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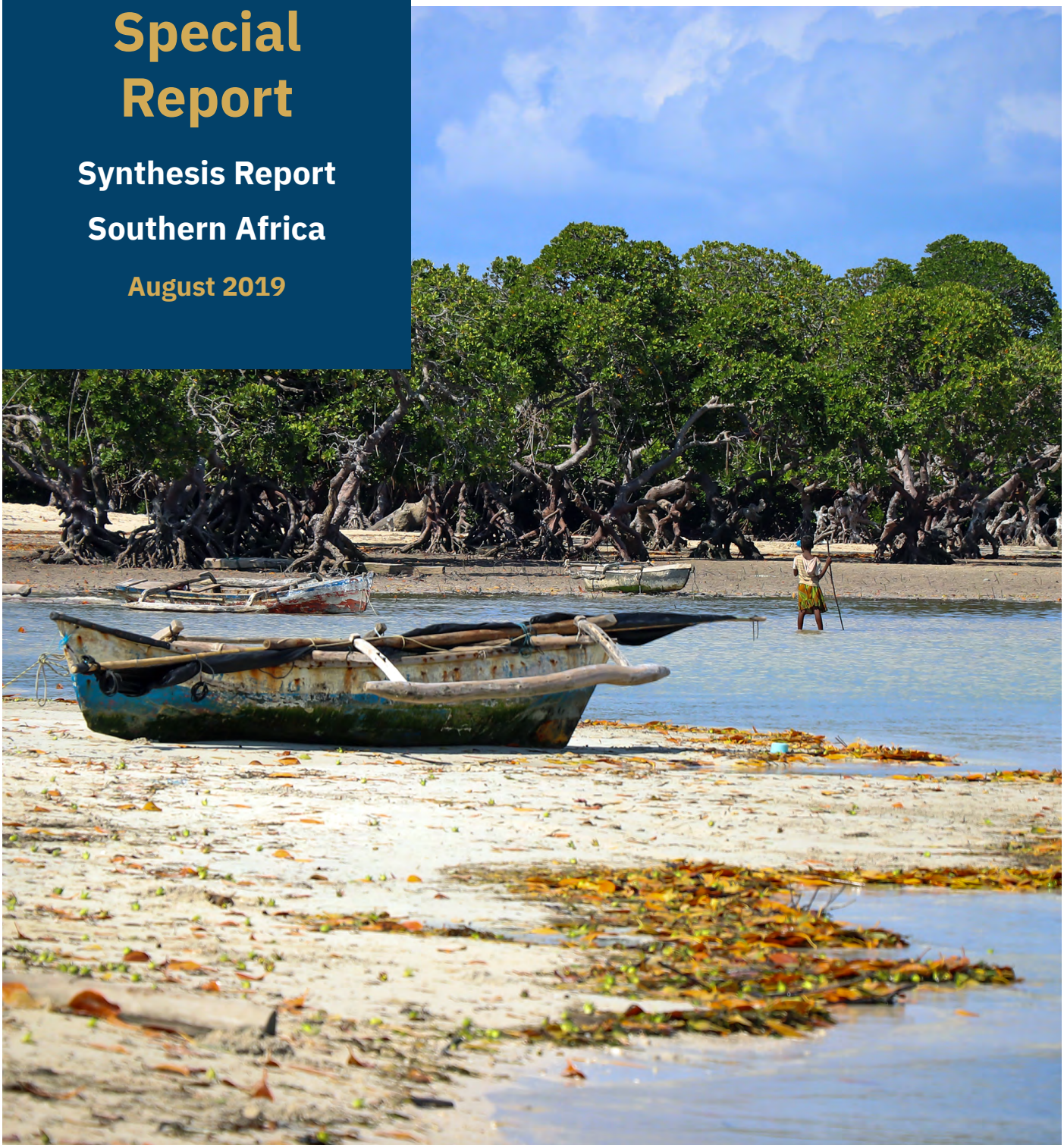

Marine and Coastal Ecosystem-based Adaptation for Enhanced Resilience in Southern Africa: Synthesis Report

ROMY CHEVALLIER

African perspectives
Global insights

SAIIA
SOUTH AFRICAN INSTITUTE OF INTERNATIONAL AFFAIRS

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Acknowledgment

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About SAIIA

SAIIA is an independent, non-government think tank whose key strategic objectives are to make effective input into public policy, and to encourage wider and more informed debate on international affairs, with particular emphasis on African issues and concerns.

SAIIA'S special reports are fairly lengthy analytical papers, usually reflecting on and analysing the findings of field research.

Cover image

Mangroves, Bazaruto Archipelago, Mozambique (Romy Chevallier)

Abstract

Despite the climate change commitments made under the landmark Paris Agreement in 2015, the world will continue to experience negative climate impacts. As such, pre-emptive adaptation planning is necessary to build and sustain countries' social, economic and environmental resilience. For vulnerable coastal and island states, this can be done through the enhanced sustainable management, restoration and conservation of their marine and coastal ecosystems. Ecosystem-based adaptation (EbA) – or ecosystem-based approaches to climate adaptation – is the use of biodiversity and ecosystem services to help people adapt to the adverse effects of climate change. EbA involves governing and managing ecosystems to enhance their resilience to climatic shocks and stresses – maintaining and, where possible, improving the quality and quantity of ecosystem services they provide to society – and in so doing supporting human communities to adapt to current and future climate risks.

Pre-emptive adaptation planning is necessary to build and sustain countries' social, economic and environmental resilience

This in turn will help to achieve more sustainable forms of development, strengthening livelihoods in ways that reduce poverty and environmental degradation. However, despite the recognition of their value, the modification and degradation of crucial habitats such as coral reefs, mangrove forests and coastal wetlands continue unabated. Moreover, these marine and coastal ecosystems are still largely absent in climate change response measures and need to be more fully integrated into national and sectoral policies, as well as budgetary and regulatory frameworks, particularly in small island states and developing countries with vulnerable coastal areas. The advancement of national climate adaptation strategies and the revision of countries' Nationally Determined Contributions (NDCs) in 2020 is an important opportunity to include marine and coastal ecosystems in official climate change response policies. Common on-the-ground EbA approaches in coastal areas include a variety of options:

- planning and policy responses such as coastal retreat or realignment to physically manage sea-level rise;
- spatial planning tools to avoid negative trade-offs and protect important biodiversity hotspots;
- the designation of marine protected areas (MPAs), other conservancies and fisheries management areas to protect key habitats and reproductive areas and vulnerable pockets of biodiversity;

- the promotion of other sustainable livelihood options to remove pressure on ecosystems; and
- restoration and rehabilitation initiatives to rebuild degraded habitats.

A combination of EbA and harder engineering solutions, such as offshore living breakwater structures and artificial reefs, can also function as a barrier between the sea and land, providing habitats for species and aiding the restoration of coral reefs. There is significant potential to expand EbA in Africa. However, effective marine and coastal EbA requires several barriers to be addressed to allow its successful implementation and ensure the opportunities provided by such an adaptation approach are maximised. These barriers include policy development and alignment; regional cooperation; access to finance; capacity building; and peer learning. There is also the need to include and promote partnerships, especially with coastal communities and marginalised groupings such as women and children.

Ecosystem-based adaptation – or ecosystem-based approaches to climate adaptation – is the use of biodiversity and ecosystem services to help people adapt to the adverse effects of climate change

Abbreviations & acronyms

CBD	Convention for Biological Diversity
CBNRM	community-based natural resource management
CFA	community Forest Association
CMP	Coastal Master Plan
CMMB	Community-based Mangrove Management Board
CPRA	Coastal Protection and Restoration Authority
EAFM	ecosystem approach to fisheries management
EbA	ecosystem-based adaptation
EIB	Environmental Impact Bond
GCF	Green Climate Fund
KFS	Kenya Forest Service
LMMA	locally managed marine area
MITADER	Ministry of Land, Environment and Rural Development, Mozambique (Ministério da Terra, Ambiente e Desenvolvimento Rural)
MIMAIP	Ministry of Sea, Inland Waters and Fisheries, Mozambique (Ministério do Mar, Aguas Interiores e Pescas)
MPCO	Mikoko Pamoja Community Organisation
NDCs	Nationally Determined Contributions
NGO	non-governmental organisation
PES	payments for ecosystem services
PSF	People's Survival Fund, Philippines
SIDS	small island developing states
UNFCCC	UN Framework Convention on Climate Change

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Introduction

Ecosystem-based adaptation (EbA) is often referred to as the 'natural solution to climate change'.[1] It recognises that healthy, intact, diverse and well-managed ecosystems provide abundant ecosystem services, enabling people and societies to adapt to current climate variability and long-term change. These ecosystems not only provide climate change

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protection and buffer sensitive coastlines against sea-level rise and storm surge, they also enhance socio-economic development goals through their provisioning, supporting, regulating and cultural services. This includes habitats and reproductive grounds for fisheries, water filtration, erosion prevention, carbon sequestration and spiritual connectivity. These services are essential to support the livelihoods and incomes of coastal populations, which are increasingly vulnerable to climate impacts. In order to ensure the health and integrity of coastal ecosystems, their protection, sustainable management and restoration are essential.

EbA is recognised as an important approach for responding to climate impacts and enhancing resilience

Developing countries safeguard many of the world's planetary boundaries and healthy ecosystems.[2] Coastal populations in Southern African countries are also reliant on marine and coastal ecosystems to support their economies and the livelihoods of their people. It is therefore imperative that countries in the region plan, prepare and implement national climate adaptation strategies that most effectively build and sustain their social, economic and environmental resilience and emergency response capacity. EbA allows these countries

1 DEA (Department of Environmental Affairs) & SANBI (South African National Biodiversity Institute), *Ecosystem-based Adaptation (EbA) Guidelines*. Pretoria: DEA, 2018, p. 5.

2 Scarano F, 'Ecosystem-based adaptation to climate change: Concept, scalability and a role for conservation science', *Perspectives in Ecology and Conservation*, 15, 2017, pp. 65–73.

to partly achieve this by integrating marine and coastal ecosystems with their coastal zone and marine management planning and their climate response and/or adaptation strategies.

Yet despite the strong scientific link between climate change and ecosystem management, the conservation and restoration of mangroves, seagrass beds, tidal marshes, dune systems, coral reefs, kelp and wetland areas are inadequately represented in national and regional climate change strategies. Disappointingly, many national climate adaptation strategies make no explicit mention of these vital ecosystems. While some countries in the Southern African region have made progress in implementing innovative marine and coastal EbA projects, there are still significant challenges related to scaling up such efforts and incorporating EbA into national, subregional, regional and global climate policies and strategies. This is largely because successful EbA implementation requires political and institutional buy-in at different levels. EbA must be mainstreamed into government processes through local, national and regional climate and sectoral/development planning. Other opportunities for scaling up EbA are through diverse organisational approaches and in partnership with different institutions.

Research objective and project overview

Adaptation policy architecture has evolved over time, with a significant shift in focus from traditional approaches, which emphasised maintaining the status quo, to more dynamic and integrative strategies. Initially, climate change adaptation focused on conventional, incremental approaches to climate risk, often centred on biophysical vulnerability, hard infrastructure-based responses and top-down management. In 2019 adaptation approaches also consider the social and economic drivers of risk, as well as various factors not directly related to climate. Furthermore, adaptation is viewed as a process to address vulnerability, including the means to support livelihood resilience, maintain the integrity of ecosystems and their services, and build the capacity of those most vulnerable. Newer adaptation approaches encourage the inclusion of broader development goals, hoping to better capture the complex interdependencies between human societies and their environment. While engineered and technological adaptation options are still common, there is growing recognition of ecosystem-based, institutional and social measures to promote integrated adaptation. Emerging approaches also seek to empower local populations and support bottom-up, participatory decision-making and planning, within a stronger institutional context.

