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

Research results from the Governance for Ecosystem-based Adaptation: Transforming Evidence into Change project, El Salvador

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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 Paz River basin in El Salvador, where local EbA interventions aimed to improve mangrove management and restore water flows, with a view to building adaptive capacity through action learning.

The report concludes that there have been widespread improvements in resilience and adaptive capacity, and vulnerability has been reduced, as a result of project adaptation measures, with women, poor and vulnerable people, and those who participate in Istatén (a local environmental organisation) experiencing most improvements. A wide range of social co-benefits emerged from the project, but restrictions to the use of natural resources have disadvantaged some people. Ecosystem resilience improved and ecosystem service provision also improved following the project. Various economic costs and benefits resulted from the project, and interviewees felt that the project was more cost-effective than other adaptation approaches. It is likely that the project will deliver sustained benefits over the long term, largely because of government and local community support for the project and for EbA in general.

Acronyms

AVE	Adaptation, Vulnerability and Ecosystems Project
BMUB	German Federal Ministry for the Environment, Nature Conservation, and Nuclear Safety
CBD	Convention on Biological Diversity
CENTA	Centro de Tecnología Agropecuaria y Forestal
CONASAV	National Council for Sustainability and Vulnerability
CRiSTAL	Community-based Risk Screening Tool – Adaptation and Livelihoods
EbA	Ecosystem-based adaptation
FIAES	Fondo de la Iniciativa para las Américas El Salvador
Go4EbA	Governance for Ecosystem-based Adaptation: Transforming evidence into change Project
IIED	International Institute for Environment and Development
IKI	International Climate Initiative
IUCN	International Union for Conservation of Nature
MARN	Ministry of Environment and Natural Resources
NGO	Non-government organisation
PLES	Plan Local para la Extracción Sostenible (Local Plan for Sustainable Extraction)
UNEP	United Nations Environment Programme
UNEP-WCMC	United Nations Environment Programme World Conservation Monitoring Centre
UNES	Unidad Ecológica Salvadoreña
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, for example, there is a growing tendency to integrate ecosystems in adaptation responses. Many Central American countries have included EbA approaches in their Nationally Determined Contributions to the UNFCCC (Luna et al. 2018) and are also considering the protection and sustainable use of ecosystems as an integral part of 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 to regulate water flows preventing flash flooding; and, establishment of diverse agroforestry systems to help maintain crop yields under changing climates. Box 1 describes some of the key attributes of effective EbA, derived from a review of relevant literature (taken from Seddon et al. 2016b).

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

1. **Human-centric.** EbA emphasises human adaptive capacity or resilience in the face of climate change.
2. **Harnesses the capacity of nature to support long-term human adaptation.** It involves maintaining ecosystem services by conserving, restoring or managing ecosystem structure and function, and reducing non-climate stressors. This requires an understanding of ecological complexity and how climate change will impact ecosystems and key ecosystem services.
3. **Draws on and validates traditional and local knowledge**. Humans have been using nature to buffer the effects of adverse climatic conditions for millennia. Traditional knowledge about how best to do this should thus be drawn upon when implementing EbA.
4. **Based on best available science**. An EbA project must explicitly address an observed or projected change in climate parameters, and as such should be based on climatic projections and relevant ecological data at suitable spatial and temporal scales.
5. **Can benefit the world's poorest**, many of whom rely heavily on local natural resources for their livelihoods.

6. **Community-based and incorporates human rights-based principles.** Like community-based adaptation (CBA), EbA should use participatory processes for project design and implementation. People should have the right to influence adaptation plans, policies and practices at all levels, and should be involved with both framing both the problem and identifying solutions. EbA initiatives should be accountable to those they are meant to assist and not simply those providing support (ie donors or governments). EbA should consistently incorporate non-discrimination, equity, the special needs of the poor, vulnerable and marginalised groups, diversity, empowerment, accountability, transparency, and active, free and meaningful participation.
7. **Involves cross-sectoral and intergovernmental collaboration.** Ecosystem boundaries rarely coincide with those of local or national governance. Moreover, ecosystems deliver services to diverse sectors. As such, EbA requires collaboration and coordination between multiple sectors (eg agriculture, water, energy, transport) and stakeholders. EbA can complement engineered approaches, for example combining dam construction with floodplain restoration to lessen floods.
8. **Operates at multiple geographical, social, planning and ecological scales**. EbA can be mainstreamed into government processes (eg national adaptation planning) or management (eg at the watershed level), provided that communities remain central to planning and action.
9. **Integrates decentralised flexible management structures** that enable adaptive management.
10. **Minimises trade-offs and maximises benefits with development and conservation goals** to avoid unintended negative social and environmental impacts. This includes avoiding maladaptation, whereby adaptation 'solutions' unintentionally reduce adaptive capacity.
11. **Provides opportunities for scaling up and mainstreaming** to ensure the benefits of adaptation actions are felt more widely and for the longer term.
12. **Involves longer-term 'transformational' change** to address new and unfamiliar climate change-related risks and the root causes of vulnerability, rather than simply coping with existing climate variability and 'climate-proofing' business-as-usual development.

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

If properly implemented, EbA can meet objectives under all three Rio Conventions (Seddon et al. 2016b). For example, its emphasis on restoring natural ecosystems and increasing habitat connectivity helps countries meet their commitments under the Convention on Biological Diversity (CBD). EbA often involves maintaining the ability of natural ecosystems to control water cycles or supports effective management regimes for dry areas, and thus aligns with the goals of the United Nations Convention to Combat Desertification. Many EbA activities sequester carbon and some prevent the greenhouse gas emissions that would be emitted from hard infrastructure-based approaches to adaptation, thus helping meet mitigation targets under the United Nations Framework Convention on Climate Change (UNFCCC). EbA promotes sustainability across a range of sectors, including agriculture, forestry, energy and water, and as such could help countries meet their Sustainable Development Goals (Seddon et al. 2016b). In addition, 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, however, 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, 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 et al. 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, Building and Nuclear Safety (BMUB) supports IKI on the basis of a decision adopted by the German Bundestag. The project is being implemented by the International Institute for Environment and Development (IIED), the International Union for Conservation of Nature (IUCN) and the United Nations Environment 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 its 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 (see Table 1), 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 has proved effective or not, what evidence has emerged and what the good practices and lessons learnt for future initiatives are. 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 and practitioners recognise what factors contribute to effective EbA implementation, 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

