement, applying the law on organic farming in Costa Rica is complicated because the watershed is shared with Panama, which does not have the same law.

- ***Lack of knowledge***. For example, there is insufficient knowledge and information to inform legal frameworks relating to various aspects of development in Costa Rica (such as laws relating to payments for ecosystem services). Donors also need better knowledge of community needs relating to training and knowledge strengthening when designing EbA projects and looking for places to implement them.
- ***Lack of financial resources***. Funding and supplies are needed but donors are disappearing; there were more in the 1990s. Donors supporting EbA need to be more efficient and flexible in terms of how they provide resources and more aware of the importance of working closely with people. More direct investment is needed because sometimes the funding goes to prop up an institution when direct support for the processes that really bring about change would be better.
- ***Insufficient policy support***. The lack of a specific and detailed National Adaptation Plan is a major problem that affects climate change policy. Capacity building on climate change policy development is needed.
- ***Insufficient collaboration across institutions, sectors and legal frameworks***. Government must not lose sight of the project objectives. National-level government needs to consider proposals and plans originating from the regional level relating to agriculture, forestry and how to address the needs of local people and farmers better. National-level government also needs to improve promotion and dissemination of agricultural and forestry policies to the local level. Government needs to be aware of the regional plan to address the needs of local people, farmers and others.
- ***Inappropriate project choices and measures of success.*** Donors should coordinate with municipalities and local governments, who are quite able to decide whether something is useful to them or not based on what is written down in their plans. Donors should also select projects that align with local people's interests and needs. Actions should be judged not by the number of visits, but rather on progress made on targets relating to integrated farming, reforestation, binational basin management, improvements to cocoa farming, and community forest nurseries. All the actions should seek to benefit the producer, to improve efficiency on the farm and make it more sustainable. Government should respect and support indigenous cultures and traditions better. Oversight and monitoring and evaluation are vital.

Local-level opportunities for implementing EbA

Interviewees from all levels described a range of policy, institutional and capacity opportunities to implementing EbA at the local level:

- ***Culture is valued.*** For example, cocoa is a crop with an acknowledged ancestral history, which is valued within the biodiverse agroforestry system. Membership of the Binational Commission for the Sixaola River Basin includes organised civil society representatives and indigenous authorities from Panama and Costa Rica (Porras 2016).
- ***Knowledge and capacity has improved*** through training provided on key watershed issues.
- ***Good relationships exist between the community and the project***, so if political and institutional support continues and the necessary capacity is present, local-level project activities could be sustained over the long-term.
- ***EbA 'champions'*** can make a difference, as evidenced by changes to policies and policymaking.

- ***Incentives are in place.*** For example, all plans for integrated farming – those relating to crop diversification, recovery of ancestral seeds, incorporation of native trees and forest restoration – include proposals to ensure food security. Incentives in the form of seeds, plants and payments of wages are provided. Payments for ecosystems services models also exist.
- ***Government is active on the ground***. For example, local government bodies from Costa Rica, Panama and other Central American countries met in December 2017 to discuss climate change challenges, and committed to using nature-based solutions to address them. A new bridge over the Sixaola River addressed physical and environmental concerns. A River Sixaola watershed development project supported many producers. There are early warning systems for the communities. Project inputs, such as materials or species, are provided. Whilst statutes might be unclear, some institutions and governance are strong, and there are strong policies. For example, government has targets for organic farming. Deep-rooted agricultural and cultural knowledge on food, crop production, gathering wild fruit, and types of palms and root crops has been strengthened and improved by the municipal government in Talamanca through a whole range of development projects. For example, the municipality has a programme of annual events, including an agrobiodiversity and seed fair, which draws on knowledge of how to manage and look after the environment (see also IUCN 2017a; Pérez de Madrid and Cruz 2018). This has been expanded to cover the whole of Talamanca canton and also more widely within the province of Limón. The programme has received international recognition and various awards.
- ***Communities are well organised*** and have strong grassroots-level organisations, which reduces vulnerability (Pérez de Madrid and Sánchez 2011). People support each other, for example they refer to '*mano vueltas*', or the exchange of hands, which is when one person helps another and vice versa on different tasks.