EbA is a relatively new discipline[3] and more analytical attention is needed to assess its impact, measure and evaluate its advantages and limitations, understand the

3 This term was coined in 2000 at the fifth Conference of the Parties (COP) to the UN Convention for Biological Diversity. See Mackey B, 'Ecosystem-based Adaptation in the Coastal Zone: Towards a New Paradigm', Presentation at IUCN (International Union for Conservation of Nature) Ecosystem-based Adaptation Day, Paris CoP21, December 2015, https://www.iucn.org/sites/dev/files/content/documents/brendan_mackey-griffith_university.pdf, accessed 30 July 2019.

circumstances under which it thrives, and examine opportunities to scale it up. This is particularly true for African countries, specifically in the marine and coastal terrain. While some anecdotal evidence corroborates the effectiveness of EbA, there is a need for more quantitative, cost–benefit analysis on the multitude of social, economic and environmental co-benefits that result from effective EbA implementation.

This research seeks to address this evidence gap by undertaking national reviews of EbA experiences emerging from different countries in Southern Africa. Although it is recognised that all adaptation efforts take place in very specific contexts, the country reviews encourage peer learning and highlight common political, policy and institutional conditions that maximise the uptake of EbA. At the local level, this evidence can help build capacity and assist people to implement transformational adaptation on the ground. At a national level it may encourage the integration of EbA approaches into the wider policy discourse and help increase funding for EbA programmes and initiatives.

As access to finance is widely recognised as a key constraint to effective adaptation in developing countries, a focus on innovative financing solutions, particularly through private sector partnerships, could strengthen EbA implementation to directly benefit marginalised coastal communities.

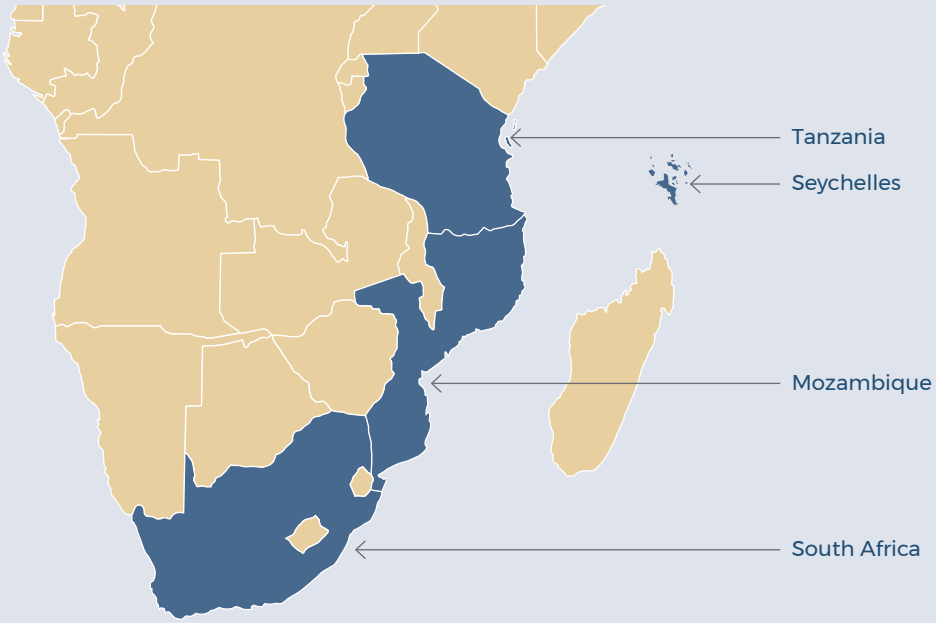
The objective of the research is 'to enhance the climate resilience of the Southern African region by strengthening the role of marine and coastal ecosystem-based adaptation in national climate responses'.[4] It focuses on marine and coastal EbA in Mozambique, Seychelles, South Africa and Tanzania. Although marine and coastal ecosystems vary, for the purposes of this report the marine and coastal ecosystems that are most prominent in the Western Indian Ocean include mangrove forests, tidal marshes, wetlands, estuaries, coral reefs, seagrasses and kelp and coastal dunes.

The main research outcomes (and intended impact of this research) include:

- improved understanding of the role of marine and coastal EbA in enhancing climate resilience among regional institutions and national policy audiences;
- a stronger evidence base to support the inclusion of marine and coastal EbA in national climate policies and strategies;
- enhanced emphasis on marine and coastal EbA in Nationally Determined Contributions (NDCs) as updated by the 2020 deadline specified by the UN Framework Convention on Climate Change (UNFCCC); and
- greater knowledge and action within the policy community and the private sector in terms of the opportunities for innovative financing and investment to support marine and coastal EbA.

4 The research project was initiated in April 2018 and ran until the end of August 2019. It was funded by the UK Department of International Development (DfID), administered through the Southern African Trust and implemented by SAIIA.

Figure 1 Research focus areas



Source: Authors

This synthesis report contains a high-level overview of marine and coastal EbA globally and in the region. Through case studies and best practice examples the report explores specific marine and coastal EbA components such as the role of innovative financing models, enabling partnerships, and gender perspectives. In addition, four comparative in-depth national reviews that further explore marine and coastal EbA in policy and practice relating to overarching opportunities and challenges in varying contexts are attached in the appendix. Research for the national reviews was conducted by in-country experts using desktop research methodology and direct stakeholder engagement (with policymakers, practitioners and sector experts at the national, provincial and local levels) in the four focus countries.

The need for resilient marine and coastal ecosystems

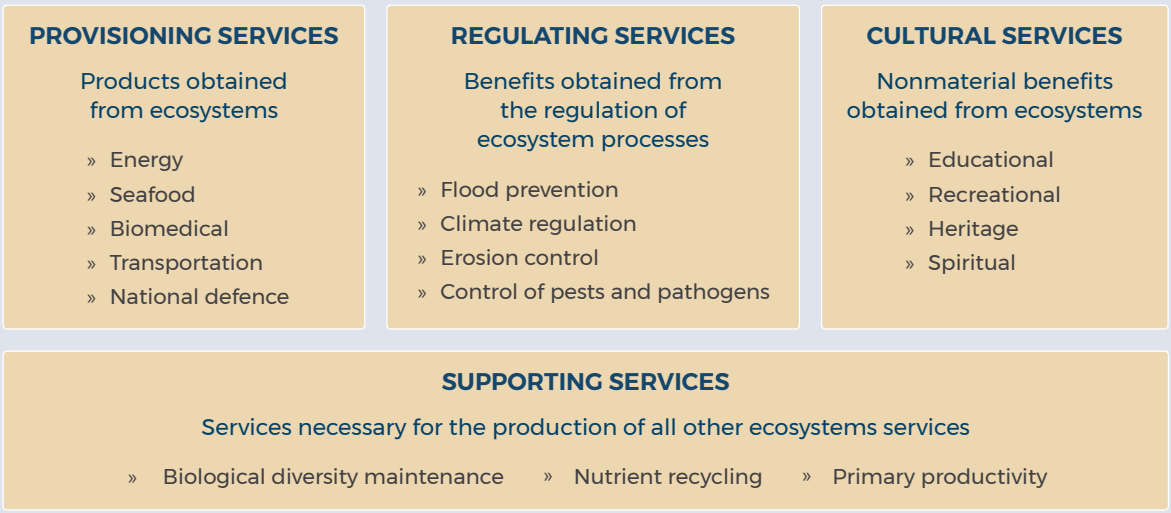
Healthy ecosystems are critical for promoting human well-being and building long-term socio-economic resilience through the range of natural services that they provide.[5] If intact

5 UN Environment, 'Making EbA an effective part of balanced adaptation strategies: Introducing the UN Environment EbA briefing notes', 2019, https://wedocs.unep.org/bitstream/handle/20.500.11822/28174/EBA1.pdf?sequence=1&isAllowed=y, accessed 5 August 2019.

and well functioning, these ecosystems are able to resist and recover more readily from extreme weather events than degraded, impoverished ecosystems.

Healthy ecosystems are critical for promoting human well-being and building long-term socio-economic resilience through the range of natural services that they provide

Figure 2 Services provided by ecosystem services



Source: Executive Office of the President of the US & White House Council on Environmental Quality, 'Final Recommendations of the Interagency Ocean Policy Task Force', 19 July 2010, https://www.nsf.gov/geo/opp/opp_advisory/briefings/nov2010/optf_finalrecs.pdf, accessed 23 July 2019

As shown in Figure 2, ecosystem services can be categorised as:

- provisioning (the products obtained from ecosystems such as food and fresh water);
- regulating (the benefits from the regulation of ecosystem processes such as air quality and pollination);
- cultural (non-material benefits such as spiritual enrichment, recreation and aesthetic experiences); and
- supporting (needed to maintain other services, such as photosynthesis and nutrient recycling).

These services have many material and non-market-related values and are intrinsically linked to poverty reduction through their provision of pro-development co-benefits. For this reason they are often referred to as 'ecological infrastructure'[6] and can be considered as the natural assets from which ecosystem services flow.[7] Given the multitude of benefits, it is widely acknowledged that ecosystems are largely undervalued, and their benefits need to be better quantified.

Despite their significant value, marine and coastal ecosystems are some of the most threatened ecosystems in the world. Recent decades have witnessed a sharp degradation of these ecosystems, mainly owing to rising human population growth; unsustainable fishing methods and overfishing; land use change and deforestation; destructive coastal development; and pollution. All of these exert significant pressure on the natural environment. Recent studies indicate that, globally, 50% of reef-building corals have disappeared over the past 30 years. In addition, more than one-fifth of the world's mangroves have been lost over the past 30 years, and many of the remaining mangrove forests are degraded.[8]

The coastlines of Southern and East Africa are characterised by a coalescence of these inland and coastal pressures. High population densities and poor resource extraction techniques have a serious impact on coastal resources. Rapid economic development continues in pristine areas along the coastline – port development, mineral exploration, urban settlement expansion and hydropower dam construction degrade natural coastal infrastructure. Added to these threats are climatic pressures, which have emerged as significant and real risks to the integrity and productivity of coastal ecosystems globally.[9]

There is increasing recognition of the link between global ecosystem health, climate change and sustainable development in many global debates. It is now widely accepted that these challenges are interconnected and cannot be dealt with in isolation. This is particularly important in the coastal zone, as many of the same ecosystem services that coastal communities rely on also play a role in helping them to adapt to climate change. There is, therefore, a need to promote resilient coastal ecosystems to reduce climate stresses, especially in vulnerable developing countries with high biodiversity and ample vegetation options.[10] An important element in enhancing natural resilience to climate change is reducing non-climatic stressors that may compound climate change effects.[11]

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6 Ecological infrastructure is a nature-based equivalent of built infrastructure that provides valuable services to people. Ecological infrastructure includes, for instance, healthy mountain catchments, rivers, wetlands, coastal dunes, and nodes and corridors of functioning ecosystems, which together form a network of interconnected structural elements in the landscape.

7 DEA & SANBI, *Guidelines for Ecosystem-based Adaptation (EbA) in South Africa*, 2017, https://www.sanbi.org/wp-content/uploads/2018/09/SA-Ecosystem-based-Adaptation-EbA-Guidelines.pdf, accessed 30 July 2019.

8 Chevallier R, 'Promoting Marine and Coastal Ecosystem-based Adaptation', Policy Insights 56. Johannesburg: SAIIA (South African Institute of International Affairs), 2018.