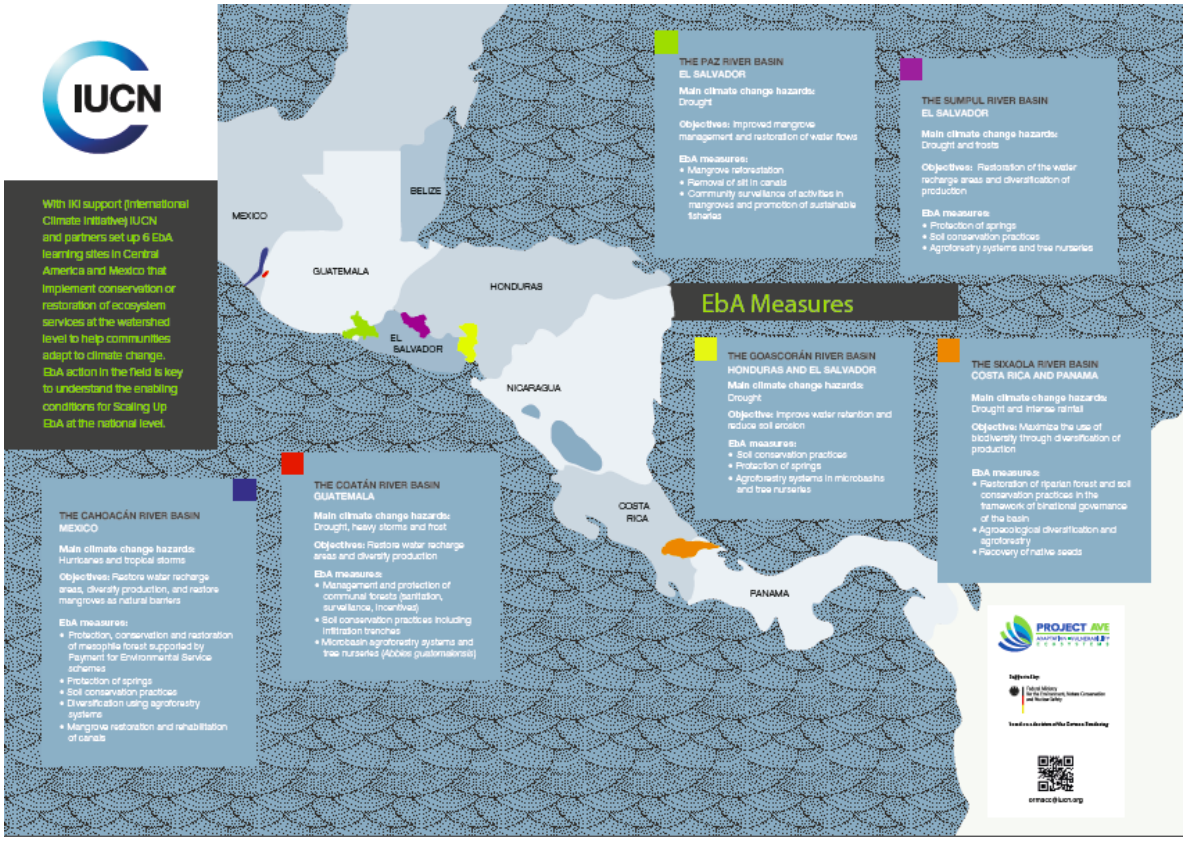
What social, institutional and political issues influence the implementation of effective EbA initiatives and how might challenges best be overcome?

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?

Mangrove ecosystem restoration and responsible fishing practices in the Paz River, El Salvador

The 'Governance for ecosystem-based adaptation: transforming evidence into change' (Go4EbA)[1] project 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 upscale EbA in the six target countries through increased understanding and capacity to address climate change, articulated policy and institutional frameworks and reliable evidence on its multiple benefits. In each country, the project has established an EbA project learning site to enhance local capacities through action learning and improve governance frameworks and institutions using bottom-up approaches. Figure 1 shows the six Go4EbA project learning sites.

Figure 1: Go4EbA project learning sites



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

In El Salvador, the project learning site is located in the lower basin and coastal area of the Paz River. At the local scale the project is collecting, synthesising and using existing evidence on the benefits derived from EbA. This evidence will support the adoption of effective EbA in the design of policies, governance structures and decision-making processes in different sectors. The project also developed a monitoring and evaluation methodology to understand EbA's contribution to food and water security.

Support for Go4EbA was secured from the German Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (BMUB) through its International Climate Initiative (IKI) programme. The IUCN member non-government organisation (NGO) Unidad Ecológica Salvadoreña (UNES) is the local implementing partner. UNES has a long story of advocacy and environmental activism in El Salvador, and at the project site in particular. Local Go4EbA activities built on work done under a previous Water Management for Adaptation project (2010 - 2013), which was also BMUB-IKI funded.

The EbA learning site is located in the department of Ahuachapán, El Salvador in the Paz River basin. This basin covers a total of 2,647 km^2 (925 km^2 in El Salvador and 1,722 km^2 in Guatemala) (Pérez de Madrid and Sánchez 2011). The objective of local EbA interventions was to improve mangrove management and restore water flows, with a view to building adaptive capacity through action learning. Activities targeted the coastal local communities of Garita Palmera, El Tamarindo and Bola de Monte. Box 2 describes the local level EbA measures implemented under the project in the Garita Palmera wetland and mangroves.

Box 2: Project EbA adaptation measures implemented in the Garita Palmera, El Tamarindo and Bola de Monte mangrove and wetland area

1. ***Channel unblocking and removal of silt in mangrove canals***: involves opening and clearing river channels to recover the hydrodynamics of the ecosystem, so freshwater can enter the mangroves and restore the optimum level of salinity in the mangrove system.
2. ***Reforestation of degraded mangrove areas***: consists of recovering degraded areas where indiscriminate felling has been practiced, and/or areas that have been designated for livestock grazing.
3. ***Community surveillance***: consists of touring previously identified key sites in order to prevent the indiscriminate felling of mangroves and the excessive extraction of crabs, fish, and so on. Also ensures that the newly planted seedlings in reforested areas are protected. Responsible community members are assigned to this activity, and periodically rotate.
4. ***Design and implementation of a Local Plan for Sustainable Extraction (PLES)***: this measure seeks to create a system that regulates the extraction of fish, crustaceans, mammals, and so on from the mangrove ecosystem to ensure the ecosystem and the services that it provides are not compromised.

Local communities here are directly dependant on ecosystem services provided by wetlands, especially fishing (including for crustaceans and molluscs), agriculture, wood and firewood (Pérez de Madrid and Sánchez 2011). The main land use in the lower part of the Paz River basin, however, is privately owned sugar cane production. This occurs in the wetland areas adjacent to the mangroves and is dependent on freshwater. During summer time, farmers use and channel the limited freshwater available in the Paz River basin, limiting its access to the mangroves.

Table 3 summarises the sectoral impacts of climate change in El Salvador. Insights from a vulnerability assessment using the Community-based Risk Screening Tool – Adaptation and Livelihoods (CRiSTAL) in 2011 formed the basis of the strategy and EbA measures selected and promoted at the project site. Local communities and private sugar cane farmers are affected by sea level rise, floods and droughts. Due to the impacts of climate change, communities have suffered losses in the production of basic grains. Agriculture is also very vulnerable to floods.

Table 3: Sectoral impacts of climate change in El Salvador

Sector	Impacts
Coastal area	Elevation of sea level: loss of cultivation and recreation areas, salinisation, reduction of fresh water, loss of mangroves.
	Prevalence of droughts: losses of US$11 and US$25 million in the production of basic grains by the years 2025 and 2100, respectively.
Agriculture	Floods: under a scenario with improvements in crop yields but without promoting measures for the control of erosion, sedimentation and runoff, the impacts of climate change in the sector would reach US$27 and US$45 million by the years 2025 and 2100, respectively.
	Floods in the basins of Río Paz, Jibia and Grande de San Miguel: high vulnerability in the production of other crops and livestock are expected, with average levels of loss of 60% for sugar cane and 80% in the case of pasture and livestock.

Source: Pérez de Madrid and Sánchez (2011).

Genuine ecosystem-based adaptation initiatives must meet the following four criteria (Martin 2016; CBD 2009; CBD 2010; Bertram et al. 2017): 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 project and meets all of these criteria.

Methodology for assessing effectiveness

Reid et al. (2017) provides a methodology for assessing EbA effectiveness. This includes a framework (Table 2), which details a set of questions to be used as part of a process to draw conclusions about the effectiveness of an EbA project that is ongoing or has ended. Table 4 describes the Go4EbA project stakeholders interviewed individually using this methodology.[3] Questions in the framework relating to the key policy, institutional and capacity barriers and opportunities to implementing EbA at the regional, provincial or state level were excluded, however, because El Salvador is a small country and results would be similar to those for the national level.

Table 4: Stakeholders interviewed

Level of interviewees	Those interviewed
National	Three government officials in total from the Ministry of Environment and Natural Resources (MARN) and the Ministry of Agriculture and Livestock were interviewed and one staff member of the Centro de Tecnología Agropecuaria y Forestal (CENTA), a research organisation that operates in the River Paz area, focusing on agriculture.
Local authority	One official from the Alcaldía Municipal de San Francisco Ménendez was interviewed.
Project implementers	Three staff members from UNES were interviewed.
Community-level stakeholders	Seven beneficiaries were interviewed, consisting of members of the Istatén Association (Asociación Comunitaria para la Protección Ambiental Marino Costera de Ahuachapán Sur) and the River Aguacate Micro-Watershed Committee.

