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Technical report on the status of coastal vulnerability in central African countries

ICAM dossier nº 10

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Abbreviations and Acronyms

AIMS	African Integrated Maritime Strategy
AU	African Union
CAS	Central Africa Sub-region
CBD	Convention on Biological Diversity
COP	Conference of Parties
CVI	Coastal Vulnerability Index
EEZ	Exclusive Economic Zone
ECCAS	Economic Commission of Central African States
EIA	Environmental Impact Assessment
FAO	Food and Agriculture Organization of the United Nations
GCLME	Guinea Current Large Marine Ecosystem
GDP	Gross Domestic Product
GIS	Geographic Information System
GhG	Greenhouse Gas
ICAM	Integrated Coastal Area Management (IOC)
ICZM	Integrated Coastal Zone Management
IOC	Intergovernmental Oceanographic Commission of UNESCO
IODE	International Oceanographic Data and Information Exchange (IOC)
IPCC	Intergovernmental Panel on Climate Change
MSP	Marine Spatial Planning
RRA	Regional Risk Assessment
TDA	Transboundary Diagnostic Analysis
UNFCCC	United Nations Framework Convention on Climate Change
UNCLOS	United Nations Convention on the Law of the Sea
UNESCO	United Nations Educational, Scientific and Cultural Organization
SLR	Sea Level Rise

Foreword

It is impossible to overemphasise the importance of access to the Atlantic Ocean for the seven coastal developing countries of Central Africa[1]. The coastal belt houses highly crucial economic sectors like fisheries, tourism, agriculture, energy and maritime transport. However, these activities suffer from poverty and inequality, underperforming governance, various conflicts, limited access to capital and markets, insufficient development of infrastructure and technology, ecosystem degradation and natural disasters[2].

Impact of climate change and other anthropogenic factors across the Central African coastal region is not uniform, but many countries have identical challenges. In order to realise the full development potential of the Central Africa coastal zone, in the face of continuously increasing vulnerability of countries to climate and environmental change, the key is to understand the region's adaptive capacity and find ways to strengthen it. Therefore, a cooperative approach to studying the coastal zone in these countries may be fruitful. Best practices of addressing the challenges can be found in recent years.

The first steps towards setting up a unified framework to tackle coastal vulnerability in the region were initiated more than ten years ago. A sub-regional workshop on coastal erosion in Central Africa (Loango, Congo, 6-10 October 2008) was organised with the support of the Intergovernmental Oceanographic Commission (IOC) of UNESCO. The Loango Initiative sought to formulate a regional approach to the challenges of coastal erosion in Central Africa. Unfortunately, the workshop recommendations have not been implemented.

The present time is opportune for another try. The Biennale of Luanda, a Pan-African Forum for the Culture of Peace, jointly convened by UNESCO, the African Union and the Government of Angola (18-22 September 2019), highlighted that "healthy oceans, rivers and lakes are key for a peaceful and prosperous Africa[3]". To achieve this vision, countries of the Central African region agreed to establish, again with the help of IOC/UNESCO, a sub-regional initiative to build institutional capacity in ocean science and integrated coastal management. They felt the urgent need to self-organise to address coastal vulnerability.

As a follow-up to the Biennale, and with the support of the Gabonese Republic and the Government Offices of Sweden, IOC/UNESCO organised on 5-7 November 2019 a technical workshop in Libreville, Gabon. The participants reviewed the available and needed expertise in the region, human resources, observing and data collection equipment as well as available coastal management and preservation practices for the marine and coastal environment in Central Africa. The workshop concluded that expanding knowledge on coastal vulnerability is a key matter of human security from the economic and social viewpoints and the only viable path to ensure the environmental sustainability of this coastal region.

1 Angola, Cameroon, Congo, Democratic Republic of the Congo, Equatorial Guinea, Gabon and São Tomé and Principe.

2 UNESCO/IOC. 2010. *Existing and needed African science-base for coastal adaptation* (IOC/INF-1289) https://unesdoc.unesco.org/ark:/48223/pf0000226957.locale=en

3 UNESCO. 2019. *Communiqué of the Pan-African Forum for the Culture of Peace -Biennale of Luanda, 18-22 September 2019.* https://en.unesco.org/sites/default/files/biennale_of_luanda_final_communique_17122019.pdf (Accessed on 11 March 2019.)

Based on the deliberations and conclusions from the Libreville workshop, this report outlines an analytical and systematic, ecosystem-based and people-centred approach to coastal vulnerability in Central Africa. After agreeing on terminology and methods for the analysis, the authors systematically study impacts of climate and environmental change on the coastal region and countries' readiness to strengthen resilience. Importantly, they were able to identify a number of opportunities to increase the adaptive potential of the region. The report concludes by proposing key principles and pathways for activities that, if implemented, will make this coastal region more resilient to climate change.

I hope that recommendations presented in this report will be thoroughly reviewed by the Central Africa countries and, after studying their feasibility, will find their way to implementation, to the significant benefit of the people of these developing countries.

Vladimir Ryabinin
IOC Executive Secretary

General Introduction

At the heart of the tropical system lies the Central African Sub-region (CAS) (Figure 1), characterised by very dynamic and vital features at the boundary between land and sea. As in many coastal countries in the world, coastal environment is key for coastal communities in Central African countries. For centuries, coastal processes have been supporting lives with provision of services, including jobs and economic growth. Altogether, Central African countries make up a total of about 3,598 km of coastline and 1,223,675 km2 of exclusive economic zone (EEZ), which represent a large potential of opportunities for regional economic prosperity and social development. The ecosystem is very diverse and rich with many forms of animal and vegetal species distinguished in complex habitats along the land and sea buffers from coastlines of the region. A large percentage, approximately 70%, of the region's overall growing population (estimated at 148,977,730 habitants in 2018 against 84,119,458 habitants in 2000) is concentrated and spread within coastal zones and heavily depends on coastal natural resources for livelihood or survival.

Figure 1. Map of coastal Central African countries.

Climate dynamics and impacts have become significant enough to be visible globally and in the Central Africa region, with more effects expected in the years to come. Coastal areas, in Central Africa and more generally Western Africa, appear to be particularly vulnerable to these changes in addition to the impacts of human activities. In other words, the Central Africa region represents one of the most vulnerable regions of Africa; and the looming spectre of intensified vulnerability factors to existing threats over the past decades implies that there is an urgent need for a suitable and sustainable management approach to this interface if the aim is to conserve and derive sustainable benefit from the coastal ecosystem while preserving human life and improving economic prospects, security, peace and stability in the region.

Although indisputable and of key importance, current adaptation measures to climate change in the Central Africa region are focused on forest defence and CO_2 emission, whereas many other sectors that depend on coastal existence have an important scope of adaptation planning and implementation policies. However, various projections (temperature, sea level, etc.) for the region suggest that future changes might pose additional significant risks for all coast-dependant sectors from resource exploitation to health, livelihood, peace and security.

Objective and scope of this report

The objective of this report is to frame an analytical approach to coastal area sustainability in the Central Africa region and to situate in this context a new pathway to regional sustainable drivers of environmental and socio-economic growth, along with the building or development of a tangible and integrated policy framework. This framework could aim at building an ecosystem-based approach to an integrated spatial management of the sub-region's coastal zone as a whole. As a primary stage, the present document highlights some key coastal challenges in Central Africa as illustrated by the climate and human-induced vulnerability profiles of the seven countries of the region, namely: Angola, Cameroon, Congo, Democratic Republic of the Congo (DRC), Equatorial Guinea, Gabon and Sao Tome and Principe. It also underlines the need for adaptation mechanisms in view of perspectives related to current and projected challenges.