Provincial (sub-national)-level opportunities for implementing EbA

Interviewees described a range of policy, institutional and capacity related opportunities to implementing EbA at the provincial level:

- ***Strong regional institutions***. For example, the Instituto Mixto de Ayuda Social (Joint Social Welfare Institute) has some funding for projects which could be channelled towards EbA implementation.
- ***Strong regional policy/legislation***. There is a decree that emphasises identity and the value of indigenous peoples' ancestral systems. This supports EbA because ancestral knowledge on farm management includes how to grow medicinal plants, timber trees and fruit trees. It supports reciprocity and the balance of nature.
- ***Government prioritisation***. The government prioritises the scaling up of EbA measures and also integrated farming approaches.

National-level opportunities for implementing EbA

Interviewees described a range of policy, institutional and capacity opportunities to implementing EbA at the national level:

- ***Strong national policy/legislation***. Box 2 describes some of the policies and plans in Costa Rica that are relevant to climate change. The National Adaptation Plan is due to be finalised in 2018. Policies also change as a result of evidence, and policy development occurs from the local level upwards. The national development plan, for example, was designed using participatory approaches at the local and regional levels. These provide definitive guidelines for national policies.
- ***Strong national institutions***. Costa Rica has an Inter-Ministerial Council for Climate Change, and a Climate Change Department (within the Ministry of Environment and Energy). Several authorities are responsible for implementing adaptation measures in the agriculture and water resources sectors. In the agricultural sector, MAG is the key player responsible for developing climate change adaptation measures, but in coordination with the Planning Ministry, the National Institute of Meteorology and the National Commission of Risk Prevention and Emergency Assistance.

- ***Government prioritising of climate change, water protection, and payments for ecosystem services***, which makes the project work stronger. For example, in 2018 the Minister of Environment and Energy signed a decree highlighting public interest in EbA and community-based adaptation. Political support is directed to sustainable practices, family farming, food sovereignty and particularly adaptation to climate change. For example, MAG and the Ministry of Environment and Energy proposed the River Sixaola watershed project, and the legislative assembly approved it. There is also global interest in climate change adaptation and support in the form of workshops on crop planting and so on as a result of this.
- ***Cultural identity strengthening every aspect of production***. In the highlands people say they are going back to the way their ancestors used to do things. They pay attention to their ancestors' knowledge. This is unrelated to the economic aspects of project activities, and it strengthens adaptive capacity. In recognition of this, indigenous people have started their own climate fund - the 'Fondo Territorial Mesoamericano' - after struggling to access international climate finance.[7]
- ***The Binational Commission for the Sixaola River Basin,*** which was created in 2010 with the goal of conserving biodiversity, promoting sustainable production methods and strengthening the binational institutional framework. The Commission is an important participatory platform for securing good governance of the Sixaola River basin (Pérez de Madrid and Sánchez 2011; Porras 2016). It falls under a broader Agreement on Cooperation for Border Development between Costa Rica and Panama, which allows the two countries to create thematic commissions to implement development projects along the border between both countries (Pérez de Madrid and Sánchez 2011). This governance platform has been crucial for scaling up EbA and supporting the fundraising and planning of restoration actions and agroforestry systems in the basin (Luna Rodríguez and Cruz Marín 2018).

Box 2: Costa Rican policies and plans relevant to climate change adaptation and EbA

- ***National Development Plan*** for the 2015-2018 period includes climate change as one of its sectoral strategic proposals.
- The 2009 ***National Climate Change Strategy*** (2010-2021) aims to facilitate the country's commitment towards carbon neutrality by 2021 using a six strategic axes: i) mitigation; ii) adaptation; iii) measurement, reporting and verification; iv) capacity development and technological transfer; v) public sensitisation, education and culture change; and vi) financing. Sectors prioritised in the adaptation axis are water, energy, agriculture and livestock, fisheries and coastal zones, infrastructure and biodiversity. Activities include promoting organic agriculture, protecting coral reefs, rehabilitating degraded areas, reducing ecosystem fragmentation, and strengthening the generation and assessment of ecosystem goods and services.
- ***The Action Plan for the Climate Change Strategy*** (2015) operationalises the above strategy and focuses on the water resources and agricultural sectors. Specific adaptation actions for 2016-2030 with an EbA focus include increasing forest coverage to 60%, consolidating the payments for ecosystem services programme and the Forest Certification programme to promote sustainable development of forest resources and effective protection of water sources, and promoting the National Biological Corridor System and the National Protected Areas System.
- The ***National Climate Change Adaptation Policy of Costa Rica*** was launched and formally approved in early 2018 (Ministry of Environment and Energy 2018), and strongly recognises EbA. It promotes locally led adaptation actions based on communities and ecosystems as cost-efficient solutions that take into account local priorities, needs and traditional or ancestral knowledge and capacities to solve the problems posed by climate variability and change. Actions

[7] See https://ojoalclima.com/pueblos-indigenas-inician-propio-fondo-climatico-tras-no-poder-acceder-fondos-internacionales/

include biological corridors, live fences in agroforestry systems, silvopastoralism, rational grazing, the use of windbreaks, contour lines, recovery of watersheds and mangroves, the stabilisation of marine silt through mangroves and the conservation of watersheds for the future provision of water.