9 UN Environment, 2018, *op. cit.*

10 *Ibid.*

11 DEA & SANBI, 2017, *op. cit.*

Case Study 1

The vulnerability of small island developing states and coastal African countries to climate change

According to the Intergovernmental Panel on Climate Change – the UN body responsible for assessing the science on climate change – even in the most optimistic greenhouse gas emission scenarios the mean temperature of the planet is set to increase by at least 2˚C a year by 2100.[12] This means that there will still be significant climate impacts on vulnerable people, particularly women and the youth, as well as on natural resources, species and ecosystems, further reducing opportunities for sustainable development and exacerbating poverty. As such, adaptation to climate change has been a central component of the international negotiations of the UNFCCC since 2007, with the Paris Agreement placing adaptation issues on par with mitigation, focusing on enhancing adaptation and resilience in less-developed countries and small island developing states (SIDS).

Developing effective adaptation measures is therefore an essential requirement to ensure continued socio-economic development and reduce the negative impacts of climate change. Failing to do so can result in financial loss, social injustice and environmental degradation, which compound existing challenges and compromise opportunities for the development of many SIDS and coastal countries in Africa.

SIDS in Africa, such as the Seychelles, Comoros, Cape Verde, Mauritius and Reunion, are often characterised by their small geographic area; steep geomorphological, hydrological and ecological gradients; and geographic remoteness. These countries share common economic and development challenges, including rapid population growth, limited natural resources, high dependency on international trade and aid, limited opportunities to create economies of scale and high susceptibility to natural disasters. Such challenges are compounded by climate-related phenomena such as El Niños, monsoons and tropical cyclones, making SIDS some of the countries most vulnerable to climate change.[13] As such, adaptation to address the increasing severity and intensity of climate-related impacts is an urgent priority, especially as many SIDS are already experiencing rising sea levels, coral bleaching and more frequent extreme weather events. In this context, it is paramount that SIDS take immediate steps to

12 IPCC (Intergovernmental Panel on Climate Change), 'Summary for policymakers', in Stocket TF *et al.* (eds), *Climate Change 2013: The Physical Science Basis. Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change*. Cambridge: Cambridge University Press, 2013, pp. 3–29.

13 WHO (World Health Organization), Climate Change and Health in Small Island Developing States: WHO Special Initiative in Collaboration with UNFCCC Secretariat and Fijian Presidency of COP23, 2017, https://www.who.int/globalchange/sids-initiative/180612_global_initiative_sids_clean_v2.pdf?ua=1, accessed 30 July 2019.

improve the management of climate-sensitive ecosystems such as coral reefs, mangrove forests, dune systems and seagrass beds.[14]

African countries in coastal regions, such as Tanzania, Mozambique, Madagascar and South Africa, are equally vulnerable to climate change. They are also characterised by developmental challenges associated with financial and political instability, including poor infrastructure development in the transport, health and education sectors. Furthermore, coastal cities such as Dar es Salaam are experiencing extremely high rates of population growth and rural-to-urban migration, which brings with it increased pressure on natural resources. It is estimated that 60% of the world's cities with a population of over 5 million are located within 100km of the coast and less than 100m above sea level. In Africa, population densities in coastal regions are three times higher than the global average. A large proportion of this population is made up of extremely poor and marginalised communities that rely on climate-sensitive ecosystems to sustain their livelihoods. Over 800 million people (10–12% of the world's population) are dependent on fisheries and aquaculture for food security, employment and social welfare. Coastal tourism is also a valuable source of income and foreign exchange earnings.[15] Considering the vital role these sectors play in terms of global food production and livelihoods, it is critical that they are integrated into financial and climate change planning.[16]

Coastal cities such as Beira, Mozambique (which has almost half a million people) are extremely ill-equipped to deal with storms. Cyclone Idai devastated more than 90% of the city in March 2019.[17] With future climate forecasts predicting more extreme climatic events, it is crucial that African coastal states urgently plan and implement solutions that respond to the range of likely climate impacts.[18]

Negotiating blocs such as the Africa Group, Least Developed Countries and SIDS coordinate their voices at international climate change summits on the social injustice aspects of climate change, as well as the need for large industrial countries to bear the financial burden of climate change and urgently reduce their carbon emissions. Considering the myriad challenges these countries face, EbA is an effective tool in managing some of them, either as a standalone solution or in combination with other adaptation approaches.

14 UN Environment, 2018, *op. cit.*

15 Hale L *et al.*, 'Ecosystem-based adaptation in marine and coastal ecosystems', *Renewable Resources Journal*, 25, 4, 2009.

16 FAO (Food and Agriculture Organization), 'Opportunities for EbA in coastal and marine ecosystems', 25 May 2018, http://www.fao.org/in-action/kore/news-and-events/events-details/en/c/1129413/, accessed 30 July 2019.

17 Owoseje T, 'Cyclone Idai destroys 90% of city in Mozambique in "disaster of great proportions"', *Independent Online*, 19 March 2019, https://www.independent.co.uk/news/world/africa/mozambique-cyclone-tropical-idai-beira-zimbabwe-malawi-a8829356.html, accessed 30 July 2019.

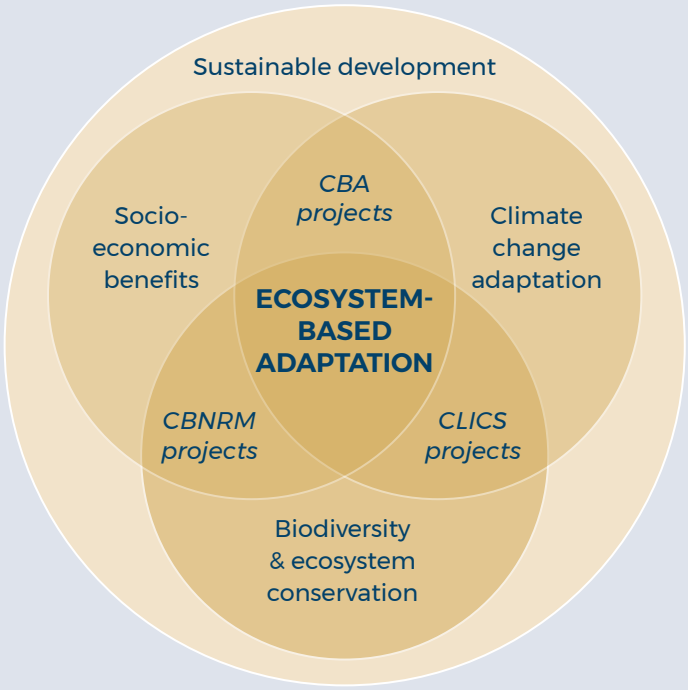
18 C40 Cities, *The Future We Don't Want: How Climate Change Could Impact the World's Greatest Cities*, UCCRN (Urban Climate Change Research Network), Technical Report, February 2018, https://c40-production-images.s3.amazonaws.com/other_uploads/images/1789_Future_We_Don't_Want_Report_1.4_hi-res_120618.original.pdf, accessed 30 July 2019.

Marine and coastal ecosystem-based adaptation

Although there are various definitions of EbA, the UN Convention for Biological Diversity's (CBD) definition – 'the use of biodiversity and ecosystem services as part of an overall climate adaptation strategy to help people to adapt to the adverse effects of climate change' – is the one most widely adopted.[19] EbA aims to maintain and increase resilience in the face of climate change and reduce the vulnerability of ecosystems and people to its impacts.[20]

The UNFCCC – the UN's key climate change body — has recognised the role of conservation, restoration and sustainable natural resources management as an adaptation action that builds the resilience of socio-economic and ecological systems. EbA is therefore a means of adaptation that is readily available to the urban and rural poor, and can generate social, economic and cultural co-benefits.[21]

Figure 3 The three spheres of EbA



Note: The integration of two spheres can lead to community-based adaptation (CBA), climate change integrated land use strategies (CLICS) or community-based natural resource management (CBNRM)

Source: DEA (Department of Environmental Affairs) & SANBI (South African National Biodiversity Institute), *Strategic Framework and Overarching Implementation Plan for Ecosystem-Based Adaptation (EbA) in South Africa: 2016–2021*. Pretoria: DEA, 2016

19 CBD (Convention on Biological Diversity), 'Climate change and biodiversity', https://www.cbd.int/climate/intro.shtml, accessed 30 July 2019.

20 DEA & SANBI, *Strategic Framework and Overarching Implementation Plan for Ecosystem-Based Adaptation (EbA) in South Africa: 2016–2021*. Pretoria: DEA, 2016.

21 IUCN, 'Coastal Ecosystem-based Adaptation', Briefing Paper, https://cmsdata.iucn.org/downloads/coastal_eba___briefing_paper_4p_final__2_.pdf, accessed 30 July 2019.

Drawing on the linkages between ecosystem services, climate change and biodiversity, EbA seeks to contribute to three outcomes simultaneously: climate adaptation, socio-economic and human well-being benefits, and biodiversity conservation and restoration (see Figure 3). The intersection of these three spheres is what distinguishes EbA from other approaches, which focus on integrating only two of three spheres.[22]

It is important to note, however, that EbA is often defined, referenced and applied differently in diverse country policy contexts. It can include a range of policy and governance-focused approaches (eg, EbA strategies, policy instruments and related legislative tools), on-the-ground actions and projects, and area-based policy management frameworks (MPAs, marine spatial planning frameworks and coastal retreat or setback lines).

EbA options[23]

This list is not exhaustive, but is intended to provide a representation of EbA interventions that can be implemented in marine and coastal environments. It is important to remember that EbA options, like other adaptation options, are not mutually exclusive. In fact, implementing a variety of options/combinations can be most effective at increasing the social resilience and adaptive capacity of a community.

Mangrove conservation and restoration

Mangroves are small trees or large shrubs that grow in the intertidal zones of tropical and subtropical regions. The structural diversity of mangrove roots and their position at the interface between land and sea offer crucial ecosystem services such as providing habitats for numerous species, improving water quality and nutrient transfer, and offering coastal protection. Additionally, mangrove ecosystems act as a refuge for corals from ocean acidification and as carbon sinks. They also reduce the vulnerability of coastal communities to climate-related coastal hazards, such as intense tidal surges. As a result, mangrove planting schemes and restoration initiatives are increasingly valued as an ecosystem-based disaster risk reduction and adaptation measure to climate change.

Coastal wetland conservation and restoration

Coastal wetlands include saltwater marshes, estuaries and lagoons. They offer critical functions for climate-change adaptation such as weakening wave and tidal energy and reducing the risk of flooding from extreme weather events and rising sea levels (owing to their capacity to absorb excess water). Additional benefits include providing ecosystem services, such as breeding and nursery grounds for a variety of birds, fish and mammals. Establishing protected areas to safeguard wetland ecosystems should be a primary consideration. Where restoration is the only option, projects should consider the hydrology of the local environment (eg, coastal wetlands such as mangroves rely on a balance of salt- and freshwater).

22 DEA & SANBI, 2016, *op. cit.*
23 UN Environment, 2018, *op. cit.*

Seagrass/kelp conservation and restoration

Seagrass/kelp beds are typically flowering plant species that grow underwater on the sandy substrate of shallow coastal zones. Seagrasses/kelp are important because they can reduce current velocity, dissipate wave energy and stabilise the sediment in shallow water environments. Reducing wave energy can lessen vulnerability to flooding and coastal erosion; two climate-related hazards that are likely to increase in severity. In addition, seagrass/kelp habitats support livelihoods and are vital for the lifecycle of many species within and around these ecosystems. Common approaches to conserving seagrass/kelp ecosystems include the management of common threats (eg, pollution, damage by boats), restoration and rehabilitation through harvesting and transplanting seagrass/kelp, and the monitoring of restored sites.