[3] See also https://www.iucn.org/es/news/mexico-central-america-and-caribbean/201704/explorando-la-eficacia-de-la-adaptaci%C3%B3n-basada-en-ecosistemas-en-el-campo

After the research interviews, researchers gathered together local stakeholders to validate climate hazards (and compare them with the 2011 CRiSTAL vulnerability assessment). Along with the interviews conducted, reports, webpages and publications on the Go4EbA project were also reviewed to assess the characteristics of project activities that contribute to effective implementation of the EbA approach. The results of this assessment are described in the following section.

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 felt that resilience and adaptive capacity improved, and vulnerability reduced as a result of the adaptation measures implemented under Go4EbA described in Box 2. Mangrove restoration and protection is a particularly important component of this because the “Mangrove forests are vital for adaptation” (IUCN 2017a). Communities observed how community surveillance ensured the mangroves started to recover, and how houses behind by a barrier of mangroves were protected during high tides. Communities also noticed how after the implementation of the PLES, crab populations recovered. Crab fishing is now regulated (in season and size). Pérez de Madrid and Sánchez (2011) reiterate how mangroves damage reduces their capacity “to act as a buffer and to act as a regulator in case of floods, high waves and high sea levels”.

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

Implementing partner and community-level interviewees felt that women and poor and vulnerable people experienced most improvements in resilience, adaptive capacity or vulnerability due to Go4EbA project EbA adaptation measures. Community-level stakeholders added that those who don’t participate in the Istatén Association (a local environmental organisation) are more vulnerable, because the association serves as a local support network. The Istatén Association has members from three communities, and community members participate in various sub-groups when there is an activity to be worked on, or if there is an incentive (ie a paid job) to participate. IUCN (2017b) also describe how Istatén representatives from the communities of Bola de Monte, El Tamarindo and Garita Palmera were trained on how to use tools to assess and monitor EbA benefits in March 2017 in order to promote participatory monitoring for food security. Many community members are women, who particularly benefit because they are developing capacities to manage the mangrove ecosystems. Project implementation has created jobs for women in clearing the mangrove channels and in reforestation. Also, women are in charge of fishing, so benefit from knowledge regarding the management of crab populations. But there are also wider overall community-level benefits because the whole community experiences improvements in resilience, adaptive capacity or vulnerability as a result of project activities.

Although community-level interviewees felt that children experienced improvements in resilience, adaptive capacity or vulnerability due to Go4EbA project adaptation measures, a lack of participation by children was also observed, along with a need to develop their knowledge. This challenge needs to be addressed.

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

Implementing partner interviewees felt that there were no trade-offs in terms of *who* experienced improvements in resilience, adaptive capacity or vulnerability as a result of Go4EbA project adaptation measures. Community-level interviewees disagreed, however, and said that members of Istatén experienced more improvements, especially those that were dependent on fishing. Community-level interviewees also explained that before Istatén existed, people came from outside the local area to collect crustaceans. They therefore experienced improvements in resilience, adaptive capacity or vulnerability. Now with Istatén, however, local people protect the mangroves and regulate how much crab collection can occur, what type of fishing nets are allowed and how much shrimp people are allowed to catch. As a result of better control and oversight, improvements in resilience, adaptive capacity or vulnerability are shared more equally.

Some of the implementing partner and community-level interviewees felt there were trade-offs in terms of *where* improvements in resilience, adaptive capacity or vulnerability as a result of Go4EbA project adaptation measures materialised, but the examples they provided instead suggested that some areas appeared to be the focus of project activities, so experience more adaptation benefits than others. Three communities – Garita Palmera, El Tamarindo and Bola de Monte – are members of Istatén and are thus particularly targeted for project activities, such as regulations limiting fishing and crab collection. Some 15 nearby communities whose main livelihood is agriculture and livestock farming also experience improvements in resilience, adaptive capacity or vulnerability as a result of project adaptation measures implemented by Istatén. Benefits are widespread because of increases in the availability of food such as crabs. Other nearby communities experience fewer improvements in resilience, adaptive capacity or vulnerability, however, because they are not participating in the implementation of adaptation measures.

Some of the implementing partner and community-level interviewees felt there were trade-offs in terms of *when* improvements in resilience, adaptive capacity or vulnerability as a result of Go4EbA project adaptation measures materialised. Short-term improvements in resilience, adaptive capacity or vulnerability have already resulted from restored and protected mangrove areas and better crab fishing regulations and therefore opportunities. Further improvements will only emerge in the medium to long term, however, because of the time it takes to change people's behaviour and the time needed for crab populations to recover once crab fishing is better controlled. For example, once the groups implementing the PLES have been established, more opportunities to improve resilience, adaptive capacity or vulnerability as a result of greater resource availability will emerge. Further support from organisations conducting training and implementing activities to protect the upper river basin in the Aguacate micro-watershed are also anticipated in time.

Social co-benefits from the EbA initiative

Implementing partner and community-level interviewees listed a number of social co-benefits emerging from the Go4EbA project:

- ***Disaster risk prevention***. As a result of Istatén reforestation activities, fewer disasters are expected and conditions to prevent disasters are in place. However, there have not been any serious natural disasters in the past four years to test this expectation.
- ***Livelihood provision or diversification and improvements in food security***. More resources that can be used to generate income are available. Reforestation activities will increase fish and crab production in the area and improve livelihoods. Mangrove restoration conserves ecosystem services (food and habitats for crabs and shrimps) and restores fishing as a means of supporting sustainable livelihoods. The vision for mangrove restoration work was promoted under the slogan 'Paz River: life, shelter and food security' (Sanchez and Roberts 2014).
- ***Health benefits***. For example, if the local communities (with support from NGOs and other institutions) can manage to get the sugar cane companies to stop dumping toxic chemicals, this will have health benefits.

- ***Security improvements and reduced conflict between communities over resources***. There is more social cohesion now, and the three communities in Istatén are more united. Conflicts over resource use and exploitation did exist in the area, and the project has made these more evident, but people are now working together to look for solutions and resolve them, and most people understand the restrictions on the use of natural resources. IUCN (2017b) describes how communities are now working together to protect their mangroves from deforestation and unregulated extraction of crabs, shrimp, fish and other mangrove goods.
- ***Improved policies and governance, and stronger institutions***. Istatén is a stronger institution now, and IUCN and UNES are supporting work in the area. A local surveillance committee for the mangroves has been established (Sanchez and Roberts 2014). Communities are demanding better policies. In the past, communities were less organised so could not fight for their rights, but now they are more active, which leads to more conflict with the private sector. This will benefit the communities because they are fighting for their rights and for a fairer distribution of resources. Strong community organisations are changing the way businesses relate to people and the ecosystem, and are also obliging public institutions to change the way they work. IUCN (2017b) describes how communities are working to persuade MARN to establish sanctions for those who repeatedly engage in banned fishing practices.
- ***Awareness and capacity built*** as a result of the Go4EbA project, especially amongst children. Istatén has taken on responsibility for mangrove protection. Because of improved awareness, the community now sees the mangroves not just as a source of money but rather as a key part of the environment and their lives. Because of improved awareness, they are strengthening their defence of the mangrove. The community has become more organised, and also uses local knowledge as part of several initiatives addressing environmental issues. Life is more difficult in the dry season (summer) now, which concerns people and has led them to take action to improve the environment. Community leaders from the San Francisco Menéndez, Jujutla and Guaymango communities in the department of Ahuachapán received training in communication tools, which included connecting communities with the media to facilitate the spread of environmental news (IUCN 2017a).
- ***Improved conditions for improving sustainable water provision***. Changes in water availability are not evident in the short term, but the project is working to build capacity and raise awareness on the issue. Moreover, a study on water security will be carried out under the Go4EbA project at the end of 2018. As part of activities celebrating World Water Day in March 2017, more than 100 representatives of micro-basin committees, community associations, water boards, groups involved in PLES and women's groups presented a proposal to the Ministry of Agriculture and Livestock to monitor water use by the sugar industry. They are also pressing for the introduction of water fees commensurate with the amount of water used. Prior to this meeting, a press conference was attended by eight national media groups to explain the project's actions and the proposal to the ministry (IUCN 2017b).

