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## Ecosystem-based Adaptation in South African Coastal Cities

ERNESTA SWANEPOEL & SIYASANGA SAUKA

African perspectives  
Global insights

# Abstract

Ecosystem-based adaptation (EbA) is the use of biodiversity and ecosystem services as part of an overall adaptation strategy to help people adapt to the adverse effects of climate change. EbA provides an approach to sustainable development that contributes simultaneously to socio-economic development, climate adaptation and biodiversity conservation. This is because EbA considers ways to manage ecosystems so that they can provide services that reduce vulnerability and increase the resilience of socio-ecological systems to both climatic and non-climatic risks, while at the same time providing multiple socio-economic benefits to society. Owing to the multiple benefits that EbA provides, it can be of use to coastal cities and the multi-faceted systems that exist within these cities. Like coastal cities around the world, South African coastal cities are highly vulnerable to climate impacts. Durban and Cape Town, among others, are increasingly exposed to climate impacts such as flooding, rising sea levels, seawater intrusion and coastal storm surges. These cities are key economic zones that are important contributors to the national economy, thus attracting large populations (including the urban poor) that reside in coastal urban and peri-urban areas. Therefore, climate impacts will affect not only urban economies but also the livelihoods and well-being of coastal populations. As EbA benefits both nature and people, it can be used to address socio-economic and development goals. However, various barriers and challenges exist in the implementation and governance of EbA in South African coastal cities. For South Africa to reap the benefits offered by EbA, it is crucial that the challenges associated with regulation, governance and management, institutional arrangements and partnerships, knowledge, communication and engagement, and financial mechanisms are addressed, and that the opportunities related to these areas are maximised. The outcomes of this paper provide learning opportunities for African and other developing coastal cities.

# Introduction

Healthy ecosystems are critical for promoting human well-being and building long-term socio-economic resilience through a range of ecosystem services.<sup>1</sup> However, the integrity of these ecosystems is threatened by climate change, which in turn will increasingly impact the many people who depend on these ecosystems, including the urban and rural poor.<sup>2</sup> Climate impacts may therefore have long-term negative consequences for sustainable development and human well-being, such as increasing poverty, undermining health and negatively impacting economies. Conversely, healthy ecosystems can enhance resilience to climate change impacts. There is growing interest in the potential for such nature-based solutions, or ecosystem-based adaptation (EbA), as part of broader adaptation strategies.

Healthy ecosystems are critical for promoting human well-being and building long-term socio-economic resilience

These dynamics are also at play in coastal cities across the world, including in South Africa, where climate change will increase exposure to impacts such as flooding, strong winds, sea-level rise, seawater intrusion and coastal storm surges. These climate impacts will affect the urban economies of coastal cities, as well as the livelihoods and well-being of coastal populations. However, in marine and coastal environments, healthy ecosystems can help to reduce climate change vulnerability and disaster risk by serving as protective barriers against hazards such as floods and storms.<sup>3</sup> Green infrastructure, for instance, remains one of the most widely advocated ways of mitigating the impacts of natural disasters, whether attributed to climate change or not.<sup>4</sup>

EbA approaches recognise that resilient ecosystems can provide climate adaptation and disaster risk reduction while also providing services that can improve people's livelihoods. There is therefore a strong case to be made for promoting EbA in South African coastal cities. This is supported by the UN Framework Convention on Climate Change (UNFCCC), which recognises that the sustainable management of natural resources, including marine

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1 Ecosystem services are the direct and indirect contributions of ecosystems to human well-being. They directly or indirectly support our survival and quality of life and can be categorised as: provisioning (eg, production of food), regulating (eg, control of climate and natural disasters), habitat (eg, promoting biodiversity and supporting the nutrient cycle) or cultural services (eg, recreational and religious benefits).

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

3 *Ibid.*

4 Sudmeier-Rieux K et al. (eds), *Ecosystems, Livelihoods and Disasters: An Integrated Approach to Disaster Risk Management (No. 4)*. Gland: IUCN (International Union for Conservation of Nature), 2006; Renaud FG, Sudmeier-Rieux K & M Estrella, *The Role of Ecosystems in Disaster Risk Reduction*. Bonn: UN University Press, 2013.

and coastal resources, can be an adaptation action that builds the resilience of socio-economic and ecological systems.<sup>5</sup>

There is considerable interest in the potential of EbA in South Africa. The Department of Environmental Affairs (DEA), in partnership with the South African National Biodiversity Institute (SANBI), has recently developed the EbA Strategic Framework and Overarching Implementation Plan (2017)<sup>6</sup> and Ecosystem-based Adaptation Guidelines (2018).<sup>7</sup> However, in terms of both research and project implementation, South Africa's EbA activities have focused primarily on watershed management and terrestrial conservation (eg, dryland and rangeland conservation and restoration). While research<sup>8</sup> on EbA at the urban level has been undertaken (including a focus on coastal cities), there is limited research<sup>9</sup> on or project development in coastal EbA. There is therefore a need for more evidence-based research and engagement on the effectiveness of coastal EbA in managing coastal risks and in helping coastal cities to adapt to climate change.

This paper seeks to develop the knowledge base for the adoption of EbA in South African coastal cities. Specifically, the objectives of this paper are to explore and highlight opportunities for action regarding coastal EbA within the policy and governance community; identify barriers and limitations, and offer solutions relating to the implementation of EbA (including climate finance); and provide an evidence base to improve the understanding of coastal EbA among local, provincial and national institutions and policy audiences. The paper includes case studies of South Africa's largest coastal cities: Durban and Cape Town. These cities have sizeable populations living in informal housing (Cape Town, 25%; Durban, 20%)<sup>10</sup> and below the poverty line (Cape Town, 20%; Durban 30%).<sup>11</sup> They are also key economic zones and important contributors to the South African economy.

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5 IUCN, 'Coastal Ecosystem-based Adaptation', Briefing Paper, [https://www.iucn.org/sites/dev/files/import/downloads/coastal\\_eba\\_briefing\\_paper\\_4p\\_final\\_2\\_.pdf](https://www.iucn.org/sites/dev/files/import/downloads/coastal_eba_briefing_paper_4p_final_2_.pdf), accessed 10 December 2019.

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

7 DEA & SANBI, 2018, *op. cit.*, p. 5.

8 Roberts D *et al.*, 'Exploring ecosystem-based adaptation in Durban, South Africa: "Learning-by-doing" at the local government coal face', *Environment and Urbanization*, 24, 1, 2012; Pasquini L *et al.*, 'Facing the heat: Barriers to mainstreaming climate change adaptation in local government in the Western Cape Province, South Africa', *Habitat International*, 40, 2013, pp. 225-232; O'Donoghue S, 'Durban: Integrating Urban Biodiversity into Ecosystem Based Adaptation', B5 MAF Panel 2014, eThekweni Municipality, [http://resilient-cities.iclei.org/fileadmin/sites/resilient-cities/files/Resilient\\_Cities\\_2014/PPTs/B/B5\\_ODonoghue.pdf](http://resilient-cities.iclei.org/fileadmin/sites/resilient-cities/files/Resilient_Cities_2014/PPTs/B/B5_ODonoghue.pdf), accessed 20 September 2018; Pasquini L & RM Cowling, 'Opportunities and challenges for mainstreaming ecosystem-based adaptation in local government: Evidence from the Western Cape, South Africa', *Environment, Development and Sustainability*, 17, 5, 2015, pp. 1121-1140.

9 Colenbrander D *et al.*, 'A coastal adaptation strategy for the City of Cape Town: An ecosystems-based management approach towards risk reduction', in Renaud GF, Sudmeier-Rieux K & M Estrella (eds), *op. cit.*

10 SACN (South African Cities Network), *State of South African Cities Report 2016*. Johannesburg: SACN, 2016.

11 *Ibid.*

# Ecosystem-based adaptation in coastal cities

## Defining and contextualising EbA

EbA is often referred to as ‘natural solutions to climate change’.<sup>12</sup> According to the Convention on Biological Diversity, EbA is the use of biodiversity and ecosystem services as part of an overall adaptation strategy. It includes the sustainable management, conservation and restoration of ecosystems to provide services that help people adapt

EbA is often referred to as ‘natural solutions to climate change’

to the adverse effects of climate change.<sup>13</sup> This definition informs the DEA and SANBI’s approach to EbA, as they emphasise that EbA approaches must consider ways to manage ecosystems so that they can provide services that reduce the vulnerability and increase the resilience of socio-ecological systems to both climatic and non-climatic risks, while at the same time providing multiple benefits to society.<sup>14</sup>

Drawing on the linkages between ecosystem services, climate change and biodiversity, EbA is an approach to sustainable development that contributes to three outcomes simultaneously: socio-economic benefits, climate change adaptation (risk and vulnerability reduction) and biodiversity conservation (Figure 1 and Table 1). The intersection of these three spheres is what makes EbA different from other approaches such as community-based adaptation, climate change integrated land use strategies or community-based natural resource management, which focus only on integrating any two of the three spheres. The position of EbA at the intersection of these three spheres means that it is likely to have a wide range of co-benefits in addition to climate change adaptation, including conservation of threatened species, livelihood benefits, sustainable utilisation of natural resources and the maintenance of essential ecosystem services such as water and food security. EbA can, therefore, enhance the effectiveness of climate change adaptation strategies through the important role it plays in protecting infrastructure and improving human security.<sup>15</sup>

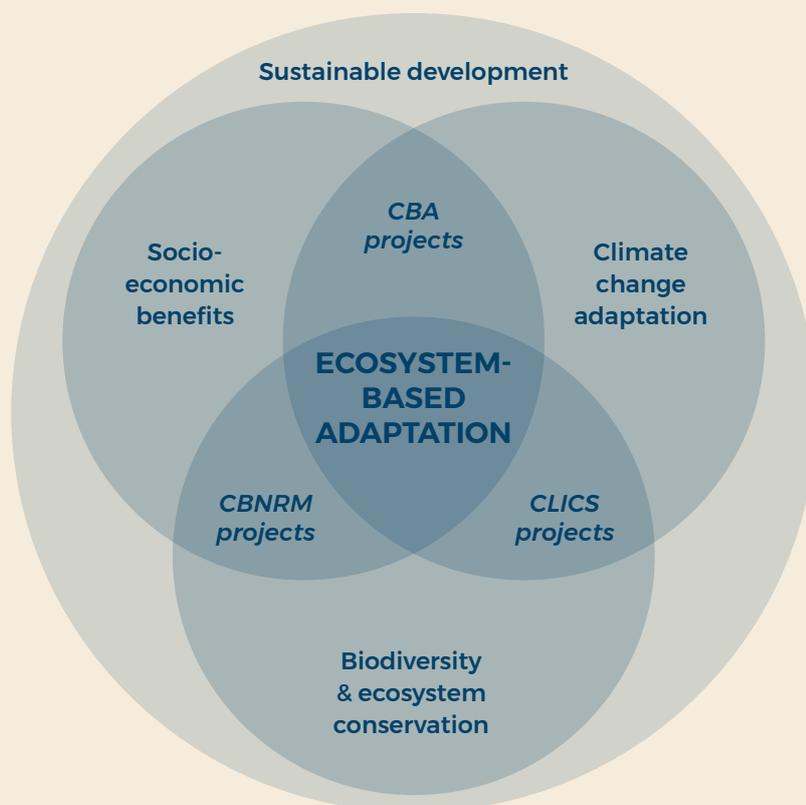
12 DEA & SANBI, 2018, *op. cit.*, p. 5.