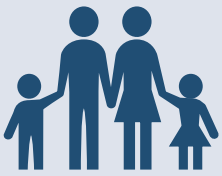
Coral reef conservation and restoration

Coral reefs are marine ecosystems located in shallow coastal zones of tropical and subtropical regions. While coral reefs occupy a small percentage of the world's oceans, they contain a disproportionately high share of its biodiversity. Coral reefs are critical not only for the ecosystem services they provide but also for their adaptation function to climate change. Coral reefs act as natural barriers, reducing wave intensity and minimising coastal erosion. They too serve as carbon sinks. In recognising both the vulnerability of these ecosystems and their important function in adapting to climate change, approaches to conserving coral reefs include farming, transplanting and monitoring coral reef species and, in some cases, establishing MPAs to allow for the natural, on-site rehabilitation of coral species.

Dune and beach conservation and restoration

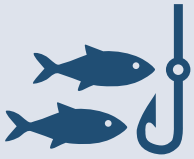
Sand dunes are naturally dynamic environments that are highly sensitive to forcing factors such as wind, wave and tidal variations. Sand dunes represent a spatial transition between terrestrial and marine ecosystems, and therefore act as a natural buffer between the land and sea. Furthermore, dune aquifers offer important water regulation and purification services, as well as protected spaces for rare species of flora and fauna. In the context of climate change, sand dunes are increasingly valued for their function in protecting coastlines from rising sea levels. Conservation and restoration efforts include minimising disturbances, implementing physical barriers to trap sand, and using hybrid approaches to stabilise dune ridges, including planting schemes that use indigenous species to biologically fix or reforest the dune ridge.

Diversification and protection of ecosystem-based livelihoods



People living in coastal communities are often dependent on natural resources and ecosystem services for their livelihoods, particularly fisheries, agriculture and eco-tourism. However, these ecosystem services are sensitive to climate change impacts. Therefore, livelihoods are strongly linked to peoples' vulnerability to climate change and must be adaptable to ecological changes in order to increase resilience and sustainability. Since ecosystem-based livelihoods are often linked to community values, culture and identity, EbA measures must be formed from community-led processes that identify areas where diversification could strengthen, rather than hinder, community resilience. The identification of sustainable, context-specific coastal livelihood strategies that support local development and income generation is key. This includes activities such as butterfly farming for export and modern beekeeping, as well as mariculture options such as promoting the farming of marine water shrimps, milkfish, mud crabs and oyster for meat and pearl production. Likewise, seaweed farming is another potential opportunity, particularly for women in the coastal zone.

Sustainable fisheries management



This integrated process seeks to attain an optimal state that balances ecological, economic, social and cultural objectives for fisheries. Management strategies have increasingly turned towards the ecosystem approach to fisheries management (EAFM) in order to ensure a broad range of interdependent relationships within ecosystems. The key features of EAFM include consideration of ecological, social and governance processes over broad spatial and temporal scales; focus on resilience; adaptive management, co-management, institutional cooperation and coordination; and a precautionary approach. Effective EAFM can achieve multiple objectives that increase coastal communities' resilience to climate change.

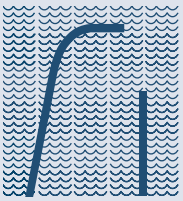
Marine protected areas

MPAs are areas set aside to protect marine ecosystems. They are an example of an area-based management measure relevant to EbA (others include integrated coastal management and marine spatial planning). MPAs have a clearly defined geographical space that is managed through legal or other effective means. They are a tool used to conserve species and habitats, maintain ecosystem functions and resilience, manage fisheries, reduce risks from natural disasters and protect natural and cultural resources and values important to human well-being. Fisheries and livelihood management initiatives are also included under EbA so long as they seek to improve fishing practices and use MPAs to expand important habitats that are essential for the maintenance of diverse fishery stocks on which local communities depend for their wellbeing.[a]

Coastal retreats

A coastal retreat, which includes managed realignment and/or coastal setbacks, is the proactive determination and implementation of realistic setback lines along coasts. Managed realignment is the deliberate altering of flood defences to allow planned flooding of a presently defended area. Coastal setback is a planning tool that identifies an area next to the existing shoreline that is then managed as a buffer zone. Both managed realignment and coastal setbacks create the potential for new habitats for biodiversity. They are often used in integrated adaptation schemes, which also include technical or structural adaptation measures.

Living breakwaters



Hybrid approaches such as living breakwaters are offshore submerged structures that form a barrier between the sea and land. The term 'living breakwaters' is often used when such structures have been deliberately constructed to provide a habitat for species or to aid the restoration of coastal reef ecosystems and support the services that they provide. A popular example of this is the creation of oyster reefs and oyster shell barriers. Artificial reefs refer to artificial structures that aim to mimic some of the characteristics of natural reefs, including their function as breakwaters. Living breakwaters/artificial reefs are considered an example of a 'hybrid' approach, which combines natural and built infrastructure and can enhance coastal resilience by providing coastal protection as well as other social and environmental co-benefits.

a Conservation International, 'Action Pledge', 2011, https://unfccc.int/resource/docs/2011/smsn/ngo/337.pdf, accessed 30 July 2019

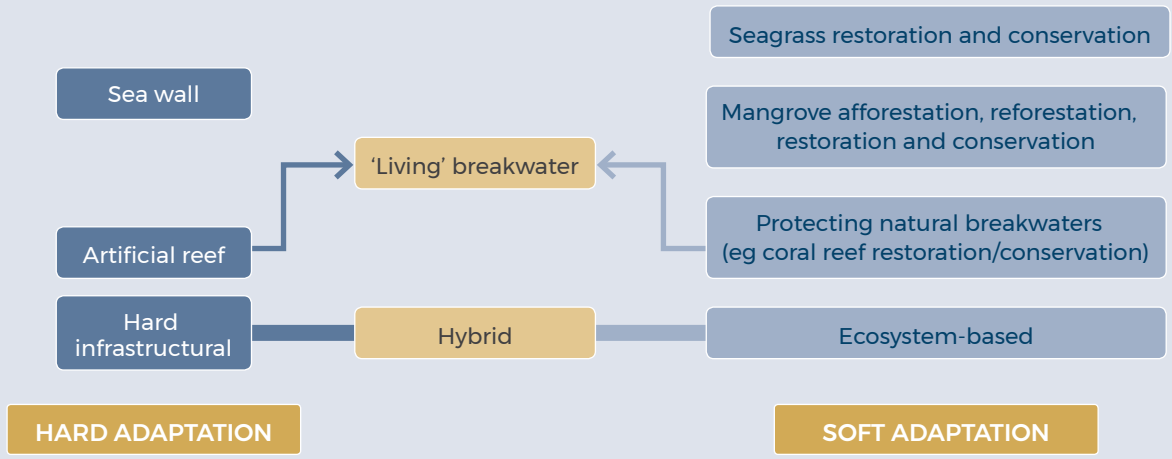
The application of EbA in practice

There is a spectrum of practical EbA options that can be implemented on the ground to improve adaptation in the marine and coastal environment. Countries differ in the types of adaptation approaches they choose. This is informed by their diverse coastal environments; their degree or level of vulnerability and physical exposure to the impacts of climate

change; the availability of natural infrastructure; their economic and political preferences, and their financial positioning and considerations.

These adaptation options[24] (see Figure 4) include the use of infrastructure and hard engineering approaches (hard adaption); ecosystem or nature-based solutions (soft adaptation); or a combination of the two approaches (hybrid adaptation) that seeks to capitalise on the characteristics of both 'hard' and 'soft', combining structural engineering with natural features.

Figure 4 Marine and coastal adaptation options



Source: Author, adapted from UN Environment

There are positive and negative trade-offs with varying adaptation choices. For example, it is often cautioned that man-made (hard) infrastructure for shoreline preservation, such as sea walls, breakwaters and dikes, can be counterproductive, often furthering erosion and changing wave energy regimes and sedimentation.[25] Moreover, both the construction and regular maintenance of hard engineering solutions are expensive. However, in the case of extreme weather events, structural barriers are often the most effective at withstanding severe physical impacts. Also, sea walls can be constructed in conjunction with pockets of green space or in combination with mangrove or coral rehabilitation projects. This was the case with Dar es Salaam's sea-wall project.[26]

24 *Ibid.*

25 Climate ADAPT, 'Groynes, breakwaters and artificial reefs', 7 May 2015, https://climate-adapt.eea.europa.eu/metadata/adaptation-options/groynes-breakwaters-and-artificial-reefs, accessed 30 July 2019.

26 The government of Tanzania has built a permanent 2 400m concrete wall in order to reduce the vulnerability of the livelihoods, infrastructure and economy of the 5 million people living in Dar es Salaam, a coastal metropolis prone to flooding. A grant of $5,008,564 was awarded to the project in 2012 for five years by the Adaptation Fund. An additional $3.34 million came from the Global Environment Facility's Least Developed Countries Fund. In addition to the sea wall, 1 000ha of mangrove habitat and 2 000m^2 of coral reef were restored.

EbA, on the other hand, offers an opportunity to invest in managing 'green protection', which dissipates wave energy and provides shoreline protection by managing or preserving natural solutions. A square kilometre of reef can protect as much as 2 000m² of coastal area, while the costs of ensuring reef health through management are far lower than constructing and maintaining an equivalent man-made defence.[27] There are also less negative side effects and many positive ecosystem co-benefits. EbA can also include projects that are 'managed' ecosystem solutions, such as coastal dune management, replenished or re-nourished beaches, or artificial coral/oyster reefs.

On the other hand, analysts believe that in some cases the most successful EbA projects are implemented in conjunction with hard infrastructure and engineered solutions. Hybrid approaches, such as living breakwaters, are offshore, submerged structures that form a barrier between the sea and land.[28] In the Mississippi Delta several hybrid adaptation tools are being used to protect and restore the Louisiana coastal area. (See Case Study 2 for a description of the restoration projects currently underway.)

Case Study 2

Large-scale shoreline restoration and protection: The case of hybrid adaptation in the Mississippi Delta

The delta of the Mississippi, the largest river in the US, is an important contributor to the ecological health of Louisiana's coastal area and the entire region, providing unique and varied landscapes that offer an array of benefits to Louisiana and its 2 million inhabitants. The river delivers freshwater and sediment that mix with the salty Gulf waters to create expansive estuaries that are biological engines and habitats for multiple species. Unfortunately, Louisiana's coastline – including the Mississippi River Delta – is vanishing at an alarming rate. Since the 1930s about 5 200km² of land have turned into open water. As such, many restoration projects have been initiated to restore and maintain Louisiana's critical coastal areas[29] by reducing tidal action and saltwater inundation, as well as building and extending land to create wetland habitats and maintain hydrologic barriers between inland lakes and navigation channels.

'RESTORE the Mississippi Delta', a coalition of non-governmental organisations (NGOs), has put together the state's 2017 Coastal Master Plan (CMP) to guide the implementation of these restoration initiatives. This plan is a $50 billion blueprint,

27 IUCN, *op. cit.*

28 Swanepoel E & S Sauka, 'Ecosystem-based Adaptation in South African Coastal Cities', SAIIA Occasional Paper, 297, May 2019, https://saiia.org.za/research/ecosystem-based-adaptation-in-south-african-coastal-cities/, accessed 30 July 2019.