Distribution and trade-offs relating to social co-benefits

Some implementing partner and community-level interviewees felt that certain social groups accrued more of these Go4EbA project co-benefits than others. For example, people who depend on fish accrue more livelihood co-benefits as a result of Go4EbA project activities described in Box 2, and some Istatén social groups have gained more awareness than others under the project.

Two community-level interviewees pointed out the wide-reaching character of Go4EbA project co-benefits, explaining that even those not involved in the Istatén Association benefit indirectly from group activities and that a wider community benefits from improved fishing.

One implementing partner interviewee explained, however, that there is some resistance from certain natural resource users because of the management changes approved in the PLES to ensure the sustainability of the mangroves. Community interviewees added that due to the new restrictions on resource use, conflicts have arisen with people who destroy the mangroves for their livelihoods.

The role of participatory processes and local knowledge

All local authority and implementing partner interviewees felt that Go4EbA project activities had incorporated local community knowledge. They provided the following examples:

- When adaptation measures are implemented, technical knowledge is combined with local knowledge about which areas should be prioritised for implementation. For example, when planning where reforestation or work on the drainage channels should occur, local experience is merged with technical knowledge.
- Community members know how the mangrove forest used to be structured, the composition of the forest and what services it provided. This knowledge is used to inform mangrove recovery and reforestation activities, and it facilitates recovery of the mangrove ecosystem. Older people transfer knowledge to new generations.
- Community knowledge on species and water cycles is collected and systematised, and then used to plan restoration activities. Local knowledge is used for plant nurseries, clean-up campaigns and by water committees. Local information about the problems affecting people is put into project software, which helps identify and map conservation targets.
- Ancestral knowledge informs all the adaptation measures implemented. There are several areas with ancestral cultures in the region, and the PLES has drawn a lot on this ancestral knowledge.
- Information on medicinal plants has been documented, and is being systematised and used.
- There are rock drawings and indigenous cemeteries in Cerrón Grande, and these are being identified to promote sustainable tourism.

The Go4EbA project adopted a range of participatory approaches.[4] Most of these could be characterised as interactive, but self-mobilisation, functional approaches (for implementation) and consultation by outside professionals also occurred. Implementing partner and community-level interviewees gave the following examples:

- ***UNES (and other institutions involved) sought to make the process of planning and implementation participatory for all Go4EbA activities implemented***. Problems are identified collectively (initially in 2011 using CRiSTAL, and then later at several workshops), and proposed solutions are developed together with the community. Meetings are held to reach agreement on where to implement project activities. For example, when planning where reforestation or work opening up drainage channels should occur, local people are consulted who walk around the area with members of external institutions to select where work should be done. Maps are drawn to identify the areas in greatest need, and the studies conducted are validated by local people. Planning processes for the defence and protection of mangroves were very participatory. Planning and implementation of actions relating to clearing drainage channels in the wetlands, reforestation, community security, and development and implementation of the PLES were also participatory.
- ***Tools to ensure participation were used.*** Individual committees were established – ten or eight committees in each community to start with – depending on the work planned following use of the participatory CRiSTAL tool (see Box 3). Use of the participatory 'popular education methodology' also ensured a real exchange of views. Participation in a vulnerability assessment enabled the community to identify specific locations for EbA strategies and implementation of adaptation measures (Sanchez and Roberts 2014).

[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 (2009).

- ***Training*** has increased the communities' knowledge, and this has led to white mangrove and red mangrove reforestation projects and projects to clear the drainage channels that give life to the wetlands. Communities learned a lot about climate change in workshops organised by UNES. UNES also ran campaigns and street events so the Salvadoran people would understand how they used to live in the past, and to strengthen their influence on policymaking. Training on the subject of water and water committees is being coordinated with the Ministry of Health; because people are organised in associations this is easier to arrange.
- ***The Go4EbA project works with local civil society and church organisations***. UNES worked to establish, support and strengthen local committees and organisations. For example, Istatén was set up in 2012 and since then it has been working in coordination with several institutions to identify the problems the communities have and then plan what actions need to be taken to minimise the effects of those problems. Istatén leaders participate in meetings, for example at the micro-watershed level. UNES also secured support from Fondo de la Iniciativa para las Américas El Salvador (FIAES) to clear the drainage channels in the Aguacate micro-watershed. FIAES is a national environmental fund and part of government, but it has an independent governing council. It works with civil society through community development associations and water associations rather than government. These organisations propose projects.
- ***Discussion groups have been established***. For example, people were concerned about the threats to fresh water quality and quantity from large farmers, including sugar cane producers, so a discussion forum was established. People were invited from MARN, the Ministry of Agriculture and Livestock and from the sugar cane growers' association to establish a discussion roundtable to reach agreement on how to prevent the sugar cane producers from burning land, dumping chemical waste, diverting the water and preventing it from reaching the community. A meeting took place and certain agreements were reached. One achievement was to stop sugar cane producers from building dykes upstream. Similarly, the conflict resolution working group held a meeting to address the challenge of securing further funding to continue unblocking drainage channels that fed the mangrove.
- ***The participation of women and youth is encouraged***. Gender workshops have been organised with participation by men and women. Women participate in Istatén, which is important as it acknowledges their abilities. Young people also participate in Istatén, and while they know less about the mangrove areas they can learn from those who have lived in these areas and know them better. Rudimentary hand-drawn maps bring young people, women and older people together in an organised way where everyone is working towards the same objective.

Box 3: The Community-based Risk Screening Tool - Adaptation and Livelihoods (CRiSTAL)

CRiSTAL is a project-planning tool that helps users design activities that support climate adaptation (ie adaptation to climate variability and change) at the community level. It focuses on projects at the local community level and helps users to identify and prioritise climate risks that their projects might address. It helps users identify livelihood resources most important to climate adaptation and uses these as a basis for designing adaptation strategies.

While climate variability and change may not always be the most important stresses affecting a specific community, they should always be considered when designing and implementing a development project, particularly in communities characterised by climate-sensitive and/or natural resource-dependent livelihoods. Indeed, any activity that does not account for present and future potential climate risks may inadvertently increase a community's exposure and vulnerability. CRiSTAL seeks to systematically assess the impacts of a project on some of the local determinants of vulnerability and exposure, so that project planners and managers can design activities that foster climate adaptation

Source: https://www.iisd.org/cristaltool/

Local authority and implementing partner interviewees felt that the use of participatory processes supported the implementation of EbA and built adaptive capacity. They gave the following examples:

- The communities can now adapt to climate variability by carrying out actions on their own. Some don't ask for many resources from the municipality to do this, rather they organise themselves and take action independently. Some invest their own financial and human resources in adaptation. For example, those attending planning and follow up meetings are not paid, so communities use their own personal time and sometimes transportation methods to attend.
- Awareness about environmental and climate change issues is good. People were expecting changes in the next 20 years, but changes are already happening in their area. This has motivated people to do something for the environment.
- Empowerment is the first step towards implementing EbA and building adaptive capacity. IUCN (2017a) also affirm the importance of empowering communities to dialogue with authorities so that their problems and proposals are heard.
- Strengthened capacities and knowledge builds adaptive capacity because it leads to changes in practice, which contributes to climate change adaptation and better management of the local area.
- Talking about climate change facilitates clear identification of what actions are needed to counteract or adapt to the changes ahead.
- Implementing EbA and building adaptive capacity doesn't just involve planning, it also involves training, protesting, practical action and negotiation with different actors, including public institutions, mangrove users and those using water in the watershed. It involves addressing watershed management and governance. Adaptation involves interacting with people and not just implementing technical or conservation-oriented solutions.