13 CBD (Convention on Biological Biodiversity), ‘Climate change and biodiversity: Introduction’, <https://www.cbd.int/climate/intro.shtml>, accessed 20 September 2018.

14 DEA & SANBI, 2018, *op. cit.*

15 DEA & SANBI, 2016, *op. cit.*

**Figure 1** EbA integrates biodiversity and ecosystem conservation, climate change adaptation and socio-economic benefits



Note: CBA – community-based adaptation  
 CLICS – climate change integrated land use strategies  
 CBNRM – community-based natural resource management

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

## The benefits provided by EbA

EbA promotes healthy coastal ecosystems that provide multiple benefits to both nature and people. It can thus ensure that coastal ecosystems can provide several intrinsic values, such as:

- **Social value:** Coastal ecosystems support many of the world’s poorest communities, who rely on the provisioning services of these systems for their food supply and livelihoods. For example, coral reefs, mangroves and other ecosystems are important for fisheries, which provide people with a key source of protein as well as livelihood opportunities. Other livelihood options include the sustainable harvesting of mangroves (which provide a variety of wood and non-wood products, such as fodder and herbal remedies).<sup>16</sup>

<sup>16</sup> UNEP (UN Environment Programme), ‘What is EbA?’, <http://web.unep.org/coastal-eba/what-is-eba>, accessed 15 June 2018.

**TABLE 1 THE CORNERSTONES AND PRINCIPLES OF EbA**

| Cornerstones must be met before a programme or policy can qualify as EbA   | Seven principles underscore effective EbA  |
|--|--|
| <ul style="list-style-type: none"> <li>• It must respond to the impacts of climate change.</li> <li>• It must make use of biodiversity and ecosystem services.</li> <li>• It must result in building people's resilience to climate change.</li> <li>• It must be framed in the context of sustainable development.</li> </ul> | <ol style="list-style-type: none"> <li>1 EbA interventions support resilient and functional ecosystems that ensure and enhance ecosystem services.</li> <li>2 EbA interventions support people in adapting to climate change and climate variability.</li> <li>3 EbA interventions are participatory, inclusive, and transparent.</li> <li>4 EbA interventions are knowledge and evidence-based as informed by the best available science and robust indigenous and local knowledge.</li> <li>5 EbA interventions are contextualised within broader national and regional policy and landscape processes and are designed to be scalable and replicable.</li> <li>6 EbA interventions strive to be integrative and to promote trans-disciplinarity and multi- sectorality throughout the project lifecycle.</li> <li>7 EbA strives to achieve co-benefits and synergistic outcomes.</li> </ol> |

Source: DEA & SANBI, *Ecosystem-Based Adaptation (EbA) Guidelines*. Pretoria: DEA, 2018

- **Economic value:** Coastal ecosystems have an economic value as they directly underpin or contribute to a number of economic sectors, including small-scale and commercial fisheries, tourism (eg, diving and snorkelling), salt, minerals, oil and construction (eg, by providing goods such as rock, sand, lime and wood).<sup>17</sup> To demonstrate the economic value of coastal ecosystems, an economic assessment for Cape Town showed that the coastline contributed approximately ZAR<sup>18</sup> 40 billion (about \$2.6 billion) per year, which amounts to ±10.7% of Cape Town's gross domestic product per year.<sup>19</sup>
- **Biological value:** Coastal ecosystems sustain a wealth of terrestrial and marine fauna and flora. For example, coral reefs contain almost a third of the world's marine fish species, and mangrove forests provide a habitat for bird, mammal and fish species. The biological values of coastal ecosystems are not simply intrinsic; much of the social and economic value of coastal ecosystems is underpinned by their biological richness.<sup>20</sup> Rich fauna and flora can enhance the appeal of ecotourism and represent a bank of genetic resources that can be drawn upon for agriculture, medicine and biotechnology.<sup>21</sup>

17 Martinez ML et al., 'The coasts of our world: Ecological, economic, and social importance', *Ecological Economics*, 63, 2-3, 2007, pp. 254-272.

18 Currency code for the South African rand.

19 Urban-Econ, *Economic Inputs into Coastal Economic and Spatial Strategic Framework for the City of Cape Town, Final Draft Report*. Cape Town: City of Cape Town, 2017.

20 UNEP, *op. cit.*

21 Martinez ML et al., *op. cit.*

Coastal ecosystems build socio-economic resilience, particularly in the context of climate- and non-climate-related coastal impacts. It is also important to remember that coastal ecosystems are intricately connected to terrestrial ecosystems, upstream freshwater ecosystems and marine ecosystems. Thus, processes and activities in one system invariably have an impact on other systems, whether positive or negative. In the context of coastal EbA, it is therefore important to look at the entire natural system, including marine, terrestrial and freshwater ecosystems.

## Implementing EbA in coastal cities

In implementing EbA, there are many options for adapting to climate change in the coastal environment. These include 'no-regret, low-regret or win-win interventions'<sup>22</sup> that use biodiversity and ecosystem services as part of an overall adaptation strategy. EbA options can also be cost effective and generate social, economic and cultural co-benefits, while conserving biodiversity.<sup>23</sup>

These options range from policy and governance-focused approaches (eg, EbA strategies and plans) to small- to medium-scale on-the-ground actions (eg, restoring mangroves, dunes, beaches, coral reefs, seagrass or kelp), large-scale coastal actions (eg, coastal and urban wetlands) and area-based management frameworks (marine protected areas, marine spatial planning frameworks and coastal retreat). It is important to emphasise that EbA approaches can also be implemented in conjunction with hard infrastructure and engineering solutions (ie, hybrid approaches). Living breakwaters, for instance, are offshore, submerged structures that form a barrier between the sea and land. (see the Annexure for a detailed overview of these options.)

EbA options are not mutually exclusive, and in certain cases a combination of approaches can be the most effective solution. In developing countries, where ecosystem services and poverty reduction are intrinsically linked, EbA provides multiple benefits to society. Thus, EbA activities need to take place alongside wider management efforts that address issues such as coastal land use patterns, environmental degradation, water quality issues and fishing activities to improve ecosystem conditions.

## The ideal

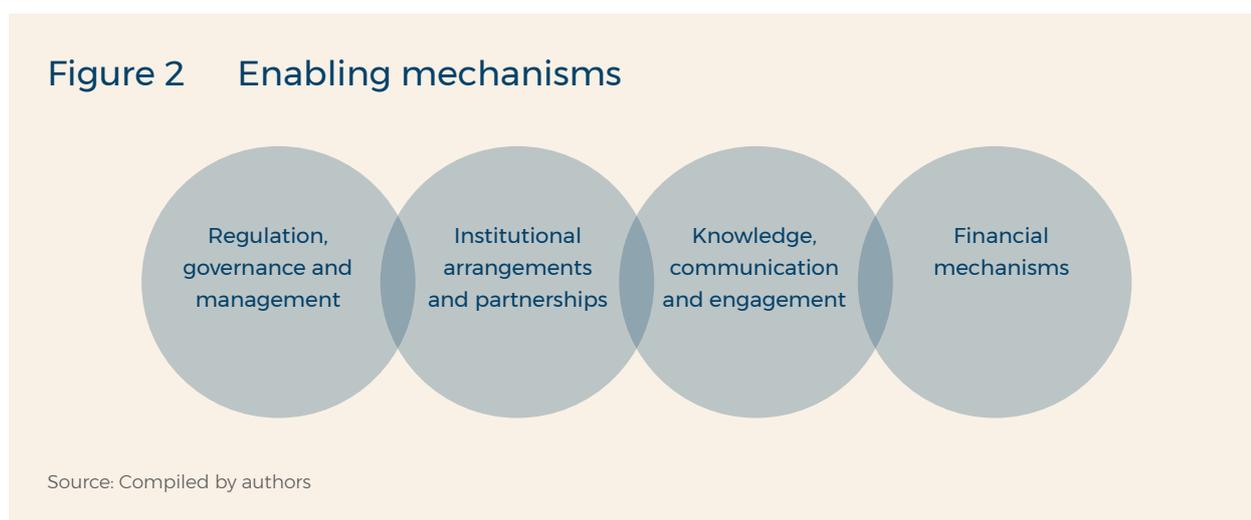
The link between ecosystem health, climate change and sustainable development is widely recognised. Therefore, EbA in coastal cities can play a significant role in managing

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22 No-regret actions are cost effective now and under a range of future climate scenarios and do not involve hard trade-offs with other objectives. Low-regret actions are relatively low cost and provide relatively large benefits under predicted future climates. Win-win actions contribute to adaptation while also having other social, economic and environmental benefits. See climateXchange, 'Examples of no-regret, low-regret and win-win adaptation actions', <https://www.climatexchange.org.uk/research/projects/examples-of-no-regret-low-regret-and-win-win-adaptation-actions/>, accessed 9 April 2019.