From the overarching view of the African Union (AU), coastal zones play a significant role in African countries and communities' developments. First, the 2050 African Integrated Maritime Strategy (2050 AIM Strategy, 2012) – which provides a broad framework for the protection and sustainable exploitation of the African maritime domain (AMD) for wealth creation – acknowledges that Africa's inland waters, oceans and seas, which encompasses coastal areas, are under pressure. It also underlines under its strategic objectives the need to improve integrated coastal zone/area management in Africa while addressing the urgent imperative to develop a sustainable "blue economy" initiative to be a marine version of green economy on land.

Secondly, under the *Africa's Blue Economy: A policy handbook* (2016) prepared by the United Nations Economic Commission for Africa (UNECA), the blue economy concept has been defined in the African context to cover both aquatic and marine spaces. This covers oceans, seas, coasts, lakes, rivers and underground water, and encompasses a range of productive sectors, such as fisheries, aquaculture, tourism, transport, shipbuilding, energy, bioprospecting, mining and related activities. The coast shows again to be a vital component of this framework as it recognises that climate change impacts on coastal zones would curb the positive expectation of the blue economy.

Thirdly, in its *Agenda 2063: The Africa We Want*, the AU reiterates under its first aspiration the importance of Africa's blue economy, which is three times the size of its landmass and coast dependent, before engaging to commit in protecting its people and biodiversity in the face of climate change challenges.

Furthermore, the Convention for Cooperation in the Protection, Management and Development of the Marine and Coastal Environment of the Atlantic Coast of the West, Central and Southern African Region (also known as the 'Abidjan Convention') – adopted in Abidjan on 23 March 1981 and coming into force in 1984 – has recognised the increasing pressures and threats to the African Atlantic coasts. As such, it

developed during the 12th meeting of Contracting Parties to the Convention (27-31 March 2017, Abidjan) an additional protocol to the Convention on Integrated Coastal Zone Management (ICZM).

With respect to Articles 35 and 36 of this protocol, transboundary cooperation and transboundary environmental assessments are encouraged between parties to the Convention. In this context, parties are recommended to "directly or with the assistance of the Organization or competent international organizations, bilaterally or multilaterally, endeavor to coordinate and/or harmonize, where appropriate, their policies and strategies, their national coastal plans and programmes regarding transboundary zones".

In addition to these sets of driving instruments acknowledging the importance of the coastal zone in Africa and the CAS, the African Maritime Transport Charter, adopted on 11 June 1994, the African Charter on Maritime Security and Safety and Development in Africa (the Lomé Charter), adopted in Lomé, Togo, on 15 October 2016, and many others also recognise the need for an integrated and sustainable management of the coastal zone, whose benefits also extend to landlocked states. These various initiatives clearly signify the multifaceted scope and innovative means of achieving blue economy objectives based on coastal processes in Africa in general and in the Central Africa Sub-region in particular.

It is therefore on these framed foundations that the development of this report has been driven by the thesis that coastal challenges in Central Africa can only be faced sustainably if the broad range of national and sectoral policies and the implementation of existing environmental legislations are brought under the same umbrella. The concepts of coastal vulnerability and Integrated Coastal Area Management (ICAM) as used in this report have therefore been conceived as conceptual references aiming at protecting coastal environment, economies and wellbeing of communities in the Central Africa region.

On this note, the regional workshop on coastal vulnerability held in Libreville, Gabon, could be perceived as being a platform for discussion and proposal of development means of pillars for coastal sustainability in central Africa. A commendable initiative in this direction was the Sub-regional Workshop on Coastal Erosion in Central Africa, termed as the Loango Initiative, organised in October 2008. Since then, no further activities have been developed following the workshop's recommendation, but multiple and very important policies and legal instruments have come to birth at national levels to help enhance environmental and community resilience and adaptation to impacts from climate and human-induced threats.

The coastal area in central Africa: Important but threatened and vulnerable asset

Literally, the coastal zone in central Africa is understood to cover the interaction of two margins from both sides of the coastline. Unfortunately, no single country in the Central Africa region has a clear legal definition of the spatial extent of its respective coastal zones. However, for the purpose of this report, the coastal zone could be roughly understood to cover a buffer of 50 km landward from the coastline and the territorial sea (12 Nautical miles) on seaward limits.

Regional observations have revealed that the Central African coastal zone, in line with other regions in Africa and especially West Africa, is and remains among the zones most vulnerable to climate and human-induced risks, with effects that transcend across many sectors and even

across the whole region. In addition to those already destroyed, degraded or lost, several ecosystems and physical infrastructures are still under threats of climate pressures, such as sea level rise and anthropogenic activities, including among others dredging. Together, these activities exacerbate coastal erosion, flooding, salinity intrusion in fresh water system as well as habitat and ecosystem service loss, with a high potential of increased effects in often less-considered sectors such as health, administration, peace and security, etc.

The Loango Initiative

The Loango Initiative[1], framed around the Sub-regional Workshop on Coastal Erosion in Central Africa, was held in Loango, Congo, on 6-10 October 2008. With the support of the IOC of UNESCO, it was the first attempt of this nature to set an integrated and coordinated regional approach to the persisting but increasing challenges of coastal erosion in Central Africa with respect to climate and human-induced stresses to the natural environment.

The initiative acknowledged the high impact of coastal erosion on coastal communities, national economies and integrity, and subsequently promoted strong commitments to establish national management plans, set up a sub-regional observatory and alert system, and engage civil society, non-governmental organisations (NGOs) and local communities in bringing the declaration of this initiative to fruition as presented in Box 1 on the right.

Unfortunately, over ten years later, no further action has been taken. It is believed that this present report will drive along the motives of the Loango Initiative to fulfilled and concretised actions.

Box 1: Extract from Loango's declaration on coastal erosion in central Africa Countries (10 October 2008).

"We…Declare, for the countries of the coastal sub-region of Central Africa, the urgency and the need to pool efforts to:

a) Have a sub-regional plan for coastal erosion management in the Central Africa zone involving the participation of local communities in the context of sustainable development and the Millennium Development Goals;

b) Develop national spatial plans which specifically describe sectoral plans in transboundary coastal zones and allow for negotiation with development cooperation agencies on financing programmes aimed at mitigating or curbing the progress of sea on the mainland (programmes for reforestation, dyke construction, beach nourishment, depollution, etc.);

c) Take into account the gender dimension, with special emphasis on the training of female officers and the role of women in the management of marine and coastal ecosystems;

d) Provide scientific data on the effects of climate change phenomena and human activities in the coastal zone;

e) Establish a network of African researchers specialised in the observation of the aforementioned phenomena."

1 Full report is available (in French only) as IOC Workshop Reports, 273 at: https://unesdoc.unesco.org/ark:/48223/pf0000372699.locale=en

Section A
Understanding the report

A-1. Key terms used in the report

In order to facilitate reader understanding of this technical report, key terms used herein are defined in accordance with terminology developed by many scientific bodies, including the International Panel on Climate Change, as follows:

Adaptation: The process of adjustment to actual or expected climate and its effects. In human systems, adaptation seeks to moderate or avoid harm or exploit beneficial opportunities. In some natural systems, human intervention may facilitate adjustment to expected climate and its effects.

Anthropogenic: Understood as "man-made" and is defined as resulting from or relating to the influence of (harmful) human activity on nature, e.g. the emission of greenhouse gases as a result of human activities and its impact on global warming.

Biodiversity: The variability among living organisms from terrestrial, marine and other ecosystems. Biodiversity includes variability at the genetic, species and ecosystem levels.