- The ***Intended National Determined Contribution*** (iNDC), submitted in 2015, provides specific adaptation goals for the period 2016-2030. These include the development of a National Adaptation Plan (NAP) by 2018, ensuring synergies with disaster risk reduction policy, promoting community-based adaptation, strengthening EbA and its links to local land use planning and territorial adaptation, and expanding the payments for ecosystem services programme to include EbA. Some 30 different community-based adaptation projects have already been implemented since 2015 under the iNDC.
- In 1997, Costa Rica published its first ***Payment for Ecosystem Services Framework*** and ten years later, in 2007, it proposed to become the first carbon neutral country in the world.
- Costa Rica's ***Forest Law*** prohibits land use change, establishes a payment for ecosystem services system and promotes reforestation and the control of illegal logging.
- The ***National Strategy and Action Plan for Biodiversity Adaptation to Climate Change Effects*** (2015-2025) identified ten strategy guidelines to increase the resilience of land biodiversity, continental and coastal waters, as well as reduce future vulnerability. The strategy refers to EbA as a way to achieve this. It views humanity as part of nature and it considers the interdependence of social and ecological systems. It prioritises the expansion of protected areas, biological corridors, the integration of biodiversity management and conservation in land management processes, and good governance, participation and institutional coordination to promote resilient communities.

Is the EbA initiative sustainable?

Interviewees differed in their views of whether there is the local-level policy and institutional support and the capacity needed to make the initiative sustainable over the long term. Three of the five national-level interviewees agreed with this statement, but two did not. Four of the six local authority-level interviewees agreed with this statement and two did not. Two of the four implementing partner-level interviewees and only one of the four community-level stakeholders interviewed agreed with the statement.

Interviewees also differed in their views of whether there is the provincial-level policy and institutional support and the capacity needed to make the initiative sustainable over the long term. Three of the five national-level interviewees, three of the six local authority-level interviewees and two of the four implementing partner-level interviewees agreed with this statement.

All national-level interviewees, local authority-level interviewees and implementing partner-level interviewees felt, however, that there was sufficient national-level policy and institutional support and the capacity needed to make the initiative sustainable over the long term.

Interviewees gave the following reasons why Go4EbA activities could be sustainable:

- ***Strong policy support*** for sustainable practices, family farming, food sovereignty and, above all, adaptation to climate change. Go4EbA activities are included in the plans of the Ministry of Economy and Finance and the Ministry of Planning in Costa Rica. National and regional planning frameworks provide support.
- ***Institutional support.***
    - For an integrated farm to be effective, each component of the farm has to be implemented properly and provided with appropriate specialised support, given the biodiversity that exists on the farms. This is challenging for an agency like MAG, which only has a few staff to deal with several communities. Training and workshops have been held for community producers, however, and the project has empowered people and given them new skills so the foundations

for it to continue have been laid. An agreement between MAG and the Inter-American Development Bank dictates that MAG should continue to follow up on the project investment for five years, so MAG has allocated a budget to hire technical staff to do this and continue to monitor Go4EbA project activities.

  - A coordinating committee was set up to monitor the project, with membership consisting of the regional directors of relevant institutions. Monitoring takes place monthly. The directors of the institutions participating in this committee are committed and have now taken over ownership of the process quite well and recognise the committee's importance.
  - The regional development council also helps keep the initiative going. The Institute for Rural Development and the ministries of agriculture in both countries have capacity and are working on getting involved in different project issues.
  - Approximately 20 associations from the local community, government institutions and academic centres have participated in the annual agrobiodiversity and seed fair organisation and their strong commitment augurs well for the post-project sustainability (IUCN 2017b; Pérez de Madrid and Cruz 2018).
  - The Agreement on Cooperation for Border Development and associated Binational Commission for the Sixaola River Basin are very important (although not without flaws). Policy support for the agreement gives the project more permanence.

- ***Emerging benefits*** from implementing the adaptation measures through a user-friendly sustainable system implemented by farmers themselves. If the farm owners are interested, they will keep integrated farming activities going. Communities confirm that the changes have been effective, and hearing this from each other is more influential than professional presentations, data or systematic scientific studies.