29 Coastal Protection and Restoration Authority of Louisiana, *Louisiana's Comprehensive Master Plan for a Sustainable Coast*, 2017, http://coastal.la.gov/wp-content/uploads/2017/01/DRAFT-2017-Coastal-Master-Plan.pdf, accessed 30 July 2019.

authored by Louisiana's Coastal Protection and Restoration Authority (CPRA) and updated every five years to align with scientific revisions. The CMP recommends some 124 restoration, protection and risk-reduction projects, to be implemented over the next 50 years. The completion of these projects would add or maintain more than 2 070km^2 of land, reduce damages by $8.3 billion annually and pay for themselves three times over during the course of implementation.[30] Each update of the CMP has been unanimously approved by the state legislature, and the 2019 Annual Plan – the annual funding vehicle for the CMP – dedicates $600 million to projects, demonstrating continued support for the CMP.

The CMP uses the 'multiple lines of defence' strategy, which combines a suite of hard and soft adaptation tools. For example, nature-based features such as wetlands restoration are combined with structural flood protection and risk-reduction measures such as levees and floodwalls. As such the plan encompasses a wide variety of project types, including sediment and freshwater diversions to build wetlands, hydrologic restoration, marsh creation, ridge restoration, barrier island and headland restoration, and oyster reef restoration.

Some of the intervention projects that have already been completed or are ongoing include the Calcasieu Ship Channel Salinity Control Measures Hydrologic Restoration project in south-western Louisiana. This ship channel connects the Gulf of Mexico to Calcasieu Lake, and is located on the Chenier Plain. The Chenier Plain has seen decades of dredging navigation canals that have dramatically changed the hydrology of the system. Saltwater intrusion has led to the extensive loss of freshwater marshes, affecting the integrity and functioning of these ecosystems and thus increasing communities' vulnerability to storm surge. This project aims to isolate the ship channel through a network of dike and sill structures designed to limit saltwater intrusion through the channel and into adjacent marshes. This project will also support storm surge protection by increasing the sustainability of adjacent marshes and dissipating wave energy and tidal flows within the ship channel.

Another large priority project is the Freshwater Bayou North Marsh Creation. The project is one of the largest and fastest land-building priority projects, projected to build around 6 350ha upon construction. It will restore marshes degraded by hurricanes Rita, Gustav and Ike and prevent Freshwater Bayou from continuing to enlarge and further erode interior marshes. Sediment will be delivered via pipeline to the site from either the Gulf of Mexico or the Freshwater Bayou Canal. The newly created marsh will protect against storm surge, wave energy and flooding. It will also foster nutrient transport, vegetation growth and soil accretion, helping to set the marsh on a path to recovery rather than destruction.

30 *Ibid.*

Financing the projects: Environmental impact bonds

Although the CPRA has identified $9.16–11.76 billion in coastal restoration funds, there is a shortfall that currently hinders the full implementation of the restoration plan. Identified funding sources include billions of dollars in penalties associated with the 2010 Deepwater Horizon oil spill, which will be deployed over the next 15 years, as well as annual revenues from offshore oil and gas production in Louisiana.

An alternative opportunity for CPRA and the Coastal Protection and Restoration Financing Cooperation is a private finance option, known as Environmental Impact Bonds (EIBs).[31] EIBs are cost-effective, environmentally friendly solutions that, as a concept, are specifically designed to overcome the challenge of strained public budgets and expensive, complex restoration projects. They are a short- to medium-term approach that represents a 'pay-for-success' debt financing structure. This approach depends on the private capital of 'impact investors' – private investors who are motivated to 'do good, while doing well'. Such restoration projects offer opportunities to finance projects that benefit both society and the natural environment.

EIBs function in similar ways to traditional bonds in that they have a fixed interest rate and term. The difference, however, is that payments made to investors are based on the outcomes of the project, rather than the project itself. For example, EIBs include a 'performance payment', which is a payment made to the investor if the project's outcomes exceed its expectations. This is an attractive alternative for several reasons: the risk of project performance is transferred to the investor; the benefits of gaining from the project through 'performance payment' attract new partners to share the costs of the project; and it encourages projects to develop evidence-based outcomes that can inform future planning.[32] Furthermore, it has also been argued that EIBs act as a significant enabler of a long-term project, which has the potential to foster greater job opportunities and wider societal cooperation.[33]

Considering the financial constraints of the coastal restoration project in Louisiana, EIBs have the potential to speed up restoration projects at a reduced cost. Thus, the CPRA should focus on attracting impact investors by quantifying the value of environmental, social and economic impacts. This will help to make up the funding shortfall that hinders the full implementation of the restoration plan.

31 EDF (Environmental Defense Fund), *Financing Resilient Communities and Coastlines: How Environmental Impact Bonds Can Accelerate Wetland Restoration in Louisiana and Beyond*, August 2018, https://www.edf.org/sites/default/files/documents/EIB_Report_August2018.pdf, accessed 30 July 2019.

32 *Ibid*.

33 Herrera D, 'Environmental impact bonds: Next big thing for green investments?', EDF, 14 July 2017, https://www.edf.org/blog/2017/07/14/environmental-impact-bonds-next-big-thing-green-investments, accessed 9 April 2019.

Case Study 3

Expansion of Puerto Rico's coral aquaculture and reef rehabilitation project[34]

For generations Puerto Rican subsistence fishers have depended on coral reefs for their fish stocks and their bio-medicinal value. These ecosystems have also played a valuable role in boosting Puerto Rico's coastal tourism, and in reducing its vulnerability to wave action and coastal erosion.

Like coral reefs globally, Puerto Rico's reefs are under severe anthropogenic and climate change pressure, which has not only destroyed the coral reef structure but also substantially compromised its natural recovery. These anthropogenic pressures are largely related to the poor management of upstream land resources, particularly deforestation. Such activities degrade the water quality and contribute to algae growth, which compromises the viability of coral reefs. These pressures are compounded by the rise in sea temperatures and ocean acidification, which results in coral bleaching and further loss of ecosystem function and services.

A community-based coral aquaculture and reef rehabilitation project was initiated in 2003, in collaboration with local NGOs, the University of Puerto Rico's Center for Applied Tropical Ecology and Conservation and a grantee organisation, Sociedad Ambiente Marino. Over a period of 11 years, this project sought to enhance the development of low-tech coral reef rehabilitation, aiming to deepen community involvement in EbA. Its main goal was to make coral farming and restoration efforts as low-tech as possible, to promote continued rehabilitation and conservation efforts beyond the funded period.

This project had two key components; one focused on coral farming (which would later be transplanted to rehabilitated and restored coral reef areas) and the other on on-site cleaning and monitoring of coral reefs.

Species of Staghorn and Elkhorn coral were selected for the experimental farming project because of their high-temperature resilience and recovery capacity.[35] There were 5 000 harvested fragments that were out-planted and monitored to replenish the depleted coral reef stocks. According to the project's closure report, the survival rate of the coral outplants was 85–90%.[36] Of the two, the Staghorn out-planting project proved to be more successful in replenishing depleted stocks and enhancing

34 Sociedad Ambiente Marino, *Expansion of the Puerto Rico Low-Tech Coral Aquaculture and Coral Reef Rehabilitation Project*, Final Report. San Juan: The Nature Conservancy, 2013.

35 *Ibid*., p. 19.

36 *Ibid*., p. 2.

reef fish communities. Owing to the location of the Elkhorn farming project, its opportunity to enhance reef fish communities was severely compromised by nutrient-loaded and sewage-polluted run-off from the mainland. Another factor that hindered the growth and development of coral species was the increased frequency and severity of storms. The report notes, however, that replanting Elkhorn coral fragments in emergency situations, following extreme events such as Hurricane Sandy in 2012, proved to be very successful in restoring the damaged reefs.[37]

This project empowered local communities and cultivated a community-based approach to climate change adaptation through integrated decision-making processes and technical, capacity-building initiatives. Some 11 000 students were actively involved through the 100 educational and outreach activities. Furthermore, scientific presentations on the project are said to have reached more than 32 000 Puerto Ricans.[38] It has since been hailed as a guide for future restoration projects in the wider Caribbean region.

There are key lessons that need to be considered, especially by funding and regulatory agencies, if the project is to be replicated elsewhere. Firstly, the project emphasises the importance of timing, particularly when transplanting coral fragments. There is a higher survival rate if the coral species are transplanted during cooler months when sea temperature is at its lowest, and in seasons when rainfall is low.[39] Secondly, because of poor management of land resources and its direct impact on the success of the coral rehabilitation project, it is necessary to work collectively with inland communities to develop and implement measures to control land-based pollution, deforestation and soil erosion.[40] Thirdly, the species of coral chosen for farming and out-planting projects is critical, demanding thorough research and planning. While it is advisable to choose a coral that has a high resilience and recovery capacity, the species of coral must maintain the natural symbiotic relations of the given coral reef ecosystem. This requires guidance from a technical scientific adviser.

This project demonstrates that a community-led, hands-on approach is essential for the sustainability of EbA project implementation. Low-tech methods are highly effective financially and empower local communities through technical, theoretical and practical experience.[41]

37 *Ibid.*, p. 170.
38 *Ibid.*, p. 19.
39 *Ibid.*, p. 270.
40 *Ibid.*, p. 176.
41 *Ibid.*, p. 96.

Left: Culebra Island (Shakzu/Getty Images) Right top: Staghorn coral (johnandersonphoto/Getty Images)
Right bottom: Elkhorn coral (johnandersonphoto/Getty Images)

The governance of marine and coastal ecosystems and climate change adaptation

Global EbA policy development

In the aftermath of the 2004 tsunami in Asia, mangroves' dense root and branch networks helped to dissipate the wave action, lessening the exposure of adjacent communities and acting as bio-shields. The tsunami and other extreme global weather events have sparked interest in marine and coastal ecosystems for adaptation purposes, encouraging their uptake globally. As a result, mangrove restoration has been incorporated into various disaster risk reduction and adaptation measures, with many vulnerable countries such as the Philippines, Indonesia and Vietnam embarking on ambitious national replanting programmes.

In many global debates a link is increasingly being made between ecosystem health, climate change and sustainable development. It is now widely accepted that these challenges are interconnected and cannot be dealt with in isolation. In 2015 the UN's Sustainable Development Agenda 2030 and its associated Sustainable Development Goal 14 'Life below water' made the case for an enhanced focus on oceans and marine resources, highlighting the linkages between marine ecosystem health and human prosperity.

Similarly, in 2017 at the UNFCCC Conference of the Parties (COP23), various stakeholders made a concerted effort to highlight the link between oceans and climate change. In fact, the Fijian prime minister, the COP president at the time, called on the global community to bring the issue of ocean health more formally into the UNFCCC process by 2020 through the Ocean Pathway partnership. He also suggested that oceans and marine ecosystems be included as a distinct negotiating item within the climate change discussions. This momentum continued at COP24 and at other high-level policy meetings since then.

The objectives of EbA are also echoed in other international frameworks, such as the Sendai Framework for Disaster Risk Reduction 2015–2030, the CBD's Strategic Plan for Biodiversity 2011–2020, the Ramsar Convention on Wetlands, the UN Convention to Combat Desertification and the Paris Agreement to the UNFCCC.[42] EbA is also central to development approaches taken by other organisations, including the World Bank and the International Union for Conservation of Nature.

In the past few years a growing number of countries have formulated, or are formulating, their national Blue Economy strategies and road maps, to diversify their economic base to further include ocean and coastal goods and services. In an attempt to unlock the economic potential of the ocean in a sustainable manner, the governments of the Seychelles and Mauritius, for example, have adopted the Blue Economy concept, and South Africa has introduced Operation Phakisa. As the Blue Economy concept gains traction internationally, it is imperative that EbA and other sustainability principles are included in these strategies.