Capacity building: In the context of climate change, the process of developing the technical skills and institutional capability in developing countries and economies in transition to enable them to address effectively the causes and results of climate change.

Climate system: Is the highly complex system consisting of five major components: the atmosphere, the hydrosphere, the cryosphere, the lithosphere and the biosphere and the interactions between them. The climate system evolves in time under the influence of its own internal dynamics and because of external forces such as volcanic eruptions, solar variations and anthropogenic forces such as the changing composition of the atmosphere and land-use change.

Climate change: Refers to a change in the state of the climate that can be identified (e.g. by using statistical tests) by changes in the mean and/or the variability of its properties and that persists for an extended period, typically decades or longer. Climate change may be due to natural internal processes or external forces such as modulations of the solar cycles, volcanic eruptions and persistent anthropogenic changes in the composition of the atmosphere or in land use. Note that the United Nations Framework Convention on Climate Change (UNFCCC), in its Article 1, defines climate change as: "a change of climate which is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and which is in addition to natural climate variability observed over comparable time periods". The UNFCCC thus makes a distinction between climate change attributable to human activities altering the atmospheric composition and climate variability attributable to natural causes. See also **Detection** and **Attribution**.

Climate variability: Refers to variations in the mean state and other statistics (such as standard deviations, the occurrence of extremes, etc.) of the climate on all spatial and temporal scales beyond that of individual weather events. Variability may be due to natural internal processes within the climate system (internal variability) or to variations in natural or anthropogenic external forcing (external variability).

Coastal area/Coastal zone: The defined land and sea space bordering the shoreline.

Confidence: The validity of a finding based on the type, amount, quality and consistency of evidence (e.g. mechanistic understanding, theory, data, models, expert judgment) and on the degree of agreement.

Disaster: Severe alterations in the normal functioning of a community or a society due to hazardous physical events interacting with vulnerable social conditions, leading to widespread adverse human, material, economic or environmental effects that require immediate emergency response to satisfy critical human needs and that may require external support for recovery.

Drought: A period of abnormally dry weather long enough to cause a serious hydrological imbalance. Drought is a relative term, therefore any discussion in terms of precipitation deficit must refer to the particular precipitation-related activity that is under discussion. For example, shortage of precipitation during the growing season impinges on crop production or ecosystem function in general (due to soil moisture drought, also termed agricultural drought) and during the runoff and percolation season primarily affects water supplies (hydrological drought). Storage changes in soil moisture and groundwater are also affected by increases in actual evapotranspiration in addition to reductions in precipitation. A period with an abnormal precipitation deficit is defined as a meteorological drought. A megadrought is a very lengthy and pervasive drought, lasting much longer than normal, usually a decade or more.

Ecosystem: A functional unit consisting of living organisms, their non-living environment and the interactions within and between them. The components included in a given ecosystem and its spatial boundaries depend on the purpose for which the ecosystem is defined: in some cases they are relatively sharp, while in others they are diffuse. Ecosystem boundaries can change over time. Ecosystems are nested within other ecosystems and their scale can range from very small to the entire biosphere. In the current era, most ecosystems either contain people as key organisms, or are influenced by the effects of human activities in their environment.

Ecosystem services: Ecological processes or functions having monetary or non-monetary value to individuals or society at large. These are frequently classified as (1) supporting services such as productivity or biodiversity maintenance, (2) provisioning services such as food, fibre or fish, (3) regulating services such as climate regulation or carbon sequestration, and (4) cultural services such as tourism or spiritual and aesthetic appreciation.

Erosion: Wearing/washing away of land by the action of natural forces. On a beach, the carrying away of beach material by wave action, tidal currents, littoral currents or by deflation.

Exposure: The presence of people, livelihoods, species or ecosystems, environmental functions, services, and resources, infrastructure, or economic, social or cultural assets in places and settings that could be adversely affected.

Flood: The overflowing of the normal confines of a stream or other body of water, or the accumulation of water over areas not normally submerged. Floods include river (fluvial) floods, flash floods, urban floods, pluvial floods, sewer floods, coastal floods and glacial lake outburst floods.

Hazard: The potential occurrence of a natural or human-induced physical event or trend or physical impact that may cause loss of life, injury or other health impacts, as well as damage and loss to property, infrastructure, livelihoods, service provision, ecosystems and environmental

resources. In this report, the term hazard usually refers to climate-related physical events or trends or their physical impacts.

Integrated Coastal Zone Management (ICZM)/Integrated Coastal Area Management (ICAM): An integrated approach for sustainably managing coastal areas, considering all coastal habitats and uses (IPCC). Mechanism for bringing together the multiplicity of users, stakeholders and decision-makers in the coastal zone in order to secure more effective ecosystem management whilst achieving economic development and intra- and inter-generational equity through the application of sustainability principles. The ICZM approach is generally facilitated through existing terrestrial and marine territorial planning legislation and mechanisms, where these exist.

National communication: A document submitted in accordance with the Convention (and the Protocol) by which a Party informs other Parties of activities undertaken to address climate change.

Policy: Any form of intervention or societal response. This includes not only statements of intent, such as a water policy or forest policy, but also other forms of intervention, such as the use of economic instruments, market creation, subsidies, institutional reform, legal reform, decentralisation and institutional development. Policy can be seen as a tool for the exercise of governance. When such an intervention is enforced by the State, it is called public policy.

Pollution: The presence of minerals, chemicals or physical properties at levels that exceed the values deemed to define a boundary between "good or acceptable" and "poor or unacceptable" quality, which is a function of the specific pollutant.

Protocol: An international agreement linked to an existing convention, but as a separate and additional agreement which must be signed and ratified by the Parties to the convention concerned. Protocols typically strengthen a convention by adding new, more detailed commitments.

Risk: The potential for consequences where something of value is at stake and where the outcome is uncertain, recognising the diversity of values. Risk is often represented as probability or likelihood of occurrence of hazardous events or trends multiplied by the impacts if these events or trends occur. In this report, the term risk is often used to refer to the potential, when the outcome is uncertain, for adverse consequences on lives, livelihoods, health, ecosystems and species, economic, social and cultural assets, services (including environmental services) and infrastructure.

Uncertainty: A state of incomplete knowledge that can result from a lack of information or from disagreement about what is known or even knowable. It may have many types of sources, from imprecision in the data to ambiguously defined concepts or terminology, or uncertain projections of human behaviour. Uncertainty can therefore be represented by quantitative measures (e.g. a probability density function) or by qualitative statements.

Vulnerability: The propensity or predisposition to be adversely affected. Vulnerability encompasses a variety of concepts and elements including sensitivity or susceptibility to harm and lack of capacity to cope and adapt. It is a function of exposure and sensitivity of assets to a hazard, which determines the potential impacts of the hazard.

A-2. Interactions between hazard, vulnerability, exposure, risk and impact

As presented in the introductory part of this report, there is high evidence nowadays of human interference with the environment and coastal climate systems in Central Africa. The assessment of vulnerability, impacts and adaptation measures discussed in this report intends to show clearly how the exposure to risk patterns in the region can curb and shift potential benefits due to the exacerbation of community and climate dynamics. In fact, it is commonly agreed that, when brought together in time and space, vulnerability, hazard and exposure level produce the risk to face potentially embarrassing event as exemplified in Figure 2 below.

The report therefore considers how impacts and risks related to climate and human-induced systems could be further reduced and managed through adequate adaptation mechanisms and actions as a continuation of those already in place. In this context, it not only presents assessed vulnerability factors for countries in Central Africa but also the needs, options, opportunities, constraints, resilience, limits and many other features in relation with sustainable solutions for regional adaptation practices.