Interviewees shared the following concerns about whether Go4EbA project activities would be sustainable, and suggestions about how to improve sustainability:

- ***National environmental and climate change policy needs to be improved to strengthen community benefits*** in the area of ecosystems and the environment. This could include making payments for ecosystem services the rule rather than the exception. Project activities also need to be part of the tourism strategy, for example to increase financial resources reaching communities. Policies need to ensure that resources get channelled to the local level.
- ***Improved collaboration is needed between levels of governance,*** for example between territorial councils, regional councils and the government council. It is important to involve governors in EbA activities. Regional and national planning frameworks and plans need to link together better, and also to involve the local level, which is where actions can grind to a halt. People are interested 'on paper', but translating this into practice needs to be addressed.
- ***Cross-border collaboration needs to be improved***. Connecting institutions, municipalities and local governments from both countries is necessary to secure the policy and institutional support and the capacity needed to make the initiative sustainable over the long-term. The Binational Commission for the Sixaola River Basin coordinates political authorities, seeking to interest them in the cross-border land, but this does not ensure sustainability.
- ***Funding is constrained***. There are projects and the willingness to make them work is there, but sources of funding are needed. Arrangements for allocating funds from different sectors need to be discussed.
- ***Technical capacity is constrained***. More empowerment of local-level producers, who implement EbA measures, is needed to keep the initiative going in the long term.
- ***Knowledge management needs to be improved***. Sometimes local views are not taken into account. Systematic scientific data collection is needed, but beyond this, and more importantly, the exchange of community experiences can reaffirm what changes are occurring. A professional person presenting a study is not the same as when information comes from a producer – producer-to-producer learning is often better. Lastly, the lessons learned from projects often are not taken into account in the future.

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

All national, local authority and implementing partner interviewees felt there were opportunities for replicating, scaling up or mainstreaming Go4EbA project activities.

- ***National policy has changed***. The Go4EbA project has attracted much interest, which could have a significant impact on the development of policies and mainstreaming of EbA. For example, Go4EbA lessons and methodologies are informing the National Adaptation Plan and the process of developing the National Climate Change Adaptation Policy of Costa Rica. Moreover, IUCN (2017b), and Marín et al. (2018) describe how Go4EbA has worked to strategically influence policymakers for scaling up EbA in Mexico and Central America at a multilevel scale.
- ***The attitudes of policymakers/planners has changed***. For example, cocoa is a valued traditional crop that can improve adaptive capacity by increasing farm income, but its credibility was low; nobody believed that the crop could be profitable due to the monilinia disease. But after ten years of work, interest in the crop has revived, mainly due to the new genetic material developed by the Tropical Agronomic Research and Education Center (Centro Agronómico Tropical de Investigación y Enseñanza). There are plans to scale out cocoa growing activities to other territories if new varieties are successful. IUCN (2017b) also describe how Go4EbA has informed decision making at the sub-national government level, and also projects under the Binational Commission for the Sixaola River Basin.
- ***Benefits for producers are materialising***. In the case of the adaptation measures for cocoa, work is being done on a variety of cocoa that cuts the costs for the producer. If it works, the idea is to share it with other territories. Integrated farms need to be strengthened before they can be scaled up.
- ***Stronger links have been forged between relevant government bodies***, which supports cross-sectoral planning. For example, there is more coordination between national and local government institutions, which has improved governance.
- ***There has been a change in donor policy*** and hence in-country funding. Some donors are strategically seeking projects that align with local interests, and there is now more knowledge to inform project site selection, planning and implementation and more flexibility in the management of resources.
- ***New tools*** have been developed to support replication. These include new governance models and work guides such as one on good agroforestry practices for adaptation.

Summary and conclusions

The Sixaola River basin in Costa Rica and Panama is a Go4EbA project site. The Go4EbA project provides an example of how EbA can be an effective approach to adaptation to climate change.

Effectiveness for human societies

EbA activities implemented under the Go4EbA initiative have improved community resilience and adaptive capacity, and reduced community vulnerability. Women, those involved in agriculture, the poor and vulnerable, indigenous people and youths have benefited from project activities in different ways. Whilst some benefited more than others – for example, those who were in less-remote locations – few social trade-offs were apparent in terms of who or where changes in resilience, adaptive capacity or vulnerability occurred. There were, however, likely trade-offs in terms of when changes in resilience, adaptive capacity or vulnerability occurred. For example, it took years for improvements in adaptive capacity resulting from the sale of wood to accrue as trees take time to grow.