In the past few years a growing number of countries have formulated, or are formulating, their national Blue Economy strategies and road maps, to diversify their economic base to further include ocean and coastal goods and services

The Paris Agreement and the NDCs

The Paris Agreement sets out the overarching goals of and framework for international climate action in the post-2020 period. Having ratified the agreement in 2016, countries committed to specific actions through their own national climate strategies, including their NDCs. These NDCs include not only countries' plans to reduce emissions but also their strategies to achieve adaptation enhancement. As such, NDCs are an opportunity to

42 Although the importance of ecosystems is mentioned in the text of the Paris Agreement, explicit mention of EbA or nature-based adaptation is made only in the NDCs of individual parties to the UN Framework Convention on Climate Change (UNFCCC).

strengthen the inclusion of nature-based solutions in national adaptation actions. Countries must submit revised NDCs every five years, with a review process that is intended to continually raise ambitions. Countries are currently preparing and updating their NDCs for submission in 2020. Of the NDCs submitted to the UNFCCC to date, few refer explicitly to marine and coastal EbA. While many do refer to ecosystem-orientated visions for adaptation, these have rarely translated into robust targets that involve local communities.

To determine the extent to which countries have committed to using EbA, the UK-based International Institute for Environment and Development reviewed the adaptation component of all NDCs submitted to the UNFCCC (162 countries were analysed).[43] Many countries proposed a range of conservation, restoration, agroforestry and community-led approaches to achieve their adaptation targets. However, only 23 of these NDCs explicitly mention EbA. For example, the Philippines' NDC includes activities to conserve and restore coastal vegetation in abandoned fishponds to help reduce the vulnerability of communities to flooding, increase tourism income and provide critical habitats for fisheries. A few African countries described current marine and coastal EbA activities, but the majority listed it only as an intended/future priority. For example, Madagascar's NDC aims to restore 35 000ha of primary mangrove forests by 2020.[44] Levels of integration and awareness of marine and coastal EbA differ substantially among countries.

Besides individual NDCs, other policy platforms can also be used for the inclusion of EbA, such as national adaptation plans and national adaptation programmes of action, disaster risk and resilience strategies, the national biodiversity strategies and action plans of the CBD, and associated sectoral policies (most commonly applied in the agricultural and forestry sectors). Every country has a different level of climate change adaptation awareness and integration, and countries vary in their levels of EbA integration and adoption. This has translated into various commitments at the regional, national, provincial and local levels. At a regional level, countries are signatories to the Nairobi Convention and other regional protocols.

National-level institutional governance, policy and regulatory landscape

The ultimate success of EbA is likely to hinge on the broader institutional, governance and policy context in which these initiatives are proposed and operate. This is true both at the local level – where capable local institutions are needed to make decisions, roll out projects and ensure the active participation of multiple stakeholders – and at the higher level, as these institutions guide policy development, uptake and political buy-in.

In order to understand the effectiveness of EbA it is important to assess the key national institutional arrangements governing marine and coastal EbA, as well as climate change

43 Chevallier R, 'Promoting Marine and Coastal Ecosystem-based Adaptation', SAIIA Policy Insights, 56, 2018, https://saiia.org.za/research/promoting-marine-and-coastal-ecosystem-based-adaptation/, accessed 30 July 2019.

44 UN, NDC Registry, 'Madagascar's Intended Nationally Determined Contribution', 21 September 2016, https://www4.unfccc.int/sites/ndcstaging/PublishedDocuments/Madagascar%20First/Madagascar%20INDC.pdf, accessed 30 July 2019.

adaptation. Because of the cross-sectoral nature of EbA, in theory, institutions involved in the formulation of climate change policy, biodiversity conservation, coastal management, fisheries, forestry, water management, oceans, land-based natural resource management and disaster risk reduction are all relevant and need to ensure a degree of coordination.

> In practice, because climate change and ecosystem management are often dealt with separately and in isolation, there are often competing mandates and jurisdictional overlaps of ministries and departments at the national and local level

However, in practice, because climate change and ecosystem management are often dealt with separately and in isolation, there are often competing mandates and jurisdictional overlaps of ministries and departments at the national and local level. This is particularly apparent with coastal ecosystems located between the land and the sea, such as mangroves and seagrasses. In Mozambique, for example, the management of coastal habitats falls between the Ministry of Land, Environment and Rural Development (MITADER) and the Ministry of Sea, Inland Waters and Fisheries (MIMAIP). The management of seagrass and coral reefs falls under MIMAIP, while coastal dunes are under MITADER. Given their forest-like nature, and their transitional location between the land and the sea, mangroves are managed by both. In practice this complicates management, surveillance and law enforcement, and is even more complicated in MPAs, which have another governance mandate. For example, agents of the Tanzanian Forestry Service are responsible for mangrove management and protection and cannot patrol areas of the high sea, on which illegal mangrove loggers often transport logs and poles. Similarly, Tanzanian marine patrol vessels (under the marine authority) cannot patrol the mainland for perpetrators of dynamite fishing. These institutional arrangements often make the governance of coastal ecosystems challenging.

A key challenge for EbA initiatives, many of which are localised projects or programme-based activities, is securing impact at wider scales. Even those initiatives that do work closely with governments often lack the multi-sectoral engagement at higher levels needed to maximise impact. Extending beyond the project scale requires embedding activities in an enabling institutional and policy framework that facilitates their replication in different contexts, across multiple scales. This has meant embedding EbA in a broader institutional and policy framework that supports the protection of the environment and the devolution of rights to communities. Such an approach allows replication and diversification to other sectors. Systematically mainstreaming local EbA approaches into local, regional and national government planning processes and policies is a good way to achieve impact at scale.

Besides coordination and policy mainstreaming, there are other gaps, barriers and enablers that relate to the uptake and roll-out of EbA policy and implementation. These include research, capacity constraints, skills shortages, lack of political buy-in and a weak policy environment. It is also important to consider national circumstances and constraints around budgetary support for EbA or the lack thereof.

Creating an EbA community to share lessons and best practice

Although a number of EbA case studies have been documented globally, an updated database mapping all activities being undertaken is required, with a view to providing technical leadership and lesson sharing on best-practice EbA. More analytical rigour is needed to assess the impact of marine and coastal EbA, measuring and evaluating its merits and limitations, and understanding the circumstances under which it thrives. For example, reliable quantitative estimates are needed to assess the capability of ecosystems to reduce storm surge and sea level-rise impacts, and to provide reliable cost–benefit analysis of how they compare with other measures based on traditional engineering approaches. While anecdotal evidence corroborates the effectiveness of EbA, there is also a need for more precise quantitative analysis of the multitude of social, economic and environmental co-benefits that result from effective EbA.

> EbA approaches can also be cheaper than hard infrastructure and often offer additional benefits that support local economies and contribute to human well-being

A recent study on EbA projects in six countries[45] (Costa Rica, India, Mexico, Peru, the Philippines and Tanzania) found that the main barrier to conducting detailed cost–benefit analysis was the lack of data on the value/benefits of project impacts, whereas the costs of project implementation were generally available. Another study compared the costs and benefits of EbA approaches with traditional engineering solutions for climate adaptation in Europe,[46] and also found that most of the available data on benefits was qualitative. Projects often described impacts using terms such as 'habitat protection' and 'recreational

45 Rizvi AR, Baig S & M Verdone, *Ecosystem-based Adaptation: Knowledge Gaps in Making an Economic Case for Investing in Nature Based Solutions for Climate Change*, IUCN, 30 October 2014, https://www.iucn.org/sites/dev/files/import/downloads/the_economic_case_for_eba___final_draft.pdf, accessed 30 July 2019.

46 *Ibid.*

opportunities' rather than providing quantitative information on the value of these benefits; even when there were methods available to quantify EbA benefits they were often not used.[47] EbA approaches can also be cheaper than hard infrastructure and often offer additional benefits that support local economies and contribute to human well-being.[48] Despite the fact that evidence shows that EbA approaches can be highly effective and their benefits are often long term and landscape scale, the evidence cannot be quantified. It is therefore essential that the relevant comparative data is available to inform decision makers.[49]

There are many challenges associated with adequate, up-to-date and accurate information about the extent, spatial distribution and health of marine and coastal ecosystems. This information is critical for the effective planning and management of these ecosystems. While there are government research institutes that provide scientific information and advice to policymakers on coastal zone management and climate change adaptation, these institutes need additional support and capacity to translate scientific analysis into policy-relevant information. NGOs and research institutes can play a constructive role in generating information and providing decision makers with analysis.

It is important to better communicate the developmental outcomes of these approaches, with an emphasis on poverty reduction and sustainable employment. In order to inform policymakers of EbA's worth, quantifying ecosystem services and job opportunities is worthwhile. For example, coral reef restoration is job-intensive, involving the rearing of coral fragments in nurseries, the transplantation of these fragments to degraded reef areas, and subsequent management and monitoring to facilitate restoration.[50] Emphasis could be placed on opportunities to scale up and replicate these projects, furthering the involvement of local fishers and nearby communities. Countries can also share lessons about their propagation techniques and experiences. Lessons can be learnt from South Africa's Expanded Public Works Programme with initiatives such as 'Working for Wetlands' and 'Working for the Coast'. These employ local unskilled labour to implement land-based invasive alien vegetation clearing, wetland rehabilitation, and waste management and collection. This model is replicable in other Western Indian Ocean countries where, for example, the removal of high densities of crown-of-thorns starfish from coral reefs or invasive vegetation from important estuaries is needed.

Although all adaptation efforts take place in very specific contexts, case studies can highlight common political, policy and institutional conditions that maximise the uptake of EbA. (See case studies 3 and 4 on Costa Rica's coral restoration and Kenya's blue carbon projects respectively.) At the local level, this evidence can help build capacity and assist people to implement transformational adaptation on the ground. At a national level, it may

47 USAID, Climate Links, 'The Economics of Ecosystem-based Adaptation', August 2017, https://www.climatelinks.org/resources/economics-ecosystem-based-adaptation, accessed 30 July 2019.

48 Rizvi AR, Baig S & M Verdone, *op. cit.*

49 USAID, *op. cit.*

50 Chevallier R, *op. cit.*

encourage the integration of these approaches into the wider policy discourse and help increase funding for EbA programmes and initiatives. EbA can also be mainstreamed into government processes within regional climate and development planning, including at the regional level. Other opportunities for scaling up EbA can be found in mainstreaming, replication and diversification within other sectors such as oceans strategies, national development frameworks and fisheries policy, as well as in development and humanitarian organisations, the private sector and at the level of multilateral financing institutions.

Marine and coastal ecosystems are intricately connected to both upstream terrestrial/freshwater ecosystems and marine ecosystems. Processes and activities in one system invariably affect other systems in positive and/or negative ways. As a result, growing awareness among natural resource managers of the interconnectivity between systems has resulted in the development of management approaches that take into account the multiple interactions within the land–sea interface.[51] More specifically, this involves understanding the linkages between activities within a whole catchment,[52] and the interaction between aquatic resources.[53] In cities, this means not only ensuring that river ecosystems are healthy but also exploring multi-benefit projects for sustainable resource management and utilisation (ie, waste and water management) and green/ecological infrastructure. EbA activities must be placed alongside wider spatial management efforts that address dynamic systems, such as upstream terrestrial land use patterns, environmental degradation, socio-economic development, water quality issues and biodiversity conservation, to improve ecosystem conditions.[54] Also, given that many ecosystems are transboundary, EbA planning and implementation work best at landscape level, with the collaboration of various stakeholders.[55]

A recent report found that, although there have been a wide variety of EbA projects, a common set of factors contributes to successful implementation across interventions.[56] According to the report, understanding costs and securing sufficient financial resources, as well as ensuring the engagement and participation of various members of society, are key driving factors in the successful implementation of EbA interventions. Understanding the economic costs, benefits and trade-offs of different adaptation approaches can guide policymakers and development practitioners towards the most cost-effective and sustainable strategy applicable to the specific local context. This is particularly true in the uncertain environment of climate change, where the impacts and economic costs of climate change vary widely and where future costs are unknown.