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 described the following factors threatening the resilience of local ecosystems and their ability to deliver ecosystem services:

- ***Climate change***. Precipitation reductions of over 15% are expected this century (Pérez de Madrid and Sánchez 2011). Climate change is causing water stress, which affects surface water in lakes, lagoons and rivers such as the Río Paz. Drought was not a problem in 1970s and 1980s but now there are times when there is no water. The only available dry season water in some areas is underground. Drought also affects trees and birds. Desertification and temperature increases affect the mangroves and people's livelihoods. IUCN (2017b) identify drought as the main climate change hazard in the Río Paz basin. Mangrove ecosystems are also threatened by displacement of the high tide line caused by sea level rise, and changes in the course of the river, in part due to extreme rainfall or associated hurricanes, which can divide the river and alter freshwater availability (Pérez de Madrid and Sánchez 2011). Strong winds are also an important climate-related threat (Pérez de Madrid and Sánchez 2011).
- ***Extreme weather events***, such as heavy rains and drought, high temperatures, flooding of the Río Paz or extreme events at sea. For example, although flood defences have minimised the effects of some floods, they affect downstream communities and their livelihoods. Coastal plains and agricultural land are particularly affected (Pérez de Madrid and Sánchez 2011). A phenomenon called ocean swell led to very high waves in May 2015. Strong waves associated with ocean swell damage community orchards, crops and vegetable gardens, lead to water pollution, and destroy mangroves (especially the Isasten species) because of salt levels, and this in turn damages aquatic life. Regulatory functions relating to water are then lost, and food provision drops. The scenic beauty provided by mangroves also disappears.

- ***Nutrient pollution and toxic agrochemicals*** (Pérez de Madrid and Sánchez 2011). Although the sugar industry provides work for some community members, the agrochemicals it produces harm the environment and people's health. The whole area is affected because the industry practices indiscriminate burning and release of toxic agrochemicals into water systems. This affects people living downstream, and some are suffering from kidney diseases.
- ***Deforestation and tree felling*** are damaging the ecosystem. Upstream deforestation affects downstream freshwater quantity in the watershed, and crops are being lost. The lower part of the basin currently shows very little sign of the mangrove forests that previously covered the land, and the landscape is now dominated by pasture or crops (Pérez de Madrid and Sánchez 2011). Without coastal forests, rainwater percolates into the soil less and there is more run-off. Filtration services provided by the forests are reduced. With fewer forests there is less firewood, biodiversity and ecosystem-based climate change mitigation. There are also cultural impacts resulting from mangrove deforestation, with children no longer going to the mangroves to bathe.
- ***Overexploitation***. Land ownership by private individuals from outside the area is problematic because their priority is maximising their profits and they are not interested in conserving the ecosystem. The sugar industry doesn't self-regulate in terms of how much water it extracts from the river. This threatens mangroves and also prevents replenishment of the coastal aquifer on which the local population's productive activities depend (Pérez de Madrid and Sánchez 2011). A lack of awareness can also lead to mangrove overexploitation. Pérez de Madrid and Sánchez (2011) describe how unsustainable use of the coastal marine ecosystem has limited its capacity to provide ecosystem services, which has made people more vulnerable to adverse climate change impacts.
- ***Weak governance*** (IUCN 2018). Some legislation exists but is not applied, in part because people in the field do not have the experience they need. The local authority does not get involved in mangrove management and the PLES due to a lack of interest and social conflicts. The process is a coordinated by communities and regional officers of MARN. External government institutions sometimes determine how the ecosystem is managed, which can threaten the ecosystem. Weak governance also aggravates the fact that the production models applied – for example, in the sugar cane industry – frame nature as a resource that anyone can make use of, buy or sell, which means that business interests use natural resources as they choose. For example, the sugar cane sector blocked and diverted the Aguacate River, which means there is no more fresh water for agriculture and the mangroves downstream. This unleashes a series of threats to the ecosystem and to people's livelihoods. Mangroves need salt and freshwater to survive, so are badly affected. With only salt water, their roots suffer from fungal infections and they die.
- ***Weak legal framework***. There isn't a law on water, the law on protected natural areas does provide some guidelines but they are inadequate, and the law on irrigation and drainage is out of date. It is pointless for the community to implement adaptation measures without legal and regulatory support to facilitate sustainable use.
- ***Salinisation*** is advancing in the dry season, in part due to a shortage of rainwater runoff and over-extraction of water resources in the Río Paz basin, and in part due to mangrove removal, because the forest acts as a barrier preventing salinisation from advancing. As the mangroves disappears, salinisation is reaching almost as far as Cara Sucia in the middle part of the basin. Inland well water and underground water reserves are increasingly saline. The stream in El Chino is already saline.
- ***Blocked estuaries***. Insufficient water can get to the estuary because all the channels are blocked. This results in the water heating up in the winter. Blocked estuaries negatively affect agricultural crops.

Boundaries influencing ecosystem resilience

One implementing partner interviewee mentioned the importance of the watershed as a key management unit for addressing ecosystem resilience. There is a need to improve watershed management upstream in El Salvador, to ensure fresh water availability downstream. But there is no basin management plan or any other management tool for that territory. Moreover, the Río Paz basin falls in both El Salvador and Guatemala so binational coordination is important (IUCN 2017b).

Thresholds influencing ecosystem service provision

Implementing partner interviewees felt there could be a threshold related to water availability. People do not realise that water is a finite resource, and there will come a time when it stops if current use levels are maintained.

Implementing partner interviewees also felt there could be a key threshold related to salinity levels which, when combined with reductions in water flow, the expansion of agriculture and livestock farming and the effects of climate change, will have a serious impact on the ecosystem.

EbA initiative impacts on ecosystem resilience and services provision

Local authority and implementing partner interviewees felt that ecosystem resilience improved following the Go4EbA project. Local authority, implementing partner and community interviewees also felt that the supply of provisioning, regulating, cultural and supporting ecosystem services improved. For example, work to clear the drainage channels in the Aguacate micro-watershed is benefiting the ecosystem because the mixture of fresh and salt water helps the mangroves flourish in summer when functioning well. This work is especially important in the dry season. Clearing channels supports the reproduction of various fish, crab and shrimp species (IUCN 2017a). When water is flowing in the Aguacate River it filters through and this reduces salinisation in people's wells.

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

National, implementing partner and community-level interviewees felt that ecosystem services were maintained or restored at the watershed level as a result of Go4EbA project activities. National-level interviewees added that they were maintained or restored at the landscape level, and local authority and community level interviewees added that they were maintained or restored at the municipality or local village/area level.

No trade-offs were described, but local authority interviewees mentioned synergies between the delivery of ecosystem services at different geographical scales in the context of a reduction in downstream flooding as a result of greater upstream water infiltration.

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 variety of timescales, depending on the service. For example, mangrove recovery could take up to five years, but recreation-related services could take one year or less to materialise. Several interviewees felt, however, that improvements could be sustained for ten years or more.

Whilst interviewees did not mention any trade-offs between the delivery of different ecosystem services at different timescales, some local authority and implementing partner interviewees commented on the fact that work done now to implement adaptation measures in the Río Paz watershed and protect critical mangrove areas will provide sustained improvements in water supplies and hence a better future for the generations that follow.

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

How cost-effective is the EbA initiative?