A wide array of social co-benefits emerged from the Go4EbA project. These may not have been spread evenly, but no trade-offs in terms of where they accrue were noted.

The Go4EbA project incorporated indigenous knowledge into its activities in various different ways. A range of participatory processes were also applied by the project, mostly towards the ‘self-mobilisation’

or 'interactive' end of the typology of participation supplied. It was very clear that the use of participatory processes supported the implementation of EbA and built adaptive capacity. There were times, however, when participation could be improved.

Effectiveness for the ecosystem

A number of factors threatened local ecosystem resilience and service provision, including climate change, land conversion, overexploitation and poor agricultural practices, pollution and weak governance. Possible thresholds beyond which ecosystems could no longer provide key ecosystem services included changes to river water quality and quantity as a result of hydroelectric dam construction and excessive use of agrochemicals.

The watershed provided an important boundary and unit of management to ensure ecosystem resilience. In the case of the Sixaola River basin, this fell into two countries. The Go4EbA project operated at the level of this watershed (and the local area level), as did the Binational Commission for the Sixaola River Basin.

The EbA project improved ecosystem resilience, and helped maintain or restore ecosystem services over the long term. It could take time, however, for improvements to the delivery of some ecosystem services to materialise.

Financial effectiveness

No cost-effectiveness studies had been undertaken, although the sense from interviewees was that Go4EbA project work was cost-effective and compared favourably with other adaptation options. A study elsewhere showed that infrastructural responses to flood damage in the Sixaola floodplain had in fact caused more damage when floods recurred. The difficulty of valuing many Go4EbA project activities would complicate a formal assessment of cost-effectiveness.

As with EbA initiatives elsewhere, a range of broader economic benefits emerged from the project. For example, farm and income diversification has reduced economic risk.

No financial and economic trade-offs at different geographical scales or timeframes were apparent, although income from ecotourism took years to emerge and remains challenging in areas where communities are remote.

Policy and institutional issues

A range of policy, institutional and capacity barriers to implementing EbA at the local level were apparent. These included insufficient knowledge and technical skills, insufficient implementation capacity, institutional weakness and a lack of government official continuity, poor collaborative and communication, government officials lacking the authority to take action, insufficient financial resources for implementing EbA, low community motivation to participate and poor market access.

At the provincial level, insufficient knowledge, financial resources and implementation capacity, the low priority afforded to environmental issues and indigenous people by the regional government, insufficient cross-sectoral institutional collaboration, unsupportive provincial policies and inappropriate incentives and low levels of development all acted as barriers to EbA implementation.

National barriers included insufficient implementation capacity, inadequate cross-border collaboration, unavailability of knowledge, unavailability of financial resources, insufficient policy support, insufficient collaboration across institutions, sectors and legal frameworks, and inappropriate project choices and measures of success.

A range of policy, institutional and capacity opportunities for implementing EbA at the local level were apparent. These included the value placed on culture, improvements in knowledge and capacity, good relationships between the community and the project, EbA 'champions', incentives in place to motivate action, government being active on the ground and well organised communities.

At the provincial level, strong regional institutions, strong regional policy/legislation and government prioritisation all provided opportunities for EbA implementation.

National opportunities included strong national policy/legislation, strong national institutions, government prioritisation of climate change and environmental issues, recognition of cultural identity and binational water basin management structures.

It was unclear whether local-, provincial- (sub-national) and national-level policy and institutional support and capacity was sufficient to ensure Go4EbA activities were sustainable over the long term. Reasons given as to why Go4EbA activities could be sustainable included strong policy support, institutional support at various levels and the realisation of local benefits. Issues potentially limiting long-term project sustainability include the need for better national environment and climate change policies, the need for more collaboration between different levels of governance and across borders, funding and technical capacity constraints and the need for better knowledge management.

A number of opportunities for replicating, scaling up or mainstreaming Go4EbA project activities existed: national policy change, changes in the attitude of policy-makers/planners, continued benefits for producers, the forging of stronger links between relevant government bodies, changes to donor policy and new tools to support replication.

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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 Adaptation, Vulnerability and Ecosystems (AVE) project, Costa Rica and Panama. The findings will be combined with those from 12 other sites in 11 other countries to help show climate change policymakers when and why EbA is effective.

Project Report

Biodiversity, Climate Change

Keywords:
Ecosystem-based adaptation (EbA), Climate change adaptation, Resilience, Costa Rica, Panama

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