23 CBD, *op. cit.*

urban climate risks while helping the urban population to cope with rising temperatures, flood events and water scarcity. EbA should be explored further, since many of the same ecosystem services that coastal communities rely on also play a role in helping them to adapt to climate change. However, the effective implementation of EbA requires not only an adequate understanding of EbA and the various EbA options, as discussed in the previous section, but also effective enabling mechanisms. The enabling mechanisms shown in Figure 2<sup>24</sup> are essential for ensuring that the benefits of EbA are realised and optimised.



## Regulation, governance and management

Sustainable development and sustainable resource governance is embedded in South Africa's national policies, legislation and regulations. As a signatory to the Sustainable Development Goals (SDGs) and various multilateral environmental agreements,<sup>25</sup> South Africa is strongly committed to sustainable development. An EbA approach can contribute to addressing several SDGs:<sup>26</sup>

- **SDG 2 – Zero hunger:** End hunger, achieve food security and improved nutrition, and promote sustainable agriculture;
- **SDG 6 – Clean water and sanitation:** Ensure access to water and sanitation for all;
- **SDG 11 – Sustainable cities and communities:** Make cities inclusive, safe, resilient and sustainable;
- **SDG 13 – Climate action:** Take urgent action to combat climate change and its impacts;

<sup>24</sup> 'Regulation, governance and management' includes planning and/or management systems, tools and frameworks.

<sup>25</sup> Including but not limited to the UN Framework Convention, Convention on Biological Diversity, UN Convention to Combat Desertification, Convention on Wetlands of International Importance and the New Urban Agenda.

<sup>26</sup> UN, 'Sustainable Development Goals', <https://www.un.org/sustainabledevelopment/>, accessed 29 November 2018.

- **SDG 14 – Life below water:** Conserve and sustainably use the oceans, seas and marine resources; and
- **SDG 15 – Life on land:** Sustainably manage forests, combat desertification, halt and reverse land degradation, halt biodiversity loss.

Domestically, sustainable development – and ultimately the protection of ecosystems and biodiversity – is governed by various legislative and policy instruments, including but not limited to the National Environmental Management Act 107 of 1998, the [National Environmental Management: Biodiversity Act 10 of 2004](#), the [Draft Climate Change Bill](#), the [National Climate Change Response White Paper](#), the [National Development Plan 2030](#), the [Environment Conservation Act](#), the [draft National Biodiversity Framework \(NBF\)](#), and the [National Biodiversity Strategy and Action Plan 2015–2025](#), which is a national requirement in terms of the Convention on Biodiversity, to which South Africa is a party. In coastal areas, the [National Environmental Management: Integrated Coastal Management Act 24 of 2008 \(ICMA\)](#), as well as municipal by-laws, sets out an approach to managing coastal resources to promote social equity and economic development, while protecting the natural environment.

EbA is included in the draft [National Adaptation Strategy \(2016\)](#) as a way to ‘integrate climate change adaptation within existing development planning and implementation processes’, as it can ‘enhance adaptive capacity, enhance livelihoods, and reduce the risk of and adverse effects from climate-related disasters’. Other key strategies and plans include the [Biodiversity Sector Climate Change Response Strategy](#), the [National Protected Areas Expansion Strategy](#), the [Operation Phakisa Marine Protection Services and Governance Strategy](#), [Climate Change Adaptation Plans for South African Biomes](#), the [National Biosphere Reserve Strategy and Implementation Plan](#), the [National Biodiversity Economy Strategy, Framework for Investing in Ecological Infrastructure](#), and the [National Strategy for Sustainable Development](#).

Importantly, South Africa has developed the [Strategic Framework and Overarching Implementation Plan for Ecosystem-based Adaptation in South Africa \(2016–2021\)](#), supported by [EbA Guidelines](#), which aims to promote EbA as a central component of the country’s programme of work on biodiversity and climate change. The strategic framework also speaks to EbA projects that are already being implemented in sensitive biomes in many provinces. These activities include restoring degraded land, protecting movement corridors, adjusting burning regimes and clearing alien vegetation.

## Institutional arrangements and partnerships

EbA has people at its centre, and uses participatory, culturally appropriate ways to address challenges.<sup>27</sup> Added to this, EbA is not a standalone practice, and, given that ecosystems

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<sup>27</sup> IIED (International Institute for Environment and Development), ‘Ecosystem-based approaches to climate change adaptation’, <https://www.iied.org/ecosystem-based-approaches-climate-change-adaptation>, accessed 10 December 2019.

generally do not have clearly defined borders, works best when various stakeholders collaborate.<sup>28</sup> Implementing EbA is therefore a social and institutional process that requires working together across sectors through partnerships with a clear focus on interventions that deliver co-benefits in an evolving context. This requires coordination at a number of levels in order to align partners' resources and programmes of work towards the achievement of these benefits.<sup>29</sup>

The DEA, with the support of SANBI, plays a leading role in the governance and regulation of marine and coastal EbA. At the DEA, the Biodiversity and Conservation, Climate Change and Air Quality, and Oceans and Coasts branches are responsible for EbA regulation, governance and management; in coastal areas, the Oceans and Coasts Branch is the leading regulator and enforcer as it is the custodian of the ICMA.

The DEA and SANBI work in close collaboration with local municipalities, provincial government, and other national departments (such as the Department of Water and Sanitation [DWS] and the Department of Agriculture, Forestry and Fisheries). This collaboration is achieved through committees, forums and working groups that include various institutions. The DEA also has an EbA steering committee. National mechanisms for coordinating the work of the biodiversity sector facilitate strategy and policy coherence, as well as cooperation between key institutions responsible for biodiversity management and conservation. Through these institutional arrangements, issues are discussed and escalated as required, knowledge is shared, and regulations are enforced. Their work is complemented by numerous other structures and task teams that operate provincially, locally or internally within specific institutions or multi-stakeholder programmes, to coordinate implementation and operational work plans. Communities of practice,<sup>30</sup> for instance, are a vital mechanism for coordinating, enriching and advancing the work of the biodiversity sector and ensuring a consistent approach in the operating environment.<sup>31</sup>

## Knowledge, communication and engagement

Knowledge sharing, adaptive learning and communication are necessary to best mobilise resources and enhance capacity for EbA. Communication and engagement should be done in a way that supports sustainability, knowledge sharing, replication and upscaling, and should also demonstrate that EbA is a valid and cost-effective adaptation option in the overall adaptation strategy.

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

29 DEA & SANBI, 2016, *op. cit.*

30 Communities of practice such as People and Parks Forum, Marine Protected Areas Forum, The Wildlife Forum, The National Biodiversity and Business Network, BioPANZA (Bioproducts Advancement Network), Bioprospecting Forum and the Adaptation Network.

31 DEA, *Draft National Biodiversity Framework*. Pretoria: DEA, October 2018.

Effective communication and equitable stakeholder engagement are necessary at all stages of the EbA intervention. Therefore, EbA interventions should be designed with input from all actors at the target site and, if relevant, in the wider region. Their timely and continuous engagement is essential to its success, as it is within these stakeholder networks that the requisite knowledge, experience, capacities and resources reside (including those managing the institutions dealing with land use and climate risks on site).<sup>32</sup>

## Financial mechanisms

Acting now on climate change can minimise negative impacts and costs in the long term. In the context of an uncertain future, finance and investment should focus on low-regret options that promote sustainable natural resource management and socio-economic development.<sup>33</sup> EbA options are low-regret approaches that achieve multiple co-benefits and support the integrated delivery of SDGs. EbA options are also readily available, as they use ecosystems to reduce climate change impacts and improve the climate resilience of local communities.

Significant financial resources are needed in order to implement EbA strategies. Unfortunately, public finance for EbA interventions, and climate adaptation as a whole, falls below the volumes required. It is thus necessary to learn how to tap into non-traditional sources of finance, including community contributions and partnerships with the private sector.<sup>34</sup> In addition, it is essential to draw lessons from international EbA projects that have been financially supported through innovative national budgeting processes and public-private partnerships.<sup>35</sup>

# The reality

## EbA in South Africa

Coastal cities are characterised by high population densities, with 23% of the world's population living within 100km of the coast and less than 100m above sea level. About 60% of the world's cities with a population of over 5 million are located within 100km of the coast. Many of the world's poorest communities live along the coast, and rely on mangrove and reef-based fisheries for food security and on tourism for foreign exchange, particularly on small islands and in tropical developing countries.<sup>36</sup> With increasing demands on ecosystem services, coastal ecosystems are threatened by growing

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32 Jiménez Hernández A, *Ecosystem-based Adaptation Handbook*. Amsterdam: IUCN NL, 2016.

33 C40 Cities, *The Future We Don't Want: UCCRN Technical Report*. New York: C40 Cities, 2018.

34 *Ibid.*

35 Chevallier R, *op. cit.*

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

populations, land use impacts, coastal economic development, unsustainable fishing methods, pollution and climate change-related impacts.

Cities are particularly vulnerable to climate change, owing to large and growing urban populations and the complex patterns of economic assets, infrastructure and services that support them. This is also true for South African coastal cities, with large populations

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living in urban and peri-urban areas. The urban poor are particularly vulnerable to climate impacts. Additional challenges in coastal areas, particularly South African coastal cities, include:<sup>37</sup>

- **Coastal sedimentation:** Sedimentation has become a major problem, especially along the east coast. Silt-laden river water and muddy beaches lessen the attraction of beaches and coastal landscapes, kill marine organisms, and contribute to rising local sea levels and extensive coastal erosion.
- **Urbanisation:** Major urban centres have sizeable populations, and high rates of population and industrial growth. As a result of this, problems exist in two main areas: planning trends in housing development, and the negative impacts associated with the growth of industry and residential developments.
- **Coastal development:** Poorly planned development in coastal cities (high-income or high-density housing, and commercial properties) can have negative impacts on the functioning of coastal and marine ecosystems, as well as on broader social issues around equity (eg, displacing poorer populations, blocking access to the beach, limiting cultural ecosystem services).
- **Influx of tourists:** The major coastal urban centres have to cater to residents and visitors alike. Coastal urban centres receive a growing number of tourists, which can overburden services and undermine coastal ecosystems.
- **Environmental pollution:** The populations of several urban centres along the coast are rapidly expanding, which is associated with increases in municipal and industrial waste.

<sup>37</sup> DEA, 'Working for the Coast project', [https://www.environment.gov.za/projectsprogrammes/workingfor\\_thecoast](https://www.environment.gov.za/projectsprogrammes/workingfor_thecoast), accessed 29 June 2018.