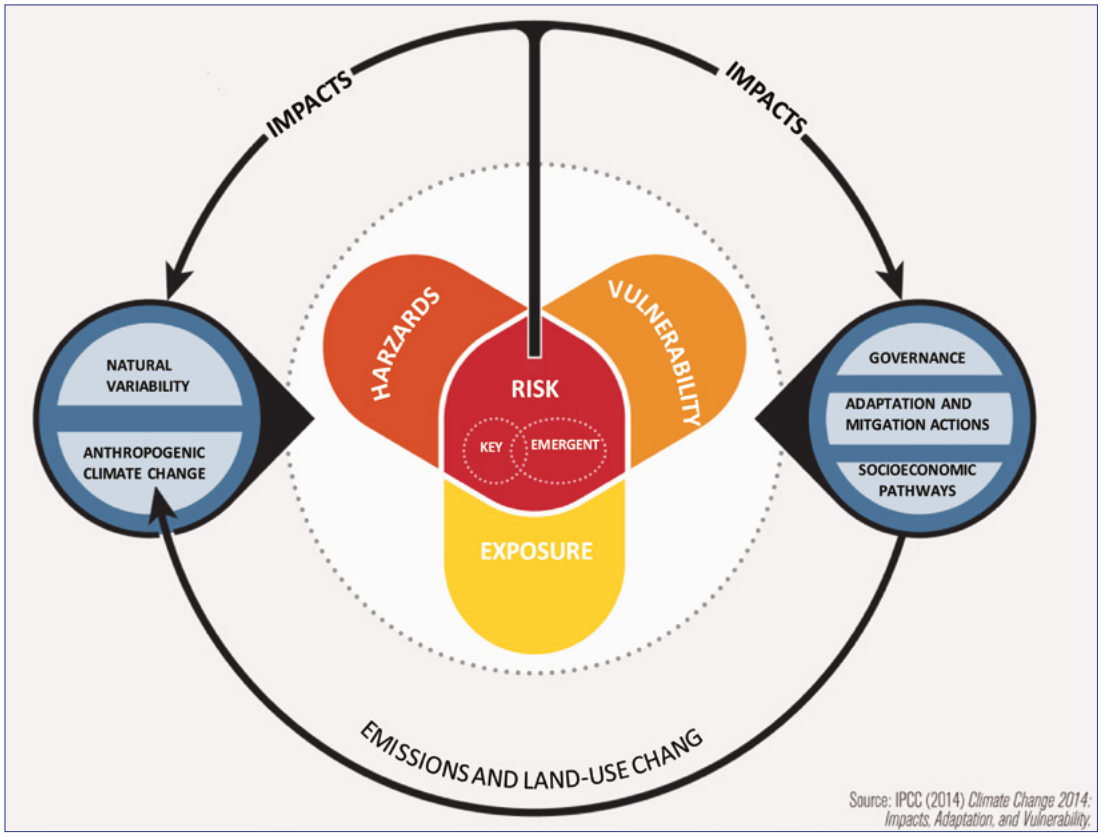

Figure 2. Interaction between the physical climate system, exposure and vulnerability to produce risk. (Credit: Hisham Ashkar – Source: GRIDA, 2018 - https://www.grida.no/resources/12772).

It is understood that countries in the region may perceive or rank coastal risks and potential environmental benefits differently, given diverse values and governmental goals. However, understanding the what, where and how of changes in the region

could serve as an evidence-based approach in sustainable coastal decision-making. The increased and available set of relevant literature expended to human, climate, management and governance systems for countries and for the region have facilitated the comprehensive assessment of these factors across a broad set of topics and sectors.

A-3. Context for coastal vulnerability assessment in Central Africa sub-region (CAS)

A-3-1. Imperative for coastal areas

In general, coastal areas are unique in many ways and are a convergent zone for human-intensive activities. Possessing a variety of rich and diverse ecosystems, these areas offer several services and benefits necessary to sustain livelihoods and societal wellbeing.

Coastal ecosystems (e.g. wetlands, mangroves, salt marshes, etc.) include both human and biophysical components providing ecological services that help in tailing off and controlling the effects of erosion on coastal lands, protecting valuable ecosystems and heritages, purifying water and recycling nutrients. The combination of all these services directly and indirectly enhances social security and economic prosperity for populations who depend on the coast for survival and governments who derive revenue from the range of activities (e.g. tourism and healthcare).

Because of their adjacency to the sea and land, coastal zones are also direct recipients of both positive and negative impacts emanating seaward and landward. This proximity exposes these zones to oceanic influences (e.g. sea level rise and ocean acidification) and terrestrial/upstream challenges (e.g. plastic pollution and excessive nutrient) which are highly visible in the Central Africa region.

A-3-2. The significance of coastal areas in Central Africa Sub-region

Social-economic perspective of coastal areas

Though technology has brought significant improvement to people's socio-economic wellbeing, it has not stopped human dependence on naturally provided ecosystem services. Therefore, the significance of the coastal zone to human progress and development cannot be underemphasised owing to the range of crucial benefits it provides both at regional and national levels, including tourism, recreation, fisheries, trade, as well as aesthetic and cultural value (Loomis and Paterson, 2014). Because of the unique location of the coastal zone as the transitional zone between land and the marine environment, populations – who rely directly or indirectly on its resources and services for livelihood and stable economy – have consistently concentrated in this region.

In the CAS, coastal communities are growing faster in contrast to those inland and expected to significantly increase by 2050 (IUCN, 2007). According to available data, the population of the region that is concentrated in the coastal zone was estimated at 1,524,380 inhabitants 19 years ago, with the bulk of the population residing in urban coastal areas (Figure 3). Angola has the highest number of coastal rural and urban population in the region, while Equatorial Guinea (partially) and São Tome and Principe (STP) are island countries, which is why almost the entirety of their populations is included in this group. With current global and regional population trends, this population would have increased considerably. This demonstrates the socio-economic importance of the coastal areas in CAS, and an indication for concern as the population growth weighs negatively on coastal and marine ecosystems (UNEP, 2017).

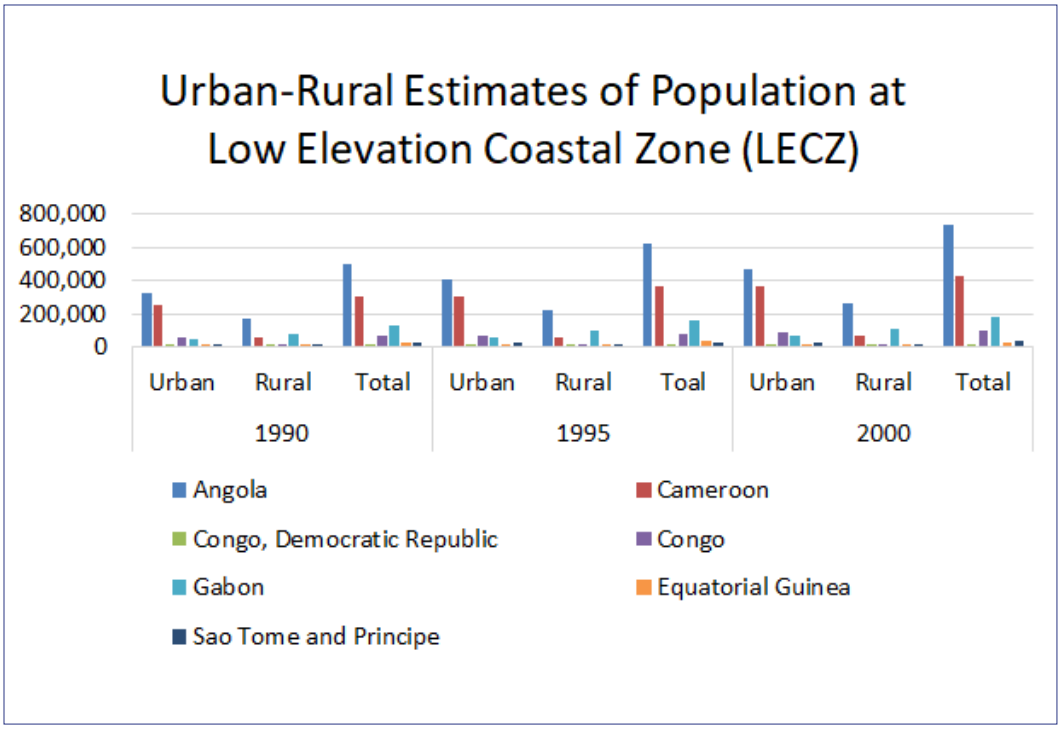

Figure 3. Urban-Rural Estimate of population at Low Elevation Coastal Zone[2] in the CAS. Data source: McGranahan, Balk, & Anderson (2007).