51 Approaches such as integrated coastal zone management, integrated coastal management, marine spatial planning and 'ridge-to-reef' focus on the links between coastal and terrestrial ecosystems.

52 The area of land from which rainwater flows into a river, lake or reservoir. Also referred to as 'basin'.

53 UN Environment, 2018, *op. cit.*

54 Swanepoel E & S Sauka, *op. cit.*

55 Chevallier R, *op. cit.*

56 McVittie A, Cole L & A Wreford, *Assessing Adaptation Knowledge in Europe: Ecosystem-based Adaptation*, Ecofys, Final Report, 2017, https://ec.europa.eu/clima/sites/clima/files/adaptation/what/docs/ecosystem_based_adaptation_en.pdf, accessed 30 July 2019.

Financing for marine and coastal ecosystem-based adaptation

Climate finance refers to local, national or transnational financing, which may be drawn from public, private and alternative sources of financing.[57] For many years, climate finance has been a major point of contention in climate change negotiations. Although estimates of the amount of investment needed are uncertain, current levels of public finance available for adaptation fall well below the volumes required. Achieving the required levels of adaptation thus requires understanding and exploring innovative financial mechanisms. It is essential to mobilise the private sector and draw lessons from marine and coastal EbA projects that have been financially supported by national budgeting processes; public–private partnerships; payments for ecosystem services (PES) schemes, such as blue carbon; and other innovative approaches such as environmental impact bonds.[58]

Financing from domestic public sources can serve as a relatively consistent and predictable source of funding that allows more flexibility in terms of allocation. Public financing for EbA can be allocated through national budgets across sectors and at multiple scales, ranging from local to regional and national level budgets. EbA-relevant sector budgets have traditionally included those of the water, agriculture and environment sectors. However, making the case for EbA financing in other sectors, such as infrastructure (moving from grey to green) or social protection, is also relevant, especially given that the environmental sector is often underfunded. Extensive engagement with relevant stakeholders is required to make this happen. At the district and local level, existing natural resource management groups are an important entry point for making the case for EbA and how to integrate it into district- and local-level natural resource management plans. EbA can be made more explicit, and therefore gain support and traction, when elaborated in sectoral and local-level strategies and plans (including budgets). National climate change policies and strategies also provide opportunities to integrate EbA as one of the explicit adaptation approaches being taken.[59] However, public finance for EbA interventions is currently insufficient. Therefore, it is crucial to learn how to tap into non-traditional sources of finance,

> It is crucial to learn how to tap into non-traditional sources of finance, including partnerships with the private sector and community contributions

57 GIZ (Deutsche Gesellschaft fur Internationale Zusammenarbeit), 'Learning Brief: Financing Ecosystem-based Adaptation', December 2017, https://www.adaptationcommunity.net/wp-content/uploads/2018/01/giz2017-en-learning-brief-financing-eba-low-res.pdf, accessed 30 July 2019.

58 Chevallier R, *op. cit.*

59 UNDP (UN Development Programme), 'Making the Case for Policy Change and Financing for Ecosystems-based Adaptation', Learning Brief, 2016, https://www.adaptation-undp.org/resources/project-brief-fact-sheet/learning-brief-4-making-case-policy-change-and-financing, accessed 30 July 2019.

including partnerships with the private sector and community contributions.[60] The public sector can also play a key role in encouraging the private sector to become engaged in the implementation of EbA actions by providing relevant information, incentives and economic signals. The Philippines' People's Survival Fund (PSF), established in 2009, aims to fund new climate change adaptation programmes and serves as guarantee for the risk insurance needs of farmers, agricultural workers and other stakeholders. This has opened a window of opportunity to include EbA activities. The PSF can obtain at least PHP[61] 1 billion (approximately $19.2 million) every year from the national budget, which can be supplemented by external contributions from local government, the private sector and individuals who support adaptation initiatives.[62]

Private sector finance can generally be mobilised for new business opportunities and to reduce business-related risks.[63] However, a central component of successful mobilisation is demystifying adaptation finance for the private sector, by producing information that builds the business case for marine and coastal EbA.[64] In order to successfully engage members of the private sector from the very beginning of an EbA measure, it must focus on their interests, threats and/or responsibilities. Making EbA financing relevant for the private sector will increase willingness to either invest in EbA measures or comply with regulations. There is a further need to develop enabling legal conditions for implementing financial instruments, so they do not only rely on the private sector's goodwill or charity.[65]

In some cases, coastal wetlands have proven to be more cost effective than hard infrastructure responses such as sea walls and levees, as they require less maintenance and may keep pace with sea-level rise.[66] In addition, research estimates that annual damages from flooding will double and costs from frequent storms will triple without the presence of functioning coral reefs.[67] The revenue generated from tourism associated with pristine marine environments is estimated at $30 billion annually and is expected to continue to grow. The payment of user fees, such as fishing licences or diving fees in MPAs, helps communities and governments to limit impacts on the ecosystem by restricting access and provides revenue that can be reinvested in management. Governments and other parties need capacity building to access climate finance, such as through the Green Climate Fund (GCF).

Furthermore, incentive schemes encourage the uptake of EbA implementation. This could entail direct support to coastal rehabilitation and conservation, or rewards for socially and ecologically sustainable practices. Often this can be achieved by improving existing subsidy systems, which tend to promote unsustainable development. In the case of Mali's National

60 C40 Cities, *op. cit.*
61 Currency code for the Philippine peso.
62 GIZ, *op. cit.*
63 *Ibid.*
64 Chevallier R, *op. cit.*
65 GIZ, *op. cit.*
66 Chevallier R, *op. cit.*
67 Beck M *et al.*, 'The global flood protection savings provided by coral reefs', *Nature Communications*, 9, 2018, p. 1.

Climate Fund, financial support for adaptation was given by the GCF and, complemented by internal sources of funding such as trust accounts (eg, the Forest Management and Protection Fund), budget allocations and private sources. The private sources mainly comprised corporate social responsibility initiatives by international companies that have been engaged in forest leasing for 30 years. Mali has been successful in building capacities to attract and channel climate finance within NGOs and civil society organisations in the country.[68]

It is essential to draw lessons from EbA projects that have been financially supported by innovative budgeting processes and partnerships.[69] In recent years, for instance, there has been growing interest in PES schemes that support EbA. PES are financial incentives offered to farmers, landowners, natural resource managers and communities in exchange for managing their land or resources to provide some sort of ecological service, environmental conservation and/or restoration. The broader umbrella may include, for example, product eco-certification, park entrance fees and tradable development rights. For example, the revenue generated by tourism associated with pristine marine environments is estimated at $30 billion annually and is expected to continue to grow.[70] In this instance the payment of user fees, such as fishing licences or diving fees in protected areas, helps communities and governments to limit impacts on the ecosystem by restricting access, and provides revenue that can be reinvested in management and additional conservation and adaptation efforts. In Cartagena, Colombia two EbA projects are currently financed through PES schemes – the repair and maintenance of natural streams and rivers in the urban area and the conservation of mangroves near the city. These measures will be refinanced through voluntary municipal tourist fees and a rainwater drainage levy for the protection of the ecosystem.[71]

Blue carbon projects are also a PES scheme. Although mangroves only make up 0.1% of the earth's surface, these coastal forests absorb and store large amounts of carbon in their root systems and soil. Owing to the increasing political momentum to reduce greenhouse gas emissions globally, voluntary carbon markets have been established to allow for the trade of carbon credits. This transfer of funds is considered a promising source of revenue for 'blue forest' conservation projects such as mangroves, tidal marshes, seagrasses and the

The trade of carbon credits is considered a promising source of revenue for 'blue forest' conservation projects such as mangroves, tidal marshes, seagrasses and the like

68 GIZ, *op. cit.*

69 Chevallier R, *op. cit.*

70 Wynberg R & M Hauck, 'People, power, and the coast: A conceptual framework for understanding and implementing benefit sharing', *Ecology and Society*, 19, 1, 2014, p. 27.

71 GIZ, *op. cit.*

like. Active projects include Mikoko Pamoja in southern Kenya (see Case Study 4) and Sofala Community Carbon in central Mozambique.

Other innovative financing schemes also exist, such as blue bonds and environmental impact investing. In 2017 the Seychelles launched an innovative investment strategy to finance its Blue Economy. The 'debt-for-nature' scheme is the first of its kind and aims to establish a replicable and scalable model to support the creation and management of 400 000km² of a new MPA. This is the first time the Paris Club creditors have supported a debt agreement designed to benefit climate adaptation, and the first time a developing country creditor – South Africa – has made a debt deal with another developing country. The combination of public and private funds, each leveraging the other, creates a new model for co-investment debt swap.

Case Study 4

Blue carbon projects for mangrove restoration (Kenya)

Mikoko Pamoja is a mangrove conservation and restoration project that aims to provide long-term incentives for community involvement and benefit. Located in Gazi Bay in southern Kenya, Mikoko Pamoja has been operational since 2010. Communities protect and restore mangroves and in turn sell the carbon credits to international buyers, for about $5–$6 per tonne. This revenue then goes into financing forest protection and restoration, and to other community-chosen projects.[72]

Thanks to its success it has become a demonstration project for the feasibility and desirability of community-led mangrove conservation through carbon credit funding. It also serves as a best-practice model for national and regional policy in this regard. However, there are site-specific factors that have aided its success. This includes the close relationship that has been built between the project developers and the community, and the latter's engagement in the design process, as well as a long history of community participation in and support for mangrove research and restoration in Gazi village. The village is host to a field station run by the Kenya Marine and Fisheries Research Institute (KMFRI), which specialises in mangrove research. Additionally, planning for Mikoko Pamoja was developed by a Community Forest Association (CFA) and includes a zonation map, detailing activities of different stakeholders in the project area. The plan is approved by the Kenya Forest Service (KFS), Kenya's state agency in charge of forest management. This agreement is a legal tool for the implementation of the Participatory Forest Management Plan and officially secures community ownership of carbon credits. The Mikoko Pamoja project will ensure community tenure through a special user agreement with the KFS and

72 Mikoko Pamoja also looks to promote other sustainable income-generating activities such as beekeeping and eco-tourism.

all income from the sale of Plan Vivo Certificates from the project will be used for the community's benefit. The ability of community members to benefit directly from the revenues generated from selling mangrove carbon credits has aided buy-in. In addition, the Mikoko Pamoja Steering Group provides technical support for the Mikoko Pamoja Community Organisation (MPCO), which consists of staff from the KMFRI, KFS, a representative of the Tidal Forests of Kenya Project and a representative of the community organisation. It must be noted that carbon-offset projects are complex and require a rigorous scientific basis to determine carbon stocks and baselines, as well as a range of technical expertise. In the case of Mikoko Pamoja, the KMFRI has provided this support. The Association for Coastal Ecosystem Services, a charity registered in Scotland, also helps to facilitate the transfer of international funds, reporting to the Plan Vivo Foundation.

Rony Chevallier

Many researchers, policy makers and community members visit Kenya's Mikoko Pamoja every year to learn more about mangrove management and conservation, and to better understand the characteristics for this project's success

Also important is an inclusive stakeholder process for the lifecycle of the project, which included various engagement forums such as village-level meetings and group discussions to promote general understanding of the significance of mangrove ecosystems and the use of carbon credits. The MPCO consists of representatives of Gazi Bay, specifically Gazi and Makongeni villages, as incomes will benefit people in those areas.