Some major coastal urban centres are also situated near river mouths, through which pollution (including agricultural run-off) impact coastal and marine ecosystems and can affect local populations.

- **Direct destruction of coastal habitats:** Direct habitat destruction compounds coastal resource-base deterioration in coastal ecosystems. Major causes of habitat destruction include overfishing and poor fishing methods, land reclamation, mining and dredging activities. All of these, unless averted, contribute to the shrinkage of the coastal resource base.

EbA has a role to play in managing climate- and non-climate-related coastal impacts. The integration of EbA into development planning is provided for in South Africa's policies and strategies (see below). This integration is primarily a national government responsibility, supported by the provincial government – at these two levels of government, there is a stronger focus on high-level strategic efforts and policy development. At the local level, which is the focus of this report, there is a stronger focus on ground-level governance and implementation.

Local governments, particularly coastal cities, continue to face various challenges in relation to EbA, although a few successes have also been witnessed. Challenges in implementing EbA include ineffective regulation, governance and management challenges, non-functioning institutional arrangements, unsustainable partnerships, lack of knowledge, inadequate communication and engagement, and ineffective and inaccessible financial mechanisms.

The following section presents case studies of two South African coastal cities, focusing predominantly on the successes, barriers and opportunities in EbA implementation.

### **Case Study: Cape Town**

While service delivery remains the highest priority for the City of Cape Town (CoCT), mainstreaming climate change adaptation into every aspect of the city's undertakings is an important priority. For the CoCT, EbA is synonymous with the city's biodiversity network, as the protection of ecosystems will contribute to climate adaptation and building climate resilience.

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Coastal management lines (CMLs),<sup>38</sup> which are required by the ICMA, are proving a useful tool for coastal planning and management. In conjunction with maps, the CoCT is using CMLs to develop 'nodal development zones'. While some cities place great emphasis on storm surges and disaster risk management as the sole determinants of CMLs, Cape Town has added a range of other key considerations. These include the presence of green belts and biodiversity networks, the need to promote access to the coast, socio-economic redress, aesthetics and dynamic coastal processes, all of which are vital to building a resilient coastal city while recognising the complexity of the coastal space. The function of determining the CML falls within the Coastal Management Branch.

The mandate for climate adaptation and the custodian of all climate change policy at the city level is the Climate Change Directorate, which is part of the CoCT Environmental Management Department. While the CoCT's Energy Directorate is responsible for mitigation activities, the Climate Change Directorate focuses on adaptation and non-energy related aspects of climate change mitigation, such as carbon sequestration through biodiversity conservation. The Coastal Management Branch and the Climate Change Directorate work in close collaboration on climate adaptation projects in coastal areas, such as coastal EbA.

In terms of strategic partnerships to enable climate adaptation, one of the biggest partnerships that the city has is with C40, the Cities Climate Leadership Group. While the city has a good working relationship with the provincial government's Department of Environmental Affairs and Planning (DEADP), it is expected to take the lead and provide resources for climate adaptation interventions. Support from the DEADP is mostly channelled to local governments that have fewer resources and less capacity than the CoCT.

With climate change a relatively new function at the municipal level, the Climate Change Directorate does not have many projects being implemented on the ground; the current focus is primarily on strategies, plans and research projects. A key research project that is being implemented is a Hazard Vulnerability and Risk Assessment, which builds on climate change projections undertaken by the Climate Systems Analysis Group in 2016. The project is spatially focused and addresses both physical and social vulnerabilities. Other relevant projects and frameworks that are in progress include the Heat Strategy, the Climate Adaptation Plan, the Built Environment Performance Plan, the Integrated Coastal Management Policy, the Coastal Management Programme, and the Green Infrastructure Plan and Network, which considers the open space network and the role of ecosystem goods and services.

When considering adaptation options, as well as restoring and rehabilitating ecosystems, the CoCT's Climate Change Policy and Integrated Coastal Management Policy advocate

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38 Coastal management lines (CMLs), as detailed in the ICM Act, are prescribed boundaries that indicate the limit of development along ecologically sensitive or vulnerable areas, or an area where dynamic natural processes pose a hazard or risk to humans. Amendments to the ICM Act now refer to 'coastal management lines' and not 'coastal set-back lines' to avoid continued confusion with EIA development set-back lines.

for an EbA approach rather than a hard engineering approach. However, despite the fact that EbA approaches are often more cost effective and easier to maintain than engineering options, they are not necessarily the first strategy considered for interventions. Engineering options are still the first recourse when it comes to adapting to climate change, particularly once a specific area faces a crisis. Therefore, while there is interest in EbA, it is often low on the list of priorities owing to preference being given to alternative adaptation approaches, as well as the need to focus on primary priorities such as service delivery.

The CoCT is an urban hub, and as a result most of its coastline that lies outside protected areas is already developed and major parts of its natural habitat have already been lost. In many areas the proverbial ship has sailed, and it has become a struggle to protect what is left of natural systems along this coastline. As Cape Town is continuously growing, a major challenge is encroachment into 'green spaces' for development purposes. This is a concern in both affluent urban areas and peri-urban areas.

In urban areas, affluent landowners extend their gardens into the remaining greenbelts by replacing natural vegetation with lawns, swimming pools and trampolines, while in peri-urban areas, there is growing pressure to accommodate expanding informal settlements. For example, while there are still green belts along the False Bay coastline, informal settlements are encroaching into some of these green spaces. Given the low-cost housing backlog and the need for land, this is a politically sensitive matter. Another example is in the Milnerton area, where coastal erosion is a major concern. Development is currently taking place close to the coast, and residents experience losses after coastal storms. A potential solution is 'phased retreats',<sup>39</sup> where development slowly moves away from the coast. This is, however, expensive, takes time and requires stakeholder buy-in, and is therefore not easy to implement.

A major challenge the CoCT is facing is the struggle to secure buy-in for EbA approaches from the public, as indigent communities see their challenges as primarily economic and social, rather than environmental (often not recognising the interlinkages between these components). Most residents fail to understand why open land cannot be used for development and social housing. There is thus a need to find a way to bridge environmental and socio-economic challenges, and make residents, particularly poor communities, understand why it is in their interests to support EbA initiatives. Promoting EbA has been successful in Hout Bay, where a current project<sup>40</sup> focuses on the rehabilitation of dunes that are impacting the socio-economy of the area by directly affecting transport links, economic zones and residential units.

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39 For more information on phased retreats as an adaptation option see Adaptation Clearing House, 'Managed retreat strategies', <https://www.adaptationclearinghouse.org/resources/managed-retreat-strategies.html>, accessed 8 December 2018; NCCARF (National Climate Change Adaptation Research Facility), 'Managed adaptation options', [https://www.nccarf.edu.au/sites/default/files/attached\\_files\\_publications/RevisedCERCCS\\_AdaptationOptionsforWeb.pdf](https://www.nccarf.edu.au/sites/default/files/attached_files_publications/RevisedCERCCS_AdaptationOptionsforWeb.pdf), accessed 8 December 2019.

40 For more information on the Hout Bay Dune project see: Scientist in Limbo, 'Dune restoration vs sand stabilisation', 1 June 2017, <https://scientistinlimbo.com/2017/06/01/dune-restoration-vs-sand-stabilisation/>, accessed 8 December 2018; City of Cape Town, 'Hout Bay Dune Rehabilitation Project is in good shape', 7 September 2018, <https://www.tda.gov.za/en/news-and-events/press-releases/articles/hout-bay-dune-rehabilitation-project-is-in-good-shape/page-1/>, accessed 28 September 2018.

Other key challenges for the city are competing objectives and limited funding. This means that while it is often aware of what challenges exist and what solutions can/should be implemented to address those challenges, it can be difficult to obtain buy-in from stakeholders, as well as the required funding.

## Funding the management of coastal erosion in Cape Town

Dune systems are dynamic and factors such as erosion, drought and lack of vegetation contribute to their dynamic nature, ultimately resulting in dunes losing their shape and stability. The Table View System, as an example, has lost its natural shape and stability and the sand now blows over the road and walkways. The CoCT is in the process of undertaking a rehabilitation project that will require the planting of vegetation to stabilise the dune and stop the sand from blowing away. The rehabilitation of the Table View dune system will cost the city close to ZAR 40 million (about \$2.7 million) over the next 10 years. There are, however, other dunes that also require rehabilitation, meaning that the city faces competing priorities with a limited budget. In addition, the management of coastal erosion along the Milnerton coastline also has to be funded by the CoCT. At the same time, the severe drought recently experienced by the Western Cape has caused money to be channelled to drought management projects. This means that the CoCT must secure budgets to rehabilitate and maintain the coastal dune systems and other coastal systems by exploring innovative funding mechanisms.

### Case study: Durban

Durban, the largest urban area in the eThekweni Metropolitan Municipality, has a coastal strip comprised primarily of dune systems, estuaries, beaches and coastal forests. There is increasing pressure, owing to political and social demands, to develop the coastal strip. As a result, a 'squeeze' is created by property developments along the coast. To manage this, eThekweni has moved new developments back and cleared land in high-risk areas, although dealing with the impacts and risks associated with existing developments has been a challenge. This process has been enabled through the use of building set-back lines, which have been in place since the 1960s. In future, eThekweni will update set-back lines to CMLs, as defined by the ICMA. This is, unfortunately, being delayed by the parliamentary approval process for CMLs.

The eThekweni Environmental Planning and Climate Protection Department (EPCPD), particularly the Climate Protection and Biodiversity units, as well as the Coastal Policy Team of the Engineering Unit, plays a leading role in the strategic guidance and implementation of EbA projects in the municipality. However, the municipality does face coordination challenges, with individual departments often not working in close collaboration with

each other. To rectify this, 'climate change champions' have been appointed in different departments to help mainstream and integrate climate change and address the 'siloes approach' to management and development planning. This initiative was led by the Climate Protection Unit and has been successful, as climate issues are now being incorporated into different departments' plans and strategies.