Figure 4 further helps capture the relevance of coastal areas in the socio-economic reality of countries in the CAS. It illustrates that coastal livelihood and economies, one of the ten elements of the Ocean Health Index, in the region exceeds the global average score of 70. Livelihoods and economies in STP are 100% dependent on its coast, while Equatorial Guinea recorded the lowest score of 13.

For instance, fish production and its value chain foster employment, allowing for both social and economic improvements in many coastal communities of the region (UNEP/GPA, 2006; Dyhia Belhabib, Hellebrandt, Allison, & Pauly, 2015; D. Belhabib, Hellebrandt Da Silva, Allison, Zeller, & Pauly, 2016) and on the basis that a substantial amount of world's marine fish harvest is caught or reared in coastal waters (Creel, 2003). Tourism is also on the rise in the CAS, with the region recording the strongest growth rates in arrivals between 1995-2014, amounting to 8% per annum (UNCTAD, 2017). Furthermore, coastal areas in the CAS provide critical inputs for industry, sites of important port cities and facilities (e.g. Luanda, Pointe Noire, Libreville and Duala) and represent key routes for the shipping of oil and gas from Africa to Europe.

2 The Low Elevation Coastal Zone (LECZ) Urban-Rural Population Estimates consists of country-level estimates of urban, rural and total population in the LECZ.

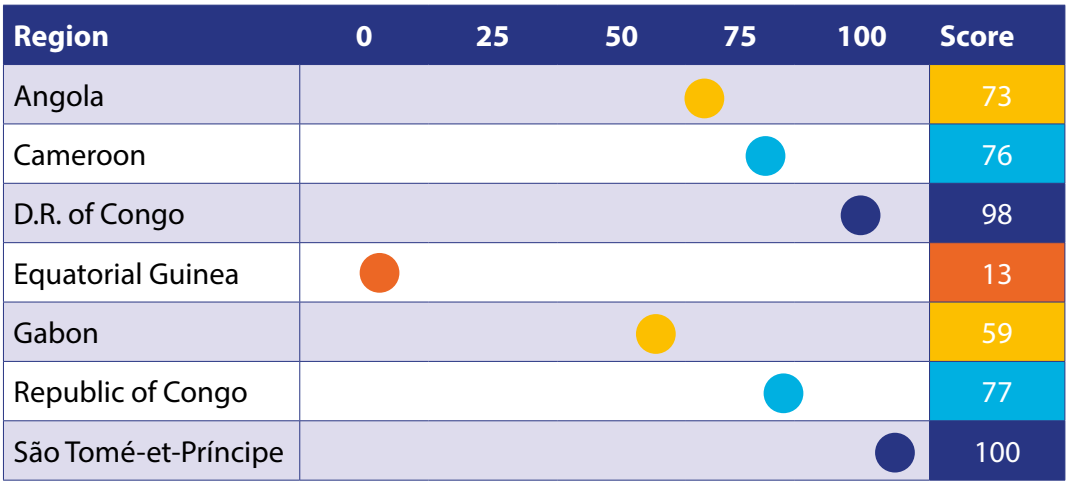

Figure 4. Coastal Livelihoods and Economies[3] in Central Africa (Source: Ocean Health Index (2019).

A-4. Communication of the degree of certainty in assessment findings

A-4-1. Indicators for communicating degree of certainty

While there are several approaches to communicating degree of certainty in environmental assessment findings (Wardekker et al., 2008), the present report considers the use of qualitative (descriptive) method as highlighted by the Intergovernmental Panel on Climate Change (IPCC, 2001) in its third assessment report. It is herein acknowledged that the degree of certainty in relation to the coastal vulnerability assessment mechanism (literature-based) in Central Africa would significantly influence the complexity of the science-policy interface. In view of the ecological, socio-economic and socio-political complexity of the region, multiple factors were attributed to substantially influence degree of certainty of the process. Indicators of spatial, temporal, material, human and administrative impacts were conceived under this concept to qualify the level of certainty in the assessment as presented in table 1.

3 Livelihoods and Economies are measured separately to indicate that the number and quality of jobs and the amount of revenue produced are both of considerable interest to stakeholders and governments and can have different patterns in some cases.

Indicator (present/future)	High risk	Medium risk	Low risk
Spatial	Large coverage of impacted area	Small coverage area	Very small coverage area
Temporal	Long length of activity of threat	Short length of activity	Very short length of activity
Material/ Infrastructure	High monetary value of infrastructure at risk	Low cost infrastructures	Very low cost of infrastructure
Human	High number of human injured/death (exposed)	Human injured (exposed)	Human threatened
Administrative	Poor management framework, limited actions and implementation, poor participation and limited transparency	Good management framework, prioritised actions implementation, relative participation	Strong management framework and actions, transparent mechanisms, strong community participation

Table 1. Indicators considered in addressing degree of certainty in assessment.

A-4-2. Indicators variability

These include factors influencing dynamics in relation to associated indicators. Among these factors:

i. Conditions associated with indicators naturally vary from one place of a country coastal zone to the other depending on several factors that may equivalently be natural or anthropogenic.

ii. Spatial and temporal variability of threats and impacts would be considered as the length of time taken to complete a process impact and space impacted within the specific time.

iii. Cost of material and infrastructure would include cost of damage, repair, reconstruction, relocation, etc. Human dimension would include change in natality, morbidity, mortality due to exposure to threats.

iv. Administrative would refer to dynamics in management and governance mechanisms as driven by impacts or awareness.

A-4-3. Data and information limitations

Data and information gaps with high potential to influence confidence and conclusions derived from the coastal vulnerability assessment in Central Africa region would include:

i. There was no clear definition of the coastal zone for all seven countries in the CAS. No countries have clear legal definition of the extent of its coastal zone landward and seaward and approach to this largely varies from one literature to another. In this situation, information on socio-economic activities such as population growth and sprawl may be biased and alter the assessment process.

ii. Considered indicators provide a broad view of coastal conditions in the respective countries of the region as depicted from literature and, as such, might not reflect the real-time conditions of the environment. Assessed individual national data and information in this regard are often outdated; consequently, there might be severe obstacles to

making conclusive statements on the regional environment that would guide the formulation of a more tangible regional coastal and marine policy.

iii. Although there is a large volume of coastal and marine data (physical and biological, socio-economic) obtained and processed from international sources, relative limited quality control and quality assurance framework and potential with regard to procedures for collecting, processing and compiling of these data implies that identical data sources would be processed to produce conflicting results. This would lead to inaccurate interpretation and assessment.

iv. Poor communication of uncertainty level in scientific communication of environmental assessment and programmes.

v. Because assessment was based on national trends, it did not attempt to express the behaviour of selected indicators at regional scale.

vi. Vulnerability indicators considered in the assessment did not follow any prioritisation classification. Since assessment was limited to national scale, it was clear that the intensity of coastal threats varied from one country to the other and could therefore be prioritised with respect to relative emergency.