Roughly half of national and implementing partner interviewees said there was evidence that the Go4EbA project was cost-effective. For example, repairing drainage channels and digging ditches increases biodiversity and brings associated increases in income. Reforestation and management activities increase the ecosystem's capacity to restore itself, which is efficient. A number of studies elsewhere in El Salvador also provide evidence on the cost-effective nature of EbA (eg Raes et al.

2017; Geologos del Mundo and UNES 2013; MARN 2016; Rodríguez Herrera 2004a; Rodríguez Herrera 2004b; Rodríguez Herrera 2010; UICN-BASIM-UES 2007).

Costs are ongoing, however, with adaptation measures such as reforestation requiring follow-up. Protected areas also need to be looked after, and an environmental education programme has been started accordingly in the surrounding areas.

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

All national and implementing partner interviewees said that the Go4EbA project had been compared to other types of adaptation interventions and was more cost-effective than other approaches. Implementing partners added that it was also more efficient.

Broader economic costs and benefits of the EbA initiative

National and implementing partner interviewees described various broader economic costs and benefits resulting from the Go4EBA project, but stated that these had not been quantified:

- Local income enhancement as a result of PLES implementation and higher levels of production. This was expected rather than experienced.
- Avoided losses from disaster risks. Protection of upstream areas on the basis of priority municipalities will reduce risks for downstream areas. Again, this was expected rather than experienced.
- Avoided costs of using grey infrastructure systems instead of ecosystem services.
- Land or service value increases.
- Opportunity costs when other land uses are not taken up.
- The costs of the intervention itself, which have not been quantified. This includes the costs of manual labour and project and logistical costs.

Financial and economic trade-offs at different geographical scales

Implementing partner interviewees say there were no financial or economic trade-offs between management at different geographical scales.

Changing financial and economic benefits and costs over time

Implementing partner interviewees said that financial and economic benefits and costs did not change over time. They explained, however, that financial benefits in terms of income increases from agricultural production and fishing are almost immediate following the clearance of drainage channels which then attract various species, and in areas where ditches are dug and new plants soon appear.

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

Local-level barriers to implementing EbA

Interviewees described the following policy, institutional and capacity barriers to implementing EbA at the local level:

- ***Awareness raising is needed***. People are not used to the idea of EbA. There is resistance from some of those using mangroves because changes affect their livelihoods and sources of income, so better awareness raising and planning regarding mangrove extraction is needed. The attitudes of some community members need to change, which requires community meetings in order to raise awareness. There will always be people with negative attitudes, but training can help change attitudes. For example, training farmers and cattle ranchers could stop them dumping toxic

chemicals on farmland. Training workshops should be held more often and in places people can get to, but this is challenging because people often have little time to spare. Local government needs to invest urgently in awareness raising. Similarly, universities tend not to look at the territory or the landscape, only the productive unit. More emphasis is needed on the connection with land, and local dependence on ecosystem services rather than the productive unit. Local and ancestral knowledge also needs to be valued more; it should be the basis for all relevant initiatives and regulations.

- ***Communities lack the authority they need***. There are few mechanisms to help communities take decisions. They lack the ability to veto private company policies which affect them and the ecosystem, such as those of the sugar cane industry. Those with money and resources – namely, the sugar cane sector – can take advantage of the ecosystem to the detriment of small-scale farmers or economically vulnerable people.
- ***Financial resources are unavailable***. Sometimes there are technical capacities but no resources to carry out projects.
- ***Capacity and technical resources are insufficient***, ***and institutions are weak***. The technical and financial capacities of local institutions need to be strengthened. Local institutions are working with local governments on adaptation issues in nine municipalities, but these municipalities do not have trained people in this field. Local institutions and capacities need to be strengthened and there is a need to invest in local human resources. The community organisation needs to grow because the more people are involved, the more they will get trained. The technical and administrative capacities of the members of the River Aguacate Micro-Watershed Committee need to be strengthened. Pérez de Madrid and Sánchez (2011) also argue that poverty and institutional weaknesses contribute to climate change vulnerability, and that whilst there is a Municipal Environmental Land Organization Plan in San Francisco Menéndez, this currently lacks specific actions for each of the micro-basins or details relevant committees. Additionally, there are no working groups set up yet to assess water management processes or to address risk and disaster management.
- ***There is insufficient collaboration across sectors and institutions***. There is a lack of integration across the issues involved. Links between the municipality and communities are weak and ongoing dialogue is needed. Stronger connections with the national level regarding the implementation of laws are needed, along with more citizen participation in the spaces where decisions are taken. There is also nowhere for local communities and those involved in the sugar cane sector to hold a discussion in a situation of equality. Current advocacy methods are confrontational and involve taking to the street; alternatives, such as negotiation, could achieve more. Spaces for discussion or dialogue where the communities can present their main demands are needed. More discussion fora for dialogue about the problems of climate change and reaching agreements between communities and the sugar cane producers are needed, and where they exist they need to be strengthened.
- ***Government is unsupportive***. Party politics can make it difficult to work with local governments in some places, which affects implementation. Local governments also have their own mandates and their own ways of negotiating resources and managing the municipal territory. Instead of hiring workers from outside they should hire local people. Also, municipal government needs to support EbA initiatives more and reinforce the community's work. This support could take the form of funding or training. Community interviewees also felt that local government needs to visit the area more often and work with the communities to see how to carry out the work that is needed. The area is remote, so is rarely visited by government officers due to a lack of resources.
- ***Legislation and enforcement are weak***. Local government needs to draw up regulations that specifically oblige every project that gets implemented to have an environmental component at all times. Municipal legislation and rulings are needed to guarantee ecosystem protection. Community interviewees also felt that local government needs to ensure laws are complied with – this is the responsibility of national authorities together with the environmental focal point in the municipality. Permits for cutting down trees need to be restricted.

National-level barriers to implementing EbA

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

- ***There is insufficient cross-sectoral institutional collaboration***. More linkages need to be made between institutions. Although the Ministries of Public Works, Agriculture and Livestock, the Treasury and MARN agreed in 2012 to work together more to fight climate change, cooperation between these institutions remains difficult to implement.
- ***Financial and technical resources are unavailable***. Government institutions responsible for the environment need to provide more technical and financial support. Implementation capacity is currently insufficient. More funding is also needed to enable stricter regulation.
- ***More government support is needed***. For example, community interviewees felt that more support from MARN and the Ministry of Agriculture and Livestock is needed. Government could strengthen the projects that have been implemented. MARN has been working in the department and municipality and should consider providing more continuity to activities, because they are not short-term processes. Moreover, the mangroves are by law a protected area, so MARN is responsible for its management. Governance needs to improve. Government officials rarely visit the area as it is remote and they lack resources. Central government institutions also need to ensure laws are complied with.
- ***Knowledge and awareness levels are low.*** Government ministries have no idea what the concept of EbA means but they are implementing EbA measures nonetheless. More systematic production of evidence is needed. Few adaptation projects in the Mesoamerican region channel effort and resources into measuring effectiveness (IUCN 2017a). The National Farming and Forestry Technology Centre focuses on conventional agriculture, which needs to change.
- ***Political paralysis occurs***. Society is polarised these days, which makes it difficult to reach agreements. Even if issues are a priority for the government, they are not a priority for the business community or the opposition in parliament, which means reaching agreement to approve loans, provide funds, and so on is difficult. Key stakeholders lack the authority to take the actions needed, mandates can be unclear, and some institutions are too weak.
- ***Better policies and legislation are needed***. Some government policies are not supportive. In the past there was talk of a general water law, which is needed now because it would establish how to regulate water use, who gives permission to do this, and who is allowed to use water. Legislation is necessary to limit current excessive water use. Pérez de Madrid and Sánchez (2011) add that whilst there is a great diversity of legislation and regulatory tools related to water management in El Salvador, they are not well articulated. Innovation and the encouragement of citizen participation in the development of environmental policies are needed.