In eThekweni, 'climate change champions' have been appointed in different departments to help mainstream and integrate climate change adaptation

eThekweni works in close collaboration with the DEA, SANBI, DWS, the Department of Cooperative Governance and Traditional Affairs, provincial government and other neighbouring municipalities. It has also formed several international partnerships and is a part of international agreements and engagements, such as with Dar es Salaam (Tanzania), as well as Pemba, Nacala and Quelimane (Mozambique). The municipality is also a member of the C40 Cities Climate Leadership Group.

eThekweni has committed to a peer-to-peer Durban Adaptation Charter, which was launched at the UNFCCC Conference of the Parties 17 hosted in Durban in 2011. The charter commits local governments to climate action in their jurisdictions that will help their communities respond to and cope with climate change risks, thereby reducing vulnerability.<sup>41</sup> The charter guides the management, implementation, capacity building and financing of climate change adaptation (among others) in local government. Among the signatories to the charter are 12 municipalities (including four districts municipalities) in KwaZulu-Natal (KZN); there are plans to include other municipalities from across the country.

EbA is currently a strategic priority for the municipality. This is evidenced by its Climate Change Strategy (2014), which states, as one of its goals, that 'biodiversity and associated natural capital need to be protected and enhanced to deliver ecosystem services that facilitate protection from and mitigation of climate change'.<sup>42</sup> Although the strategy does not explicitly mention EbA, it does mention the need to 'prioritise the restoration, protection and management of ecosystems that play a key role in alleviating the impacts of climate change on vulnerable communities or infrastructure'.<sup>43</sup> This means that EbA is an intrinsic part of the municipality's climate adaptation strategy.

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41 Durban Adaptation Charter, 'About the Charter', <http://www.durbanadaptationcharter.org/about-the-charter>, date accessed: 28 September 2019.

42 eThekweni Municipality, *Durban Climate Change Strategy*. Durban: eThekweni Municipality, 2014.

43 eThekweni Municipality, *op. cit.*

The 2010 World Cup provided an opportunity for the municipality to prioritise several climate change initiatives, such as reforestation of degraded areas as a way to sequester emissions. In terms of project implementation, key focus areas for eThekweni are dune systems, estuaries and coastal forests. eThekweni is also involved in the uMngeni Ecological Infrastructure project with various stakeholders, which is focused on addressing issues of water quality and water security. Additionally, it is leading the Community Ecosystem-based Adaptation project, which is aimed at uplifting local communities by creating 'green' jobs for the poor and unemployed, restoring ecosystems and reducing climate vulnerability.

Another key project that the municipality has implemented is a hybrid EbA project that combines off-shore dredging activities and dune rehabilitation (see text box). Since the Durban beach is not a nutrient-rich environment, the removal of sand has minimal impact on the natural system as a whole. A mapping exercise, which comprises three hydro-climatic scenarios, illustrated that the current EbA hybrid approach should be sufficient until about a 300cm (3m) rise in sea level, after which the municipality will have to switch to hard engineering options.

## Hybrid approach to dune rehabilitation in Durban

Just before the 2010 World Cup coastal storms and high tides caused large parts of the coastal dune to be washed away from the area in front of the Marine Drive properties, south of Umhlanga Rocks.<sup>44</sup> Added to this, storm swells sent



IC Smart/Ceity Images

Rehabilitated dune vegetation Durban, South Africa, 2016

<sup>44</sup> Horn D, Edwards T & A Starke, *Park to Park Dune Rehabilitation Project Management Plan*, September 2015, <https://www.emdlo.tiup.co.za/wp-content/uploads/2016/12/UIP-DUNE-Management-Plan-Umhlanga-Final.pdf>, accessed 9 May 2019.

massive waves crashing into Durban, washing away sections of the promenade and damaging nearby restaurants. This, combined with continuous impacts from wind-blown sand and fears of rising sea levels, led to the development of the dune rehabilitation initiative.<sup>45</sup>

The project is a hybrid solution as it involves dredging sand from the ocean floor, which is then used to stabilise sand dunes. It also involves augmenting and protecting existing dunes, where possible, by extending frontal dune zones. This is achieved by erecting sacrificial fencing (to aid dune development) and timber boardwalks (to define beach access points), as well as planting indigenous dune plants. It has resulted in the establishment of a new frontal dune zone along extensive stretches of the Promenade and along the Durban coast (such as South Beach and Bay of Plenty). The project has required the introduction of a regular maintenance regime. The key successes of this project have been the protection of infrastructure against wave surge and climate change-induced sea-level rise, the management of wind-blown sand from beaches, and the creation of an attractive green space.<sup>46</sup>

Over the years, this project has been remarkably successful. The rehabilitated dunes have grown vegetation and have captured sand. Ironically, the project has been so successful that some dunes on the Durban Promenade have started blocking sea views, which has sparked opposition from tourism stakeholders and in some cases have led to dunes being destroyed.

Funding for EbA projects – and for all other departmental activities – is mostly provided by the municipality. External funders are also approached for additional funding should this be required; this is done by submitting proposals to funding institutions (eg, Greenfund, the Danish International Development Agency, SANBI, Gesellschaft für Internationale Zusammenarbeit GmbH [GIZ], the US Agency for International Development [USAID] and the Development Bank of Southern Africa).

The municipality is currently experiencing challenges with skills and resource capacity, which limit the number of functions that can be fulfilled. Added to this, the lack of institutional and inter-departmental coordination means that there are still problems related to integrated responses. Other challenges experienced by the municipality, particularly the departments responsible for EbA implementation, include limited recognition of the benefits of EbA, limited knowledge of the benefits of ecosystem services and how these can be maintained or destroyed by communities, and political interference (when it comes to project prioritisation).

45 Sprig, 'Dune rehabilitation', December 2010, <https://www.sprig.co.za/2010/12/dune-rehabilitation/>, accessed 28 September 2018.

46 Open Greenmap, 'Durban Central beachfront dune rehabilitation', <https://www.opengreenmap.org/greenmap/durban-ethekwini-municipality-south-africa/durban-central-beachfront-dune-rehabilitation-38721>, accessed 28 September 2018.

# Challenges and opportunities

Based on the case studies above, various challenges and opportunities for EbA in coastal cities emerge. These are discussed briefly below and can be broadly described as challenges and opportunities associated with regulation, governance and management, institutional arrangements and partnerships, knowledge, communication and engagement, and financial mechanisms.

## Regulation, governance and management

South Africa has three spheres of government – national, provincial and local – all operating at different scales. It is one of the leading countries in terms of EbA policy development, and other countries rely on its strategies and guidelines as examples for their own policy development. However, the country experiences various challenges in the regulation, governance and management of EbA, particularly at the local level. These challenges include:

**The lack of CMLs as enabling mechanisms for EbA:** One of the most important management tools available for EbA governance is the CML provided for in the ICMA. Despite the ICMA's promulgation in 2009 and it being a legislated requirement for municipalities to have a CML in place, there is currently not a single coastal municipality in South Africa that has promulgated one. The CoCT completed its CML in 2014 and is still waiting for it to be promulgated by Parliament in terms of the ICMA. In the interim, the CoCT has incorporated it into its Municipal Spatial Development Framework (MSDF, represented as the Coastal Urban Edge). The MSDF is the CoCT's main planning tool and is used to guide and determine urban form and typology. It is the only local government to have incorporated its CML into the MSDF, and is now regulated in terms of its MSDF and the municipal planning by-law. eThekweni Municipality has included the development of the CMLs in the action areas identified under the 'adapting and building resilient communities' priority area of the KZN Coastal Management Programme (2017-2022).<sup>47</sup>

The DEA and DWS have not yet developed CMLs for estuary management. They have been using the 5m contour line as a default option for governance, planning and management purposes, but this is not adequate. It is necessary to better map out estuaries geographically and at a higher resolution, and to join estuaries to municipal CMLs. This will ensure more integrated management of coastal areas.

**Complex jurisdictions:** Jurisdictional authority between municipalities, the DEA and DWS is complex and can undermine effective cooperation. The regulation, governance and management of EbA in marine and coastal areas are primarily the responsibilities of the

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<sup>47</sup> KZN Provincial Government, 'KwaZulu-Natal Coastal Management Programme (2017 - 2022)', Presentation, [https://www.phelamanga.co.za/images/CMP\\_PRESENTATION\\_20517.pdf](https://www.phelamanga.co.za/images/CMP_PRESENTATION_20517.pdf), accessed 28 September 2018.

DEA, although this is solely from the high-water mark seawards; from the high-water mark landwards, municipalities are responsible for the regulation, governance and management of EbA. As such, the coastal Spatial Development Frameworks (SDFs)<sup>48</sup> end at the high-water mark. For estuaries, the DWS is the leading regulator.

This means that for coastal cities, regulating entities can be one of three different entities or a partnership between several entities, depending on the natural system and geographic boundary. Also, certain EbA interventions (eg, the protection of kelp forests) fall under marine spatial planning (under the DEA), coastal wetlands fall under water resources management (under the DWS), and mangrove forests fall under coastal spatial planning (in the municipality).

**Enforcement of legislation:** A challenge faced by both eThekweni Municipality and the CoCT is the enforcement of the ICMA. The municipalities are not empowered to enforce the act, but the national and provincial governments face capacity constraints that undermine their ability to enforce it. Municipalities generally do not have sufficient financial and human resources to implement the functions of multiple government entities.

**Political will:** Since the coast is an attractive space for development, politicians often prioritise revenue-generating sectors, addressing social challenges (in peri-urban areas) or levying rates and taxes (in affluent urban areas). In these instances, the possibility of addressing social challenges or obtaining income from additional rates and taxes supersedes the critical functioning that EbA provides, leaving little incentive to protect or rehabilitate marine and terrestrial ecosystems.

**Competing priorities:** Political objectives and competing strategic priorities within municipalities in the context of restricted budgets mean that choices must be made and only a limited number of projects can be implemented. As such, EbA projects are often lower on the list of priorities, with social issues, basic services and engineering projects more likely to be prioritised during the municipal planning and budgeting process. For instance, the recent drought in the Western Cape forced the CoCT to take urgent measures to ensure an alternative water supply. A desalination plant was built in False Bay, which required the flattening of a section of dune cordon. In this instance, the severity of the drought and the urgent need to supplement water supply trumped the protection of the natural vegetation. eThekweni, on the other hand, installed a desalination plant several kilometres away from the beach strip and managed to maintain the dune systems because, at the time, it did not face the same critical water shortage as the CoCT.