A-4-4. Expert's knowledge

i. Contributions from national experts in completing country profiles helped in improving confidence in the assessment process.

ii. Potential biases in information communication from regional experts were not measured or questioned and not all questions relating to the coastal profile and vulnerability were answered by national experts.

Section B
Observed impacts, vulnerability and adaptation

The last three decades have witnessed serious concerns regarding climate change effects in coastal areas of the world, especially in low-lying countries. This apprehension would probably soar, with global sea level rise expected to increase to over 10 mm/year (pessimistic scenario) by the year 2100, which would absolutely trigger an increased rate of risk, impact and vulnerability over present observations. However, climate change is not the only culprit in the accelerated rate of coastal vulnerability. Several anthropogenic factors such as overexploitation of forest resources, soil and aggregate mining, haphazard housing development and rapid urbanisation have been identified.

Currently, the Central Africa area is adversely affected by the consequences of climate variability and change, coupled with existing socio-economic processes associated with growing bio-geographical vulnerability and exposure in the coastal areas of the region. As a result, the 3,598 km coastline, coastal communities and assets are increasingly at risk, including anticipated risk to the adjacent1,223,675 km^2 of EEZ. Therefore, for the purpose of developing a coastal management plan, an assessment of highly vulnerable coastal areas is of great

importance (Tragaki et al., 2018). This means that ecological sensitive areas, Ramsar forests, very important lagoons, riparian forests, remarkable beaches etc., along the CAS coastal area must be identified, carefully monitored and protected.

In this section, a combined identification and assessment of the risks and threats to coastlines in Central Africa were carried out in order to thoroughly understand the physical and socio-economic vulnerability of the region to coastal hazards, as well as the existing and likelihood of their impacts on society. Major threats identified include sea level rise and the associated increase in flood risk, coastal erosion and wet/dryland loss, droughts, salinity intrusion, marine pollution/water quality change, reduction of marine stocks, urban sprawl and coastal/maritime infrastructure development, and hazards arising from more frequent storm surges.

Though largely inadequate, countries in the region have existing strategies to deal with these threats and impacts. Differences and similarities are highlighted in the countries' current adaptation strategy. It results that all countries in the CAS face dilemmas in the implementation of their adaptation strategies. Uncertainty about the extent and timing of climate-driven impacts could be perceived in this regional context as a major underlying cause aside the relatively low commitment of decision-makers. Several approaches are available to deal with these dilemmas. The key findings are summarised in comprehensive country profiles in the annex section of this report.

B-1. Observed impacts, vulnerability and exposure

B-1-1. Floods

The risk of coastal flooding is increasing across the Central Africa region, and factors such as population growth, increased infrastructure located in coastal zones, sea level rise and general changes in climate have been largely attributed as causative.

Incessant floods adversely affect people across countries in the region, which generally result in loss of houses and commercial buildings and the interruption of transport for long periods. For example, floods affect on average about 100,000 people every year, more or less 0.4% of the total population in Angola—concentrated in large urban cities including Luanda, Benguela, Cabinda and Namibe (see Figure 5), located in risk areas that are susceptible to the effects of climate change (NAPA, 2011).

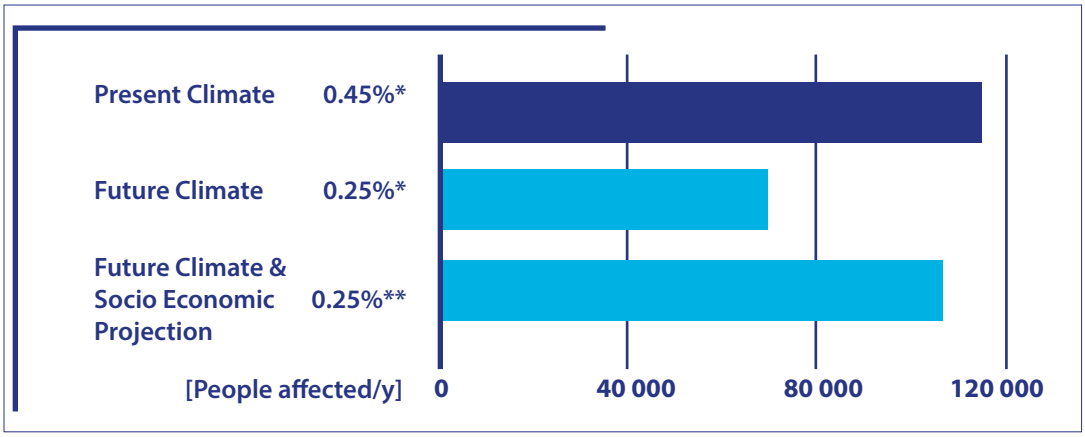

Figure 5[4]. The affected people are geographically concentrated in the most urbanised provinces of Angola: Luanda, Cabinda, Huambo. The affected gross domestic product (GDP) in flooded areas is also high, cumulating on average 0.7% of the total GDP every year at country level. Source: CIMA & UNISDR (2018).

By recognising the consequences of sea level rise on coastal areas, it is clear from the IPCC 4th Report that an increase in sea level (90 cm in 2100) would have the potential aftermath of flooding, with devastating effects on critical infrastructure (both natural and man-made) and livelihoods in coastal communities in the Central Africa region.

In Cameroon for example, 38 of the 72 villages listed in the single-mode Coastal Agro-ecological Zone are identified with potential to be permanently flooded (MINEPDED, 2015), which could cause the demolition of fishermen's houses, the migration of approximately 5,900 fishermen and their families, and the loss of 33,000 ha of mangroves (30% of the total area of mangrove forests in Cameroon) (OCHA/UN/Bureau de la Coordination des Affaires Humanitaires, 2012). At a countrywide scale in Cameroon, the average yearly value of direct economic loss in the present climate is of 130 million USD, with the highest proportion of loss in the housing, productive and service sectors (see Figure 6).

4 * % computed with reference to the total 2016 Population/GDP
** % computed with reference to the total 2050 Population/GDP

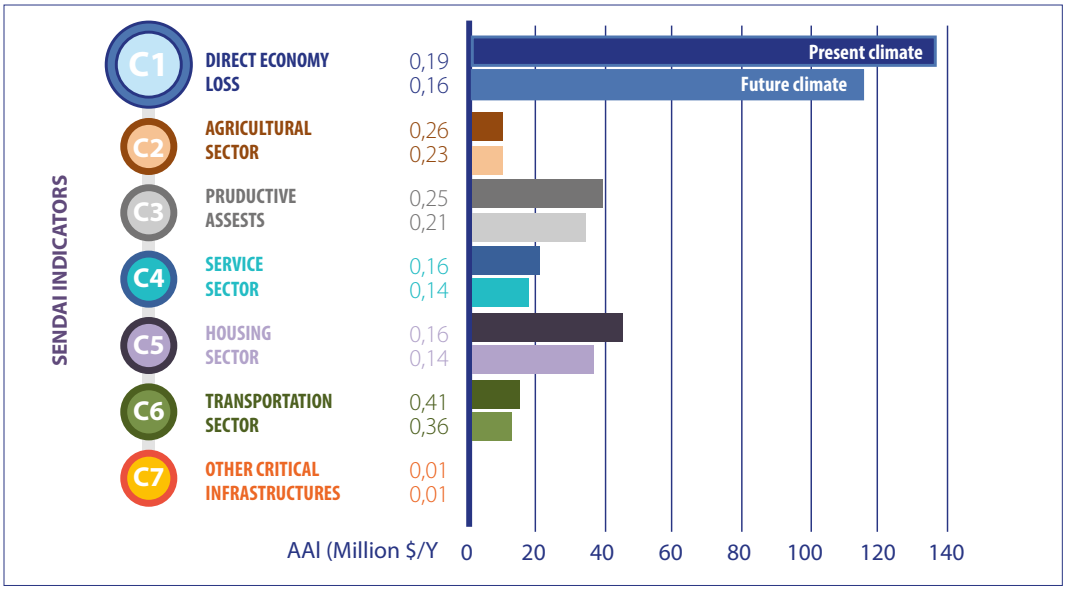

Figure 6. The average yearly value of direct economic loss in the present climate in Cameroon, which roughly amounts to 0.19% of the total stock value. The housing, productive and service sectors have the highest proportion of loss. Source: (UNISDR and CIMA, 2019).