Interviewees also described the following donor-related barriers to implementing EbA at the national level:

- ***Donors are withdrawing*** because El Salvador has been declared a middle-income country.
- ***More financial resources are needed***. The communities and Istatén are willing to work, but need more resources. Donors should be developing and funding projects that prioritise ecosystem recovery and community participation.
- ***Innovation is key***. Innovative work with beneficiaries or implementing organisations is key.
- ***Reducing donor bureaucracy is important***. Some donors are more bureaucratic than others. Donor reports use lots of paper because not everything can be presented in a digital format.
- ***Donors need to get better at supporting long-term initiatives, listening to people's demands, strengthening local capacities and working in line with country systems***. Donors should abide by existing national priorities and legislation in El Salvador. They should work with existing institutions to finance initiatives. Donors should support exchanges to address emerging issues and improve responses to new situations or circumstances.
- ***Donors need to adopt an integrated landscape approach***. In order to address a serious problem in one municipality it's important to work in other municipalities too. For example, donor-funded work on water needs to invest in upstream watershed areas where water filters down from. Donors need to prioritise coastal municipalities when planning projects.

Local-level opportunities for implementing EbA

Interviewees described the following policy, institutional and capacity opportunities for implementing EbA at the local level:

- ***People are motivated to take action***. They are aware of the problems and are not indifferent to them. Ecosystem deterioration provides an opportunity to engage, and they are willing to get organised.
- ***Supportive local institutions, policy and legislation are in place***. The EbA plan for the communities (related to the project implementation strategy) includes capacity strengthening. Local stakeholders have opportunities to receive support from a Ramsar committee, or a potential alliance amongst locals and organisations articulating adaptation measures along the coast. There have been successful local experiences in water management using municipal rules and local participation, and in 2010 the San Francisco Menéndez municipality made proposals for a new territorial organisation and an action plan to fight climate change which included risk management and adaptation measures (Pérez de Madrid and Sánchez 2011). Pérez de Madrid and Sánchez (2011) also describe how the Community Commissions for Civil Protection in the El Aguacate micro-basin respond to disaster risk and are integrated within higher structures at the municipal, departmental and national levels. All of the state departments which are represented or have functions within the area participate in this structure for civil protection. There is also a Municipal Environmental Land Organization Plan in San Francisco Menéndez, with general guidelines for land management.

National-level opportunities for implementing EbA

Interviewees described various ways that supportive national institutions, policy and legislation provided opportunities for motivating action on implementing EbA. The current government has paid attention to environmental issues, which provides an opportunity for adopting EbA approaches. MARN is championing ecosystem restoration and is committed to implementing national-level restoration actions as part of the Bonn Challenge. MARN has participated in establishing PLES groups and is also supporting the working group on water. This helps environmental problems to be addressed and put on the agenda. Pérez de Madrid and Sánchez (2011) also describe how public and private entities are showing more interest in spatial/land planning and other conservation measures, as opposed to building infrastructure and river dredging, to address climate change related extreme events.

Box 4 describes a number of policies and strategies that provide an enabling framework for EbA implementation. MARN is the main government institution in charge of carrying out the measures related to adaptation strategies and policies, and the National Ecosystems and Landscape Restoration Programme as well as the Treasury are also both responsible for implementing adaptation measures.

Box 4: Policies and strategies that support EbA implementation in El Salvador

- The ***Climatic Scenarios,*** published in 2010, are a national tool for climate planning and management.
- Objective seven of the ***Five-year Development Plan 2014-2019*** is to reach an environmentally sustainable, climate change-resilient society and economy. There are five sectoral and macroeconomic policies in the plan, one of which is the ***Environment and Risk Reduction Policy***, which refers to climate change and adaptation and highlights the links between adaptation, ecosystems, water management and agriculture.
- The ***National Environmental Policy*** (2012) lists climate change adaptation and risk management, through the development of both physical and natural infrastructure, amongst its action priorities.
- The ***National Climate Change Strategy*** (2013) was developed to reduce risks, maintain productive activities and ensure the wellbeing of the population. The ***National Ecosystems and Landscape Restoration Programme*** is one of the three priority guidelines for the Strategy's climate change adaptation component. It was launched in 2012 as a flagship tool to cope in a planned manner with the degradation of ecosystems and the services they provide. It prioritises the restoration of critical ecosystems and landscapes, as well as sectoral adaptation strategies emphasising agriculture, water resources, infrastructure and health. It emphasises resilient, biodiversity-friendly agricultural production systems and natural infrastructure for coastal protection. It is being operated through a National Dialogue Platform with emphasis on mitigation-based adaptation. A National Restoration Opportunity Map has also been developed with the support of IUCN, which is complemented by an economic analysis of restoration opportunities (Raes et al. 2017).
- The above strategy prioritised the design of specific strategies and sectoral plans for integration into the ***National Climate Change Plan***, which was published in 2015. This Plan includes a ***Biodiversity and Ecosystems Management Programme*** for climate change adaptation and mitigation, and thus a strong emphasis on EbA principles. Actions listed include protection, rehabilitation and conservation of ecosystems and their ecological functions; reducing pressure on biodiversity and ecosystem contamination; innovation and development of knowledge on biodiversity and ecosystems for adaptation; and control of land use change to agricultural, tourism or urban use. As part of the ***Agricultural, Forest and Agroforestry Practices and Activities Transformation and Diversification Policy*** of the National Climate Change Plan, one measure aims to design and implement sustainable management of forests and the development of agroforestry systems with an adaptation-based mitigation approach, addressing the specific circumstances and needs of indigenous communities and culturally or economically vulnerable people. Another programme under the National Climate Change Plan seeks adaptation strategies focusing on water resources.
- The above plan informed the ***Intended Nationally Determined Contribution*** drawn up by MARN in 2015. This reflects the government's commitment to environmental issues and emphasises ecosystem and landscape restoration. Responsibility for implementation has been identified. Mitigation commitments also rely on restoration, agroforestry systems and mangroves.
- The ***National System of Civil Protection and Disaster Prevention and Mitigation*** was created in 2006. This has strengthened observations and early warning systems, reducing the loss of human lives to extreme climatic events. Within its institutional set-up, the Ministry of Public Works is in charge of the ***Directorate for Adaptation to Climate Change and Strategic Risk Management***. This focuses on, amongst other things, establishing natural disaster prevention measures and strengthening climate change adaptation capacities.

- The ***National Biodiversity Strategy*** (2013) includes restoration, conservation, critical ecosystems and "biodiversity for the people". It discusses the impacts of climate change on the structure and functioning of ecosystems and the role of biodiversity and ecological connectivity in climate change adaptation under its research component.
- The ***National Forestry Policy*** (2011-2030) identifies EbA measures relating to forest ecosystem restoration and agroforestry that contribute to food security, water production and vulnerability reduction.

Is the EbA initiative sustainable?

All interviewees felt that the policy, institutional and capacity support needed at the local and national levels was sufficient to ensure the Go4EbA project could be sustainable over the long term, largely because of government and local community support for the project.

The government of El Salvador, and notably MARN, prioritises climate change and ecosystem restoration and improvements. This is also true at the municipal and regional levels. FIAES also provides support. Existing relations between the municipality and the project team (which includes UNES) for a previous IKI-supported EbA project in the area ('Climate Change Governance Capacity: Building regionally and nationally tailored EbA in Mesoamerica') and the fact that the municipality is aware of the local environmental problems bodes well for continuity (Pérez de Madrid and Sánchez 2011). Priority areas for long-term restoration and planning have been identified in the policies of MARN and the Ministry of Agriculture and Livestock. Ahuachapán is a priority department. FIAES helped develop the local sustainable development plan (which is different from the PLES), planning key priorities for restoration in the department. This has a time horizon of 2030. FIAES will continue to work in the department for five years, thus improving sustainability.