**Lack of long-term planning:** Long-term planning is a major challenge at both national and local level. This is particularly important since project approval and implementation at the national and local level are protracted processes, taking anything from one to five years

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48 A Coastal Spatial Development Framework is a framework that seeks to guide the overall spatial distribution of current and desirable land uses within the coastal region of a municipality in order to give effect to the vision, goals and objectives of the municipal Integrated Development Programme.

from concept development to project completion. Since conditions are fluid, decisions made today may not be applicable in the future. Population change, changing economies and climate change result in constant changes to the environment, and decision makers need to be responsive to these changes.

### **Institutional arrangements and partnerships**

To ensure effective EbA governance and implementation, the DEA and SANBI work in close collaboration with the CoCT (Climate Change and Coastal Management units) and eThekweni Municipality (Climate Protection, Engineering, and Biodiversity branches). While coordination mechanisms are in place (as discussed earlier), issues regarding institutional coordination (both within departments and across institutions), as well as resource constraints, limit the ability of the entities to exercise their mandates. This is unfortunate, since these entities enable coordination, collaboration and knowledge/information sharing between the various institutions. Different spheres of government tend to operate in silos, and as a result institutions do not always understand the planning challenges faced by city municipalities.

At the DEA, eThekweni and CoCT, partnerships have proven useful in terms of helping institutions meet their objectives. For instance, the DEA is partnering with the Council for Scientific and Industrial Research to develop indicators to monitor marine and coastal environments. At eThekweni, the Climate Protection Unit works closely with the Energy Office on mitigation efforts, as well as with the Coastal Policy Unit of the Engineering Department. Similarly, the Biodiversity Unit at eThekweni, also situated within the EPCPD, has strong partnerships with various national departments and institutions. eThekweni Municipality also works closely with KZN Parks & Recreation on the implementation of rehabilitation projects, as well as with private sector entities on dune rehabilitation.

There is also potential for strong partnerships with insurance companies. Unfortunately, insurance companies have in the past proven hesitant to share information on their spatial risk assessments for coastal areas. This means that local governments must fund and undertake their own studies and essentially duplicate the work already undertaken by insurers. This is not only time consuming but also an inefficient use of resources.

### **Knowledge, communication and engagement**

At the community level, the lack of knowledge of nature-based adaptation options and ineffective engagement by governance stakeholders result in a lack of buy-in for EbA projects. Communities are often not aware of how ecosystems can benefit them, or how undermining ecosystem services can result in negative social impacts. There is therefore a need to explain the benefits of EbA to communities effectively. To achieve this, it is critical that communities are engaged continuously, particularly when political cycles result in changes in governance.

Within institutions, the lack of knowledge of the shared benefits provided by EbA, coupled with ineffective communication, leads to unsuccessful collaborations and partnerships.

For example, in some municipalities EbA implementation and overall climate adaptation is not progressing as fast as it could because various departments do not have a clear understanding of coastal risks, the dynamic nature of natural systems and the relevance of climate change to their own governance mandates. Practitioners often make plans for the current environment, not recognising that the natural system will change and that solutions based solely on current realities may not be applicable in future.

More needs to be done to ensure that all members of society, particularly municipal practitioners, understand climate change and how current and future climate impacts can and should be managed. This includes a holistic understanding of climate adaptation and how different sectors (and departments) have a role to play in building a resilient society and ensuring socio-economic development.

### **Financial mechanisms**

Municipalities already operate with constrained budgets where service delivery is the primary priority and climate adaptation is often seen as an additional 'nice to have'. The availability of financial resources can be an enabling or inhibiting factor in the governance and implementation of EbA in coastal cities. In both eThekweni Municipality and the CoCT, the municipalities play a major role in funding EbA projects through the budgeting process, but this is not sufficient.

Additional external funding is also sourced as required, from both national (eg, SANBI) and international sources (eg, GIZ, USAID and C40). Securing external funding and exploring innovative financing models are essential in enabling municipalities to meet their funding needs. However, even when external grant funding is received it can be difficult to justify EbA prioritisation, and to effectively and efficiently use such funding for EbA initiatives. Bureaucratic challenges relating to establishing partnerships and the management of funds made available by external sources must be addressed if such funding sources are to make a meaningful contribution to enhanced resilience at the city level.

## **From reality to ideal**

As emphasised throughout this report, EbA benefits both nature and people, and can be used to address South Africa's socio-economic and development goals. For example, poor urban and rural communities, whose livelihoods often depend on healthy natural resources and ecosystems, can benefit from EbA projects and programmes. Therefore, it is important that South Africa recognise and communicate the developmental outcomes of EbA, with an emphasis on poverty reduction and sustainable employment. For this to happen, it is critical that the challenges associated with regulation, governance and management, institutional arrangements and partnerships, knowledge, communication and engagement, and financial mechanisms are addressed, and that the opportunities are exploited efficiently.

## Regulation, governance and management

EbA offers an opportunity to fully integrate coastal and marine resources into coastal zone and marine management planning and response strategies. However, local governments require the necessary legislative frameworks, supported by institutional arrangements, to enable effective governance and strategic direction. Although CMLs provide this, the fact that they have not been promulgated inhibits local government.

EbA needs to be drawn into local government planning initiatives. A planning mechanism such as the SDF is critical in lending greater weight to EbA during trade-off assessments. For example, when its CML failed to be promulgated, the CoCT incorporated the CML into its main planning tool, the MSDF.<sup>49</sup> The promulgation of the CML remains an important piece of the governance puzzle; once this happens local governments will have more power when dealing with properties that encroach onto coastal ecosystems.

EbA needs to be drawn into local government planning initiatives, but promulgation of the CML remains an important piece of the governance puzzle

Long-term planning must be a priority for the municipality, and should be integrated into the decision-making process. Decision makers need to understand the system as a whole to see how it will change in future, and how climate change will influence these changes. Long-term planning enables a balanced approach, and therefore allows for the inclusion of dynamics such as population growth, growing economies and climate change. For instance, the populations of inland cities will likely shrink owing to increasing heat stresses, while coastal cities will have growing populations owing to the cooler climate. Coastal cities will also be exposed to increasing climate risks, which will have an impact on these populations. It is therefore critical that all coastal cities, and particularly smaller coastal towns, use strategies such as EbA and multi-disciplinary planning now, while they grow, and not wait until they are large cities and are forced to take retroactive steps.

One action suggested as an initial framework to guide best practice is to integrate EbA interventions into broader adaptation strategies and practices across sectors.<sup>50</sup> This means

49 The City of Cape Town is the only local government to have drawn its CML into the MSDF, and it is now regulated in terms of its MSDF and planning by-laws. This is a huge win for the CoCT, since it used its biodiversity network as one of the key informants and spatial representation of EbA to determine the position of the Coastal Urban Edge. Lessons learned from this process, as well as various principles and process that may be followed in the determination of CMLs, can be found in Colenbrander DR & MR Sowmans, 'Merging socioeconomic imperatives with geospatial data: A non-negotiable for coastal risk management in South Africa', *Coastal Management*, 43, 3, 2015, pp. 270-300.

50 DEA & SANBI, 2018, *op. cit.*, p. 21.

ensuring that EbA projects and policies are in line with other sector policies and plans and work towards a common goal.

## Institutional arrangements and partnerships

The delivery of a wide range of co-benefits through EbA requires a coordinated programme of work implemented by partners and stakeholders across sectors, and by governments across national, provincial and local levels. This may also require international cooperation, given that many ecosystems are transboundary. A transdisciplinary and multi-sectoral programme of work is thus needed. There are opportunities to learn from the institutional mechanisms established to coordinate South Africa's biodiversity mainstreaming programmes.<sup>51</sup>

Strengthening opportunities for lesson sharing and knowledge exchange is a priority activity in most of the strategies reviewed in the NBF. Over the past decade the biodiversity sector has demonstrated the effectiveness of working in multi-stakeholder (and often cross-sectoral) partnerships that operate at different scales to address biodiversity conservation and social development challenges in an integrated way. These partnerships are a powerful mechanism for coordination at the sub-national level, across government, the private sector and non-governmental organisation lines, and are an excellent opportunity to address multiple priorities simultaneously. Multi-stakeholder partnership programmes can be determined spatially (landscape-scale initiatives) or thematically (large-scale projects dealing with particular aspects of biodiversity conservation or management), or through a combination of these criteria.<sup>52</sup>

Cross-institutional partnerships create a sense of common purpose, [and] facilitate alignment and more strategic allocation of limited resources

The ICMA provides for mandatory national and provincial coastal committees, while local coastal committees are optional. These committees are among the most important institutional arrangements already in place that can be used as a platform to address EbA approaches. It is important to work in strong, collaborative partnerships, as cross-institutional partnerships create a sense of common purpose, facilitate alignment and more strategic allocation of limited resources, and build cohesion at a larger scale. They also make it possible to leverage greater implementation capacity than is possible when

51 DEA & SANBI, 2016, *op. cit.*

52 DEA, October 2018, *op. cit.*

institutions act in isolation.<sup>53</sup> It is important that all levels of government take coordinated action and that stakeholders are able to share lessons learned. For this to happen, it is essential that a shared purpose and vision is emphasised and understood by all.

## Knowledge, communication and engagement

In municipalities, currently only a small group of individuals are knowledgeable about climate adaptation and EbA. There is, therefore, a need to improve the way that EbA is communicated; a simple message that relays the benefits of EbA is needed to get the buy-in of individuals. Messaging should focus on addressing human rights and be 'risk' focused, for example: What are the risks associated with climate change impacts in coastal zones? How can EbA assist in managing and mitigating these risks? Such an approach will ensure greater support for EbA and increase the likelihood of nature-based solutions being accepted as a strategic priority for a city.

To encourage knowledge sharing, peer learning and capacity development, improved communication should be promoted. This applies to both community members and practitioners in the municipality. An annual lekgotla targeted at coastal municipalities and other relevant stakeholders, for instance, would also provide a safe space for learning and knowledge sharing. Environmental awareness and education, driven by a profound understanding of the coastal risks and social drivers of negative environmental impacts,

**Community members and practitioners need a safe place for learning and knowledge sharing**

are essential in ensuring long-term behavioural changes. For instance, environmental education while children are still in school will ensure that environmental protection becomes rooted in their everyday habits. This is also stated in the NBF, which prioritises 'mobilising people' to ensure 'people's awareness of the value of biodiversity is enhanced through more effective coordination and messaging'. According to the NBF, this can be achieved by:<sup>54</sup>

- developing and funding a coordinated national biodiversity communication, education and awareness strategy, implementation plan and monitoring framework; and
- strengthening environmental literacy through citizen science programmes.