More so, the main impacts of flooding in the region are mainly felt around adjacent lands in the low-lying portion of the coastline. These are incidentally areas that are not only densely populated, but harbour critical infrastructures except adequate drainages and channels, causing serious sanitation problems and a heavy threat to coastal and marine biodiversity (ONEQUIP, 2009). Particularly during high tides (MECN-EF, 2007), ocean waters generally cross the Moanda-Banana road in the Democratic Republic of the Congo and invade mangroves and inhabited lands, resulting in increased salinity of mangrove water and soil as well as many material losses and agricultural.

B-1-2. Droughts

Essentially, events of droughts are regional in nature, long lasting with devastating effects (Correia et al., 1991). In the Central Africa region, drought perhaps is not the most common of the major climatic disasters in coastal areas but has its toll, particularly on the agricultural sector—with recorded consequences on the socioeconomic situation. For example, since the 2011/12 agricultural campaign, three coastal provinces (Benguela, Namibe and Cuanza Sul) in Angola have been experiencing a drought situation, with a significant number of people identified to be affected by drought in each province (Table 2), while agricultural production remains the dominant part of the direct losses (roughly three quarters) (Figure 7).

Province	2012	2013	2014	2015	2016 (1st quarter)
Benguela	97135	15000	273161	16342	7805
Cuando Cubango	45000	306606	2976	267832	22444
Cuanza Sul	10000	44238	1928	44238	44238
Cunene	550000	550000	555000	755930	75930
Huila	215792	427465	306480	291925	205507
Namibe	15000	177627	177627	177627	177627
Total	932927	1520936	1737172	1553894	1213551

Table 2. Drought-affected population by province 2012–2016 in Angola: Benguela, Cuanza Sul and Namibe are the three coastal provinces. Source: PDNA (2016).

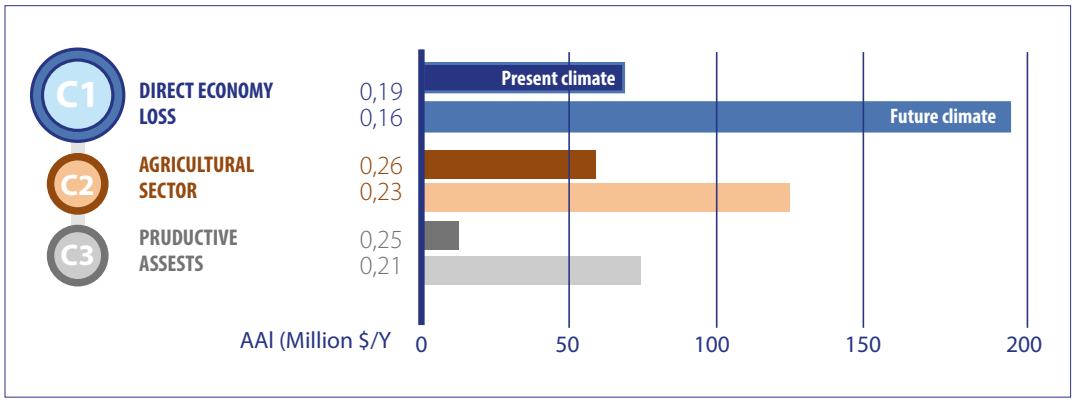

Figure 7. Economic losses due to draught in Angola[5]. Source: CIMA & UNISDR (2018).

Reports[6] have also underlined the impact of drought on agriculture in the coastal province of Cameroon. Data from the National Cocoa and Coffee Board suggests the drop in cocoa production was nationwide with 7,610 tons of cocoa exported in March 2016, 5,780 tons in April and the figure further dropped to 3,205 tons by the end of June of the same year. The report suggests that this drop was linked to the effects of droughts, worsened by the ignorance of people cutting down shade trees of cocoa.

Consistent with the effects of drought on the agricultural sector in the region, decrease in crops and livestock production with concomitant consequence on jobs/ employment has been studied. For instance, under present climate conditions, more than 2% of the livestock in Equatorial Guinea can be affected by drought (i.e. animals living in areas hit by droughts) on an average annual basis[7] (Mico and Kargbo, 2013). While under future climate conditions, the number of affected livestock is projected to increase to almost 3%. This combined with significant physical crop losses, the number of working days is expected to decrease, thereby amounting to a loss in jobs and livelihood. In total, about 6 thousand (present) and 0.8 thousand (future) working days are lost, which amounts to about 0.05% and 0.01% of the average number of working days (Figure 8).

5 C2 is computed considering only the direct loss suffered because of a loss of agricultural production with respect to a reference production in the present climate, C3 is computed considering only the loss in hydropower production as compared to a nominal production in present climate.

6 http://www.ipsnews.net/2016/08/drought-deals-harsh-blow-to-cameroons-cocoa-farmers/

8 Under present climate in Equatorial Guinea, average crop losses are dominated by five crops (banana, cassava, oil palm, plantain and sweet potato), and under the future climate for only three crops (banana, oil palm and plantain.

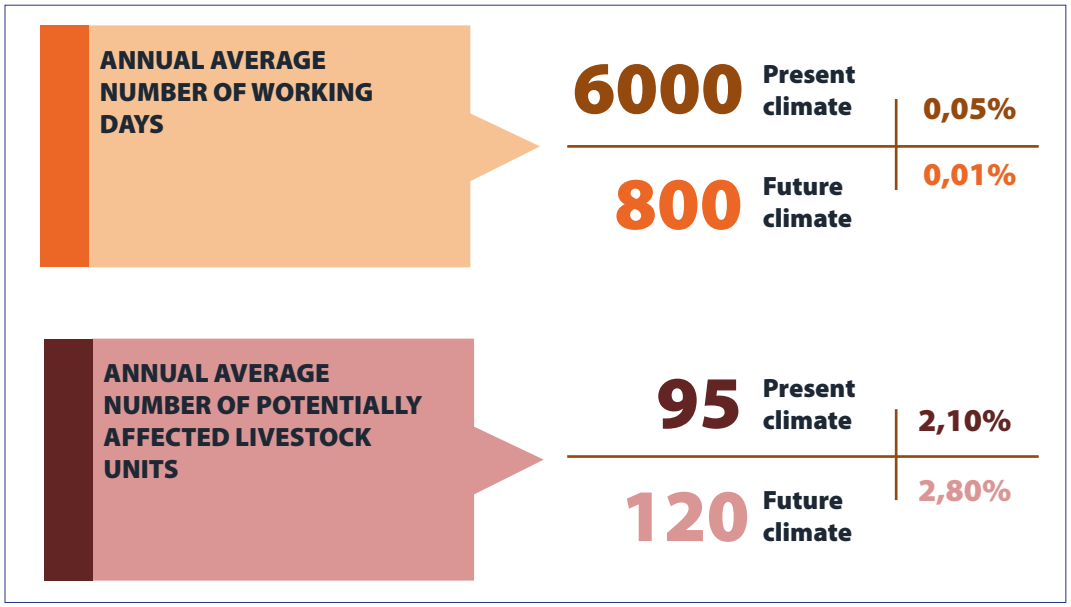

Figure 8. Annual average number of working days lost due to drought and annual average number of potential affected livestock[8] units in Equatorial Guinea. Source: Mico & Kargbo (2013).