Go4EbA project work is also part of the community's agenda. Work plans for ecosystem conservation were developed by the people, and UNES supports planning processes.

Possible challenges to Go4EbA project sustainability identified by interviewees include the lack of sufficient support (because the need is so great, and for environment units), the need for stronger policy support, the need to improve water management, and possible high-level political shifts if the current government changes. Participation by all stakeholders needs to continue, and the sugar cane sector needs to abide by agreed policies for project actions to last over time.

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

All interviewees felt that opportunities had emerged for replication, scaling up or mainstreaming the Go4EbA project or for influencing policy. They provided the following examples:

- ***The current policy and legislative context provides opportunities for further EbA implementation***. Box 4 provides details on this context.
- ***Further supportive policy and legislation is being formulated, which holds promise for scaling up EbA in the future***. El Salvador's Intended Nationally Determined Contribution proposes and highlights three policy tools: a National Climate Change Plan (which was published in 2015), a National Adaptation Plan (to be developed) and a Climate Change Framework Law (to be developed before 2019). These policy tools, as well as synergies with mitigation options, provide opportunities for scaling up EbA. Hopes for national recovery are particularly vested in the farming sector. A new Sustainability Cabinet (the National Council for Sustainability and Vulnerability, or CONASAV) has also been proposed to integrate climate change and risk management into the national public policy related to implementation of the National Climate Change Plan.
- ***Policymakers/planners attitudes have changed***. Advocacy work was done with some institutions, with positive results, although others rejected the street protests arranged by UNES.
- ***Stronger links have been forged between relevant government bodies supports cross-sectoral planning***. Involving the Ministry of Agriculture and Livestock supports scaling up, as the

ministry it is stronger and has more clout than MARN. Efforts have been made to bring together stakeholders (individuals, the private sector and the government).

- ***Sharing and learning between communities is taking place***. One implementing partner interviewee mentioned that the work communities are doing implementing adaptation measures in downstream areas has caught the interest of upstream communities in parts of the Aguacate River watershed. This could lead to further improvements in ecosystem services provision. A wider forum – a 'Mangrove Alliance' – has been proposed to build on community activities and implement project adaptation measures all along the coast of El Salvador, and strengthen organisations. This needs local government support and participation.
- ***Donor support will follow national prioritisation***. Donors tend to propose work based on national commitments.

Some interviewees also mentioned challenges with replication, scaling up or mainstreaming, namely, that it is difficult to implement legislation on a national scale because of the technical and human resources required, and the need for more policies and regulations, as well as the need to strengthen and implement those that already exist.

Conclusions

The Go4EbA project site in the department of Ahuachapán, El Salvador, is being implemented in the Garita Palmera wetland and mangroves in the lower part of the Río Paz basin. Project adaptation measures include unblocking channels, reforestation of critical mangrove areas, community surveillance, and design and implementation of a Local Plan for Sustainable Extraction.

Effectiveness for human societies

Resilience and adaptive capacity have improved, and vulnerability has been reduced, as a result of project adaptation measures. Women, poor and vulnerable people, and those who participate in Istatén (a local environmental organisation) experience most improvements in resilience, adaptive capacity or vulnerability, although improvements are widespread. There may have been trade-offs in terms of where improvements in resilience, adaptive capacity or vulnerability accrue because of the focus on specific communities targeted by the project and those involved with Istatén. For example, people coming from outside the local area no longer benefit from unregulated natural resource use. But these people also benefit from improvements in natural resource availability due to actions undertaken by the Istatén communities.

Whilst there may be trade-offs in terms of when improvements in resilience, adaptive capacity or vulnerability as a result of Go4EbA project adaptation measures materialise, short-term improvements from restored and protected mangrove areas are already apparent, and further improvements are expected in the medium to long term as people's behaviour changes and the delivery of ecosystem services improves.

A wide range of social co-benefits emerged from the project: disaster risk reduction; livelihood provision or diversification and improvements in food security; health benefits; security improvements and reduced conflict between communities over resources; improved policies and governance, and stronger institutions; improved awareness and capacity; and improved conditions for improving sustainable water provision. Whilst these benefited some social groups more than others, the benefits were widespread. Natural resource use restrictions did, however, disadvantage some people.

Go4EbA project activities incorporated local community knowledge in various ways. The project also adopted a range of participatory approaches. This supported the implementation of EbA and built adaptive capacity.

Effectiveness for the ecosystem

A number of factors threaten the resilience of local ecosystems and their ability to deliver ecosystem services: climate change, extreme weather events, nutrient pollution and toxic agrochemicals,

deforestation and tree felling, overexploitation, weak governance, weak legal frameworks, diseases affecting mangroves, salinisation and blocked estuaries.

The watershed is likely to be a key level for addressing ecosystem resilience. The Río Paz basin falls in both El Salvador and Guatemala so binational coordination is important.

Thresholds relating to water availability and salinity levels could influence ecosystem service provision.

Ecosystem resilience improved and ecosystem service provision also improved following the Go4EbA project. Ecosystem services were maintained or restored at the watershed or landscape level and also at the municipality or local village/area level. Trade-offs between the provision of different ecosystem services at different geographic scales were not apparent; rather, synergies in the context of a reduction in downstream flooding as a result of greater upstream water infiltration were observed. Similarly, although ecosystem services would be maintained or restored over a variety of timescales, depending on the service, no trade-offs in the delivery of ecosystem services at different timescales were observed.

Financial effectiveness

Although the project was perceived as cost-effective by some, evidence verifying this was lacking and some project costs are ongoing. Interviewees felt that the project was more cost-effective than other adaptation approaches.

Various broader economic costs and benefits resulted from the Go4EbA project. Benefits included local income enhancement, avoided losses from disaster risks, avoided costs of using man-made systems instead of ecosystem services, land or service value increases and opportunity costs when other land uses are not taken up. Costs included those associated with project implementation.

There were no apparent financial or economic trade-offs between management at different geographical scales, and interviewees felt that financial and economic benefits and costs did not change significantly over time.

Policy and institutional issues

A number of policy, institutional and capacity-related issues at the local level acted as barriers to implementing EbA: the need for further awareness raising; communities lacking the authority they need; the unavailability of financial resources; insufficient capacity and technical resources, and weak institutions; insufficient collaboration across sectors and institutions; unsupportive government; and weak legislation and enforcement.

A number of policy, institutional and capacity-related issues at the national level acted as barriers to implementing EbA: insufficient cross-sectoral institutional collaboration; unavailable financial and technical resources; the need for more government support; limited knowledge and awareness levels; political paralysis; and the need for better policies and legislation. A number of donor-related barriers to implementing EbA are also apparent: donor withdrawal; the need for more financial resources and innovation; excessive donor bureaucracy; the need for donors to get better at supporting long-term initiatives, listening to people's demands, strengthening local capacities and working in line with country systems; and the need to adopt an integrated landscape approach.

The motivation of local people to take action, as well as support from local institutions, policies and legislation, provided local-level opportunities for implementing EbA.

The prioritisation of environmental issues and EbA-related solutions provides support at the national level for implementing EbA. A wide range of national policies and strategies provide an enabling framework for EbA implementation.

It is likely that the Go4EbA project will deliver sustained benefits over the long term, largely because of government and local community support for the project and for EbA in general.

A number of opportunities for replication, scaling up or mainstreaming the Go4EbA project or for influencing policy have emerged: the current policy and legislative context provides opportunities for further EbA implementation; further supportive policy and legislation is being formulated; a change has been seen in policymakers'/planners' attitudes; stronger links have been forged between relevant

government bodies to support cross-sectoral planning; sharing and learning between communities is taking place; and there is donor support.

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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 Governance for Ecosystem-based Adaptation: Transforming Evidence into Change project, El Salvador. The findings will be combined with those from 12 other sites in 11 other countries to help show climate change policymakers when and why EbA is effective.

Project Report

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