53 *Ibid.*

54 *Ibid.*

If EbA is a suitable option for the area under consideration, then multi-stakeholder engagement should be planned at the onset of the process. In order to ensure equitable stakeholder engagement at all stages, it is essential that EbA workshops be timely programmed at each step of the process, convening actors from the target site (and its catchment area) along with relevant local and national experts. Such workshops should include a focus on mapping and spatial analysis; risk profiling; stakeholder identification; institutional and policy screening; ecosystem services appraisal; the evaluation and selection of adaptation measures; and the definition of monitoring and evaluation indicators.<sup>55</sup>

## Financial mechanisms

Limited financial resources compromise the ability of institutions in the biodiversity sector to fulfil their mandates and implement EbA projects. The BIOFIN Biodiversity Finance Plan for South Africa (2017)<sup>56</sup> was developed to identify and support the implementation of innovative finance solutions that augment existing sources of funding from the government, the private sector and other sources. Additional resources can be mobilised by:<sup>57</sup>

- increasing allocations from existing sources (the national fiscus and non-state resources);
- improving the effectiveness with which existing funds are used (through more strategic allocations and reducing costs); and
- mobilising resources from new sources.

There are opportunities for municipalities to explore external sources of funding. This gives municipalities a chance to obtain supplementary funding, although appropriate internal systems and mechanisms are needed to enable this (ie, municipalities should not have so much red tape that it deters funders). External sources include traditional funding sources (such as the Green Climate Fund) or more innovative sources. Innovative approaches to climate finance are key to ensuring that sufficient and sustainable funding is available to effectively implement EbA interventions. For instance, in recent years there has been a growing interest in payments for ecosystem services (PES)<sup>58</sup> to enable EbA interventions. Incentive schemes<sup>59</sup> can also encourage the uptake of EbA implementation.

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55 Jiménez Hernández A, *op. cit.*

56 For more information, see BIOFIN (Biodiversity Finance Initiative), 'South Africa', 2017, <http://www.biodiversityfinance.org/south-africa>, accessed 14 December 2018.

57 DEA, October 2018, *op. cit.*

58 Payments for ecosystem/environmental services (PES) refers to the concept of external service beneficiaries making direct, contractual and conditional payments to local landholders in return for adopting land use practices that secure environmental conservation and restoration. The broader umbrella may include product eco-certification, park entrance fees, and tradable development rights. A narrower definition, based on Wunder (2005): A voluntary transaction in which a well-defined environmental service (or a land use likely to secure that service) is bought by a service buyer from a service provider if and only if the provider continuously secures the provision of the service. Wunder S, 'Payments for Environmental Services: Some Nuts and Bolts', Jakarta: CIFOR (Center for International Forestry Research), 2005.

59 Incentive schemes for local projects and communities include direct financial support to coastal rehabilitation and conservation, or rewards for socially and ecologically sustainable practices.

Another useful funding avenue for EbA projects in coastal cities is the insurance industry. As the insurance industry possesses abundant tools, systems and skills to assess coastal risks, a partnership with it will enable cities to budget for, finance and manage the economic aspects of coastal risks. For example, the Nature Conservancy has argued that a trust fund (such as a Coastal Zone Management Trust similar to that established in the Caribbean to promote conservation of coastal areas) and an insurance-for-nature approach is a unique solution to some of the most urgent challenges faced by marine and ecosystems around the world.<sup>60</sup> These methods provide sustainable finance for the implementation of coastal and marine EbA.

In seeking project finance, whether internally or from external funding sources, it is essential that project design and marketing be prioritised. The manner in which a project is packaged and marketed determines whether it can access specific pots of funding, particularly funding streams not directly allocated to EbA or climate adaptation. This is certainly the case with municipalities, where climate adaptation efforts must be weighed against other objectives in the context of limited budgets. In eThekweni, for instance, the dune rehabilitation project (a hybrid EbA/hard engineering project) was funded by the municipality because the project proposal highlighted not only the environmental benefits but also the benefits to tourism (a key contributor to Durban's economy) and to people living along the coast. Providing a business case for the project, including socio-economic benefits, ensures there is a greater likelihood that the project will be funded. A similar approach was employed in Dar es Salaam, where a 'city park' is being planned in the Msimbazi Valley. The project is partly funded by the World Bank, and was able to access significant funding by promoting the venture as an 'urban planning, restructuring and resilience' project rather than purely a flood-risk management project.

To achieve this, it is important that projects are designed using cross-sectoral teams that can highlight the benefits of the EbA project for different sectors, particularly socio-economic benefits. By highlighting the different components of the projects as well as the various benefits, it is possible to access funding that is targeted at any one of those benefits.<sup>61</sup>

Lastly, it is important that funding proposals include cost-benefit analyses to ensure support. For example:

- 'This EbA project will cost ZAR xx million to implement over x years, while the alternative is an engineering project that will cost ZAR yy million to implement over y years. The added benefits of the EbA project are *a*, *b*, and *c*, while the engineering project will only address issue *d*.'

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60 See Swiss Re Group, 'Designing a new type of insurance to protect the coral reefs, economies and the planet', 5 March 2018, [http://www.swissre.com/global\\_partnerships/Designing\\_a\\_new\\_type\\_of\\_insurance\\_to\\_protect\\_the\\_coral\\_reefs\\_economies\\_and\\_the\\_planet.html](http://www.swissre.com/global_partnerships/Designing_a_new_type_of_insurance_to_protect_the_coral_reefs_economies_and_the_planet.html), accessed 10 December 2019.

61 For instance, a sustainable fisheries management project can be positioned as a fisheries, biodiversity/conservation, livelihoods or poverty reduction project, and can, therefore, access funding that is targeted at any of these themes.

- ‘If we do not implement this EbA approach, the long-term cost to manage the negative climate change impacts will be *a*, *b* and *c*.’

In conclusion, implementing identified EbA priorities and strategies requires the operationalisation of policies, which depends, in part, on available financial resources. In addition, policies need to be translated into budget allocations and expenditures, making climate change part of the national budgeting process.<sup>62</sup> With enabling policies, institutional mechanisms and partnerships, municipalities will be able to address their funding needs, which is one of the main gaps in transferring societally set goals into implemented adaptation measures.

## Recommendations

Despite a number of demonstrably successful EbA cases, current practice still focuses on planning and implementing ‘grey’ infrastructure solutions (eg, concrete walls and dykes). This is because of a lack of transferable and user-friendly concepts, methodologies and instruments to mainstream and integrate EbA into local government planning and decision-making processes, among others. Moreover, many individuals and organisations at the local, regional and national level do not yet know of the benefits of EbA. Often, those responsible are not familiar with EbA alternatives to hard infrastructure approaches or are unable to assess these options properly. Although more and more projects deal with adaptation mainstreaming and EbA-related issues, there is currently no systematic exchange between the parties concerned.<sup>63</sup>

Despite a number of demonstrably successful EbA cases, current practice still focuses on planning and implementing ‘grey’ infrastructure solutions

Drivers of, and barriers to, EbA implementation and mainstreaming include financial and human resources, knowledge and information, ownership, and stakeholder engagement and partnerships. In particular, the lack of thorough and systematic documentation on the long-term functioning and effectiveness of EbA projects, as well as long-term cost-benefit analyses (social, environmental and financial), has led to reluctance, scepticism and uncertainty.

62 UNDP, ‘Making the Case for Policy Change and Financing for Ecosystem-based Adaptation’, Global Ecosystem-Based Adaptation in Mountains Programme Learning Brief, 4. New York: UNDP, 2016.

63 GIZ (Gesellschaft für Internationale Zusammenarbeit GmbH), ‘Mainstreaming ecosystem-based adaptation’, <https://www.giz.de/en/worldwide/37322.html>, accessed 2 July 2018.

If stakeholders understand and communicate the existing coastal risks and their underlying causes, as well as EbA options and their associated benefits, buy-in will improve. 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 not only improve coastal cities' ability to adapt to climate change impacts but also increase the resilience of coastal communities and their socio-economic well-being. Based on this report, several key recommendations can be implemented.

## Regulation, governance and management

Local government requires relevant regulatory and legislative frameworks, supported by long-term planning and adequate resources, to enable effective governance and strategic direction. However:

- **The lack of CMLs is inhibiting the implementation of EbA.** CMLs for coastal municipalities and estuaries should be promulgated to ensure more integrated management of coastal areas and provide local governments with a stronger basis for managing and governing issues such as developments that encroach onto coastal ecosystems.
- **There is not enough clarity on the jurisdiction between municipalities, the DEA and the DWS:** It is essential that all the stakeholders are informed about jurisdictions and relevant institutional arrangements, and that awareness is raised.
- **Coastal municipalities struggle to enforce legislation:** Municipalities and other spheres of government need sufficient financial and human resources, as well as support from various partnerships. By sharing roles and responsibilities, different spheres of government will be able to implement their mandates more effectively.
- **Competing priorities, political objectives and strategic priorities in the context of limited budgets mean that choices need to be made regarding project selection, with EbA projects often side-lined in the process:** It is recommended that champions are identified within municipalities to advocate for EbA. This can further bridge the knowledge and skills gap in those authorities responsible for EbA implementation and enforcement. Champions for EbA approaches can also ensure that guiding science and management frameworks are brought to the attention of local decision makers.
- **A lack of long-term planning is a challenge at both the national and local level:** Since conditions are fluid, long-term and multi-disciplinary planning should be integrated into decision-making processes. Added to this, local conditions must be taken into consideration by categorising high-risk areas/communities and climate impacts to ensure that these areas receive the necessary EbA focus. This will ensure a balance between the development and protection of ecosystems.

## Institutional arrangements and partnerships

Effective institutional arrangements and partnerships, both within departments and across institutions, enable coordination and collaboration and have proven useful in helping institutions meet their objectives. However, coordination challenges limit the ability of institutions to carry out their EbA mandate.