Mikoko Pamoja has received a lot of international attention and was awarded the prestigious UN Development Programme's Equator Prize in 2017 for its contribution to finding innovative solutions to tackle poverty, the environment and climate change. Mikoko Pamoja is currently being replicated on Kenya's south coast at Vanga (with new funding from the DiCaprio Foundation). There are many other opportunities for the application of a similar model in mangrove-rich Western Indian Ocean countries, including in Tanzania's northern marine park near Tanga.

Despite its successes, the project does face challenges related to motivation, leadership and capacity within both its MPCO and CFA, lack of adequate support from the KFS in terms of capacity building, cost–benefit sharing of forest resources with the community, transfer of powers for community-based forest management, and legal prosecution of prohibited deforestation activities.

Partnerships to support uptake of EbA in policy and practice

EbA requires cross-sectoral collaboration through partnerships with a clear focus on implementing interventions. This requires coordination at several levels in order to align resources and programmes of work among partners.[73] Bodies that are independent from stakeholders and agencies can also help to steer projects, bridging gaps and creating trust between different groups.[74]

Mobilising resources to improve equity and environmental justice requires the participation of impacted communities and the involvement of civil society, particularly marginalised groups such as the elderly, youth and women.[75] Communities can participate in EbA projects through monitoring, data collection, surveillance, planting and rehabilitation, as well as by acting as the key enablers of project implementation, as in the case of Vietnam's women-led mangrove programme (see Case Study 5).

Case Study 5

Women as key participants in EbA implementation in Vietnam

Vietnam is one of the most-hazard-prone countries in the world.[76] Along its 3 444km coastline live marginalised communities whose dependency on climate-sensitive livelihoods make them extremely vulnerable to the increased frequency and severity of typhoons and rainfall, and rising sea levels. Furthermore, women and the youth are significantly more vulnerable to climate change owing to the gendered norms

73 DEA & SANBI, 2016, *op. cit.*
74 McVittie A, Cole L & A Wreford, *op. cit.*
75 C40 Cities, *op. cit.*
76 USAID, 'Climate risk profile: Vietnam', https://www.climatelinks.org/resources/climate-change-risk-profile-vietnam, accessed 5 March 2019.

of society, which include discrimination and unequal access to decision-making and positions of authority.[77]

In 2005 Typhoon Damrey devastated Vietnam, with tidal waves and upstream flooding destroying more than 100 homes and over 500ha of crops in Da Loc alone. More crucially, the saline contamination of land upstream severely compromised the outputs of future harvest seasons, which directly impacted women, as they are responsible for producing food and income for their family and the wider community.[78]

Acknowledging the extreme vulnerability of Vietnamese coastal communities, the humanitarian organisation CARE International initiated a project in Thanh Hoa (northern Vietnam) that sought to develop an 'integrated community-based approach to mangrove management, disaster risk reduction, and climate change adaptation'.[79] This project ran from 2007–2011, and specifically identified women as the keystone agents of change. By 2011 a total of 458ha of mangrove forest had been planted in Da Loc and Nga Thuy, with a 70–90% survival rate.[80] Furthermore, 700 people were directly involved in the planting phase daily.

The success of this project has been attributed to the empowerment of marginalised groups through the establishment of the Community-based Mangrove Management Board (CMMB).[81] The CMMB includes the Women's Union and students from local schools. Women's participation in CMMB activities is significantly higher than that of men, and adolescent women are prioritised. In addition, women 'took the lead role in piloting and applying livelihood models, consistent with their normal responsibilities'.[82] This includes the management of mangrove nursing and ecosystem maintenance, and actively engaging with youth to promote community-inspired ideas to climate change adaptation. Youth make up the body of the 'Green Team', which is responsible for promoting and developing coastal resilience strategies, and are represented in numerous projects facilitated by the CMMB.

The CMMB has proven to be highly successful in organising, managing and mobilising groups for the rehabilitation of local mangrove forests, as well as in fostering a deeper appreciation for the value of mangrove ecosystems beyond their provisioning services. One of the more successful outcomes of the project is the development of the CMMB's Participatory Land Use Planning document. This ensures that the ecosystem

77 CARE International, *Building Coastal Resilience in Vietnam: An Integrated, Community-based Approach to Mangrove Management, Disaster Risk Reduction and Climate Change Adaptation*, Project Report. Geneva: CARE International, 2014, p. 52.
78 *Ibid.*
79 *Ibid.*, p. 8.
80 *Ibid.*, p. 25.
81 *Ibid.*, p. 52.
82 *Ibid.*

benefits of the mangrove forests are distributed 'fairly and transparently and build capacity for inclusive management'.[83]

The CMMB's commitment to both develop the socio-economic status of the community and rehabilitate and protect the mangrove ecosystem – and its resultant successes – has been recognised by the national government. The CMMB has since become an active interest group in national dialogues, serving as a crucial platform for marginalised groups to voice their concerns and shape national socio-economic development plans. The government has also awarded a five-year contract to the CMMB to manage the mangrove system in Thanh Hoa.[84]

While it remains a challenge for women to easily access decision-making positions, the significant representation of women on the CMMB is a positive move towards transforming social and gendered norms and behaviours. Given that women bear the brunt of climate change impacts, their role in bodies such as the CMMB is crucial in both empowering the community and enhancing its resilience to such impacts.

However, in order to maintain healthy coastal ecosystems, local governance institutions need to be strengthened to increase their benefits from the sustainable use of marine resources, and policy and legislation is still needed to support more broad-based community management. While community-based natural resource management (CBNRM) is widely recognised as an important principle, countries differ widely in terms of their levels of inclusiveness in its application. Much can be learned about marine co-management through the models currently being rolled out by international social enterprise Blue Ventures and Zanzibari NGO Mwambao Coastal Community Network. (See Case Study 6.)

Case Study 6

Promoting EbA through enhanced community-based partnerships

Blue Ventures International has been developing and rolling out marine management models that yield rapid economic benefits for people, showing that effective conservation is in everyone's interest. Blue Ventures started working with the Vezo community in Madagascar in 2003 by supporting a single village to close off a small section of its octopus fishing grounds for a few months to boost productivity. When

83 *Ibid.*, p. 48.
84 *Ibid.*, p. 8.

the fishery was reopened, communities saw a huge increase in octopus landings and fisher incomes. Octopuses double in weight every month and are thus a quick-growing commercial species suited for catalysing interest in this approach. As news of this remarkable fishery boom spread, neighbouring communities adopted a similar approach, often extending the closure period by between two and seven months. Crucially, this sparked interest in more ambitious, longer-term coastal management efforts, enabling Blue Ventures, in 2006, to help create Madagascar's first locally managed marine area (LMMA), governed by a small network of fishing villages. Since then, this temporary fishery closure model has been adopted along a large extent of Madagascar's coastline, with more than 70 LMMAs established to date. Today, 17.7% of the island's seabed is managed by communities, for communities.[85] LMMAs are also found in nine countries in the region, protecting some 11 000km^2 of marine resources, with Madagascar and Tanzania having the largest areas of LMMA coverage.

Romy Chevallier

A Mozambican child shows off his catch for the day, illustrating that effective community-led conservation is in everyone's interest

Besides temporary fishery closures Blue Ventures also manages a diverse portfolio of other conservation programmes such as blue carbon PES schemes; sea cucumber and other aquaculture enterprises; community-based reproductive health service delivery; education; and ecotourism businesses. Through toolkits, training, technical advice, mentoring and learning exchanges, Blue Ventures collaborates with other like-minded organisations to apply and adapt this approach in new geographies, including in Mozambique and Tanzania.

Besides the considerable socio-economic benefits to coastal communities, these closures have a major impact on the health of coral reefs. By reducing fishing pressure for a time period, one increases the number of seaweed-eating fish, which in turn decreases the amount of harmful seaweed and allows juvenile corals to grow. Fish numbers also have a direct effect on algae and the ability of corals to take advantage of this. This in turn makes corals more resilient to climate change.

85 Mainland Tanzania, Kenya, Mozambique and Madagascar all have legislation to decentralise marine resource management.

Another entity doing work in community-based marine management is the Mwambao Coastal Community Network, which came into existence in 2010 with the aim of reversing the degradation of marine resources in Tanzania and Zanzibar. It has developed a knowledge and advocacy network to build capacity and resilience for the sustainable management of coastal marine resources, especially coral reefs. Over the years its role has evolved to support the implementation of grassroots-level activities, developing prototypes and strategies for improved CBNRM. By working through local institutions, namely the shehia fishermen committees (SFCs) in Zanzibar and Beach Management Units on the Tanzanian mainland, Mwambao is integrating traditional practices, scientific approaches and lessons from the international best practice examples of Blue Ventures, Fauna and Flora International and the Indian Ocean Commission, to pioneer a collaborative marine management approach across a number of locations. Today, Mwambao supports eight communities in Tanzania and Zanzibar to manage their octopus fisheries across 1 050ha.

Conclusion

While the importance of marine and coastal ecosystems is increasingly recognised globally, EbA has not really gained widespread traction among all stakeholder groupings and in climate change policies, and is yet to be fully integrated. While numerous countries have national policy frameworks to guide their adaptation priorities, many still have a way to go with regard to incorporating and mainstreaming marine and coastal ecosystems in climate response strategies. This includes the incorporation of coastal ecosystems into the next iteration of NDCs to the UNFCCC.

To date only a few large-scale EbA projects are operational, and those that do exist are rather isolated and small in nature, and lack financial sustainability. Despite a number of demonstrable cases in which significant success has been achieved with EbA, many governments still believe that other non-ecosystem-based solutions are necessary to address the destructive impacts of sea-level rise. Engineering and mechanical activities, such as sea walls and dikes, tend to be the preferred response measures to rising sea levels along the coast. One reason for this is the lack of transferable and user-friendly concepts, methodologies and instruments for mainstreaming, adapting and integrating EbA.

It is thus imperative that softer, nature-based responses are used (as standalones or in combination with hard engineering) as a central element of coastal protection, including the rehabilitation and restoration of key coastal ecosystems. For this to be achieved, certain general drivers of and barriers to EbA mainstreaming must be addressed. Barriers include financial and human resources deficits; lack of knowledge and information; weak policy context; inadequate spatial data, technology, law enforcement and alternative/improved livelihood planning; and a lack of awareness raising and education. In particular, the lack of

thorough and systematic documentation on long-term functioning and effectiveness, as well as long-term cost–benefit analyses, has created reluctance, scepticism and uncertainty. Additionally, there are significant challenges related to scaling up EbA and incorporating it into local, national and subregional climate policies and strategies.

Here, a wide variety of national and international stakeholders can help governments to achieve their objectives. The key to success is the inclusion and participation of communities through co-management models. With increased financial and human resources, knowledge and information, ownership, and stakeholder engagement and partnerships, there are opportunities to improve the level of mainstreaming and implementation of EbA. This will increase not only coastal cities' ability to adapt to climate change impacts but also the resilience of coastal communities.[86]

Key Recommendations

- Improve understanding of the role and value of marine and coastal EbA in enhancing climate resilience among regional institutions and national policy audiences.
- Provide a stronger evidence base to support the inclusion of marine and coastal EbA in national climate policies and strategies.
- Fully integrate EbA into national and sectoral policies, as well as budgetary and regulatory frameworks of climate change response measures.
- Enhance the emphasis on marine and coastal EbA in NDCs as updated by the 2020 deadline specified by the UNFCCC.
- Strengthen knowledge of and action within the policy community and private sector around opportunities for innovative financing and investment to support marine and coastal EbA.
- Enhance stakeholder partnerships throughout the lifecycle of EbA projects.
- Learn from existing projects and share best practices.
- Equip community-based organisations with the skills and information to actively participate in EbA policy and project design and implementation.

86 Swanepoel E & S Sauka, *op. cit.*

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