- **Different levels of government, and departments within these levels of government, tend to operate in silos, and as a result institutions do not collaborate as effectively as they could:** Integration between various departments should be prioritised, as the delivery of a wide range of EbA benefits requires a coordinated programme of work implemented by partners and stakeholders across sectors. The establishment of local coastal committees is one way of promoting collaboration at this level.
- **Human resource and capacity constraints at all levels of government limit the functions that can be implemented:** In such instances, partnerships make it possible to leverage greater implementation capacity than is possible when institutions act in isolation. Partnerships provide opportunities for lesson sharing and knowledge exchange, and also facilitate alignment and more strategic allocation of limited resources.
- **Owing to limited participation by and unbalanced contributions from different stakeholders, partnerships often do not meet the required objectives and are therefore often unsustainable:** It is essential that a shared purpose and vision is highlighted and understood by all. It is therefore important to work in strong, collaborative partnerships, as cross-institutional partnerships create a sense of common purpose and build cohesion at a larger scale.

## Knowledge, communication and engagement

The manner in which EbA is communicated plays a major role in determining whether all relevant stakeholders support the initiative. It is essential that all stakeholders are included in the EbA conversation, and that simple language with a focused message relaying the socio-economic benefits of EbA is used. Added to this:

- **At the community level, lack of knowledge and ineffective engagement result in a lack of support for EbA projects:** There is a need to simply and effectively explain the socio-economic benefits of EbA to communities by continuously engaging them.
- **Within institutions insufficient knowledge, coupled with ineffective communication, is one of the leading causes of unsuccessful collaborations and partnerships:** More can be done to ensure that all practitioners understand climate change and how current and future climate impacts can and should be managed. This is particularly important since socio-economic factors that will be impacted by climate change are the responsibility of different departments.

- **To encourage knowledge sharing, peer learning and capacity development, improved communication should be promoted:** This applies to both community members and practitioners in the municipality. Environmental awareness and education, driven by an in-depth understanding of the coastal risks and social drivers of negative environmental impacts, are essential in ensuring long-term behavioural changes. For instance:
  - » an annual lekgotla, forum or indaba can provide a safe space for learning and knowledge-sharing for government officials and practitioners working with EbA;
  - » environmental education in primary or high school will ensure that environmental protection becomes rooted in pupils' everyday habits; and
  - » environmental literacy through citizen science programmes will promote awareness of and support for nature-based adaptation options.

## Financial mechanisms

Financial constraints compromise the ability of institutions to fund and implement EbA projects. Municipalities can get additional funding from both national and international sources. To improve financial resources, they should:

- **Explore national and international innovative approaches to climate finance:** This is key to ensuring that sufficient and sustainable funding is available to effectively implement EbA interventions. Innovative approaches include:
  - » implementing financing mechanisms based on partnerships with different stakeholders;
  - » exploring PES to enable EbA interventions;
  - » designing funds that ensure sustainable long-term project funding;
  - » implementing incentive schemes that encourage the uptake of EbA implementation, such as directly supporting coastal rehabilitation and conservation, or rewards for socially and ecologically sustainable practices; and
  - » going into partnership with the insurance industry, as it is well versed in evaluating coastal risks.
- **Prioritise project packaging and marketing when seeking project finance, whether internally or externally:** This will require projects to be designed using cross-sectoral teams that can highlight the multiple benefits, particularly socio-economic benefits, that are possible.

# Conclusion

The coast is an area where various pressures are converging, leading to significant challenges. A balance is needed between addressing socio-economic issues, on the one hand, and protecting ecosystems, on the other hand. EbA has proven to provide multiple benefits for coastal cities and the populations they support. However, for this to happen, it is critical that the barriers highlighted in this report are addressed. Importantly, the full integration of EbA approaches into local decision-making requires long-term commitment and patience from all stakeholders.

# Annexure: Options for EbA in coastal cities

There are many options for implementing EbA in marine and coastal environments. These options, like other climate adaptation options, include no-regret, low-regret or win-win interventions that use biodiversity and ecosystem services as part of an overall adaptation strategy. Below are brief descriptions of some of the available options for marine and coastal EbA.<sup>64</sup>

## **Mangrove conservation and restoration**

Mangroves are trees or large shrubs that are salt-tolerant and grow in intertidal zones in tropical and subtropical regions. There is good evidence that, in the right circumstances, mangroves can help to reduce vulnerability to climate-related coastal hazards. As a result, mangrove restoration has been used as an ecosystem-based disaster risk reduction and adaptation measure. Other additional benefits include habitats for numerous species, protection for corals from ocean acidification, improved water quality and nutrient transfer, filtering and trapping sediment from run-off, reduced water turbidity and essential light being allowed to reach ecosystems. Mangroves also act as carbon sinks.

## **Seagrass/kelp conservation and restoration**

Seagrass/kelp beds are formed by a group of flowering plant species that grow underwater in the sandy substrate of the shallow coastal zone of most continents. Seagrass/kelp can reduce current velocity, dissipate wave energy and stabilise the sediment, most reliably in shallow waters with low wave energy environments, and where biomass does not fluctuate over time. Reduced wave energy can help lessen flooding and erosion in coastal areas and settlements – two hazards that may increase in severity with a changing climate. In addition, seagrass/kelp habitat support livelihoods and are important for a wide range of species that may spend all or part of their life cycle within the seagrass/kelp ecosystem.

## **Coral reef conservation and restoration**

Coral reefs are marine ecosystems located in shallow coastal zones of tropical and subtropical regions. The ecosystem is shaped by the calcium carbonate structures secreted by coral polyps. Coral reefs occupy a small percentage of the world's oceans, but contain a disproportionately high share of its biodiversity. The importance of coral reefs for a wide range of ecosystem services is widely recognised, as conserving existing areas of coral reef often results in improved ecosystem service provision. In addition, coral reefs contain species that are important for medicine and can support tourism and recreation.

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64 UNEP, 'Coastal ecosystem-based adaptation', *op. cit.*

## Dune and beach conservation and restoration

Sand dunes are naturally dynamic environments that are constantly changing in extent and form, owing to fluctuations in natural environmental forcing factors (ie, winds, waves and tides). Dunes and beaches are widely seen as a buffer between the land and sea and as providing important coastal protection and tourism opportunities. In addition, sand dunes play an important role in water regulation and purification, as coastal dune aquifers are a major source of water extraction, and also conserve specialised flora and fauna.

## Coastal retreats – managed realignment and coastal set-backs

Coastal retreat is the proactive determination and implementation of realistic set-back lines along coasts, whether the land affected is urban, rural or agricultural. Managed realignment (also known as managed retreat, dyke realignment, dyke reopening, de-embankment and de-polderisation) and coastal set-backs (ie, CMLs) are two forms of coastal retreat. 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 a zone next to the existing shoreline that is then managed as a type of buffer zone. Both managed realignment and coastal setbacks create the potential for new habitats for biodiversity. It is important to recognise, however, that by allowing the coast to reclaim land, important habitats behind existing coastal defences, such as grazing areas, will be altered by tidal inundation, which ultimately will have an effect on biodiversity.

## Coastal wetland conservation and restoration

Coastal wetlands include saltwater marshes, estuaries, mangroves, lagoons and coral reefs. Wetlands have been widely recognised as providing a range of valuable ecosystem services. Of particular importance for adaptation is their role in reducing incoming wave and tidal energy by enhancing energy dissipation through increasing the roughness of the surface over which incoming waves and tides travel. Additionally, in contrast to hard defences, wetlands can keep pace with sea level rise with the increased accumulation of sediments raising the elevation of the wetland. Lastly, restoring inland wetlands can promote the flow of fresh water from inland aquifers to recharge coastal aquifers and re-balance the freshwater-saltwater interface. They also provide a variety of other ecosystem services, including breeding and nursery grounds for various birds, fish, shellfish and mammals, supporting the resilience of these ecosystem services and the livelihoods they provide, and providing water filtration functions and ecotourism opportunities.

In cities, **urban wetlands** play an important role as water filters and in flood control. Urban wetlands absorb excess rainfall (like a giant sponge), which reduces flooding in cities and prevents disasters and their subsequent costs. In addition, the abundant vegetation found in urban wetlands acts as a filter for domestic and industrial waste, which contributes to

improved water quality. Urban wetlands also supply cities with water and green spaces for recreation, which helps to promote human well-being.<sup>65</sup>

### **Marine protected areas (MPAs)**

MPAs are areas set aside to protect marine ecosystems. They have a clearly defined geographical space, which is recognised, dedicated and managed (through legal or other effective means) to achieve long-term conservation of nature, along with associated ecosystem services and cultural values. MPAs are a tool 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.

### **Sustainable fisheries management**

Sustainable fisheries management is an integrated process that 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) as an alternative to species-based management in order to account for the broad range of interdependent relationships that occur within ecosystems. Effective EAFM can achieve multiple objectives that increase coastal communities' resilience under climate change and therefore act as an EbA measure.

### **Living breakwaters**

Breakwaters are off-shore, often submerged, structures that form a barrier between the sea and the 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. 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 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. This list is not exhaustive, but is intended to provide a representation of EbA interventions that can be implemented in South African coastal cities.

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65 WWF Zambia, 'Wetlands for sustainable cities', 2 February 2018, [https://www.wwfzm.panda.org/resource\\_center/press\\_releases/?229370/Wetlands-for-Sustainable-Cities](https://www.wwfzm.panda.org/resource_center/press_releases/?229370/Wetlands-for-Sustainable-Cities), accessed 18 June 2018

# Authors

## Ernesta Swanepoel

specializes in climate change and international environmental law, with specific interests in climate change policy developments and ocean governance. She is an admitted attorney who holds a BCom (Law), an LLB and an LLM (Marine and Environmental Law).

## Siyasanga Sauka

is a Climate Change Researcher at the South African Institute of International Affairs (SAIIA). She holds a BSc (Hons) and an MSc in Geography, and her work focuses mainly on climate change, integrated natural resource management and environmental sustainability.

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## Cover image

The Umgeni River, Durban, Kwazulu-Natal, South Africa (Wildacad/Getty Images)

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Jan Smuts House, East Campus, University of the Witwatersrand  
PO Box 31596, Braamfontein 2017, Johannesburg, South Africa  
Tel +27 (0)11 339-2021 · Fax +27 (0)11 339-2154  
[www.saiia.org.za](http://www.saiia.org.za) · [info@saiia.org.za](mailto:info@saiia.org.za)