B-1-3. Erosion

Throughout the Central Africa region, coastal erosion is a key environmental problem ravaging coastlines and likely to be exacerbated by climate change and anthropogenic factors. In fact, the practical consequences of coastal erosion have been visible in the region for several years (IUCN, 2007). Destruction and disappearance of critical habitats and coastal infrastructures is widespread in the region, with considerable effects on coastal communities who are both victims and perpetrators. Since most of the essential infrastructures are found in the coastal region - roads, ports, airports, telecommunication, schools, hospitals - the socio-economic implication of coastal erosion in the region cannot be overlooked. However, absence of effective coordination of solutions, at local, national and inter-state levels (IUCN, 2007), inadequate knowledge of coastal and marine environments and their interaction with both terrestrial and oceanic processes, coupled with ineffective planning and management, have compounded the situation (Odada, 1997).

In some coastal areas of the region, the geomorphology of coastal formation allows for continued coastal erosion. For example, the coastal plain of Angola consists of alluvia, chalk and sand, underlain by oil-bearing formations over the northern two-thirds, while most of the plateau in the eastern two-thirds of the country lies buried under deep deposits of infertile windblown Kalahari sands. These formations are easily eroded by wave and wind actions. Likewise, the river gravel of the northeast contain diamonds and rare kimberlite pipes (Thornton, John Kelly Clarence-Smith, 2019); as a result, mining activities particularly around diamond mines in Lunda-Norte have exacerbated coastal erosion (Mendelsohn, 2019).

8 Livestock is a summation of all livestock animals (referred to as livestock units) using FAO conversion factors. The amount of lost working days also decreases between present and future climate.

Figure 9. Catoca open-pit diamond mine located in Lunda Sul Province, Angola. Source: https://www.wencomine.com/news/wenco-systems-run-catoca-fourth-largest-diamond-mine-world/.

Increasing urbanisation and the need to cater for the housing and food needs of a rising coastal population have also accelerated some of erosional processes; in fact, human activity could be the primary cause of degradation. Nevertheless, natural-erosion processes remain prominent in the ongoing degradation of this fragile environment. Indiscriminate sand and aggregate mining for constructions, in addition to the clearance of fragile zones, denudation and compaction of soil through overgrazing, exhaustion of soil through intensive cropping without compensation from applications of organic matter and nutrients are ongoing activities in the Central African coastal zones. According to the MECN-EF report on the profile of DRC's coastal zone (MECN-EF, 2007), the sea has gained in 26 years almost 27 metres of land on the continent, a speed of erosion of the order of 1.03 metres/year, causing spectacular damage, such as the disappearance of the hotel Maray-Maray which was one of the jewels of the city of Moanda, and the exposure of Hotel Mangrove whose proximity to the coast line would be reduced to less than 30 metres.

At the level of the Moanda cliff (coastline with rugged topography), ocean waters have gained 80 metres of land in 40 years, leading to an estimated erosion rate of 2 metres/year and danger to the city of fishermen (Nsiamfumu) and the city of Bela Vista. The report states that it is expected that the shoreline would be reduced by nearly 50 metres along the coastal strip (Moanda at Banana Point) and about 100 metres towards Nsiamfumu, resulting in the disappearance of the road section that connects the two entities (see Figures 10 and 11).

Figure 10. The Muanda-Banana Road is under threat from the fury of the ocean. Source: Marc Ngwanza/Papy Mulamba Mwana, UNDP DRC.

Figure 11. A palm tree swept away by coastal erosion at Nsiamfumu village in Muanda territory in central Kongo. Source: Marc Ngwanza/Papy Mulamba Mwana, UNDP DRC.

The current spate of coastal erosion is also having devastating effects on biodiversity, particularly birds, turtles and mangroves. In Equatorial Guinea, erosion is expected to indirectly impact bird biodiversity in the Reserva Natural del Estuario del Muni, an ecosystem where at least 20,000 marine birds can often be found during migration

(UNEP, 2017). Similarly, erosion has been documented to affect mangroves and tall vegetations on several of Bioko island's nesting beaches, causing green turtles to nest uncharacteristically in front of the vegetation line (Veelenturf et al., 2019).

B-1-4. Salinity intrusion

Once saline groundwater is found where fresh groundwater was previously, a process known as saltwater intrusion or saline intrusion happens. There is an understanding that sea level rise is expected to result in the inland migration of the mixing zone between fresh and saline water (Werner & Simmons, 2009; Ketabchi, Mahmoodzadeh, Ataie-Ashtiani, & Simmons, 2016). In addition to sea level rise, increased groundwater pumping can increase saltwater intrusion in groundwater aquifers. Recent studies have shown the occurrence of this phenomenon in Africa (Steyl & Dennis, 2010; Ayolabi, Folorunso, Odukoya, & Adeniran, 2013) and indicated that the coastal population will become more vulnerable to salinity intrusion (Gabche and Smith, 2002).

Although there is a shortage of data and information about saltwater intrusion in the Central Africa region, saltwater intrusion has been reported to occur to some degree in many of the coastal countries in the region. Unnamed small aquifers (Cretaceous–Tertiary) along the coast of Angola have been described to be relatively highly mineralised, sometimes associated with salt-bearing formations. In some deltas and low parts of alluvial plains, the quality of groundwater is reported to be influenced by salt water (British Geological Survey, 2019). In Cameroon, the drowning of the mouths of the major coastal rivers like the Mungo Wouri and Sanaga today describes a broad embayment along the coastline as it opens into the Gulf of Guinea, which greatly enhances tidal movements with consistent inflow of saline waters. The immediate effect is the proliferation of the brackish water environment where the mangrove vegetation thrives on the mud flats further inland (CMEF, 2005). According to 2004 observations in Cameroon, surface salinity varied between 27.5 ppt in Limbe, 23 ppt in Wouri Estuary and 30 ppt in Campo. In the Democratic Republic of the Congo, the increasing salinity of mangrove water and soil is generally a result of various flood scenarios with a negative impact on ecosystems and surrounding biodiversity.

Even though the phenomenon of saltwater intrusion is a natural process, it can also be influenced by anthropogenic activities and resource management issues in the coastal zones, aggravated by spiralling population growth in the coastal zone which currently represents 60% of the regional population. This spiralling population coupled with resource management issues (such as deteriorating water quality and sanitation in urban areas and associated impacts on environment and public health; pollution of coastal waters; coastal erosion) and institutional constraints that are typical of many parts of Africa compound saltwater intrusion phenomenon in the region.

Hence, the common source of water for domestic, industrial and agricultural use (particularly in the semi-arid coast areas, e.g. Angola) in the coastal areas is pumped groundwater (FAO, 2008; Siebert, Burke, Faures, Frenken, & Hoogeveen, 2010; Pavelic, Giordano, Keraita, Ramesh, & Rao, 2012). Therefore, in the event that the demand for water is higher than its supply, as can often occur in densely populated coastal areas, the water pumped will have an increased salt content (see Figure 12), which could also have both economic and health implications.

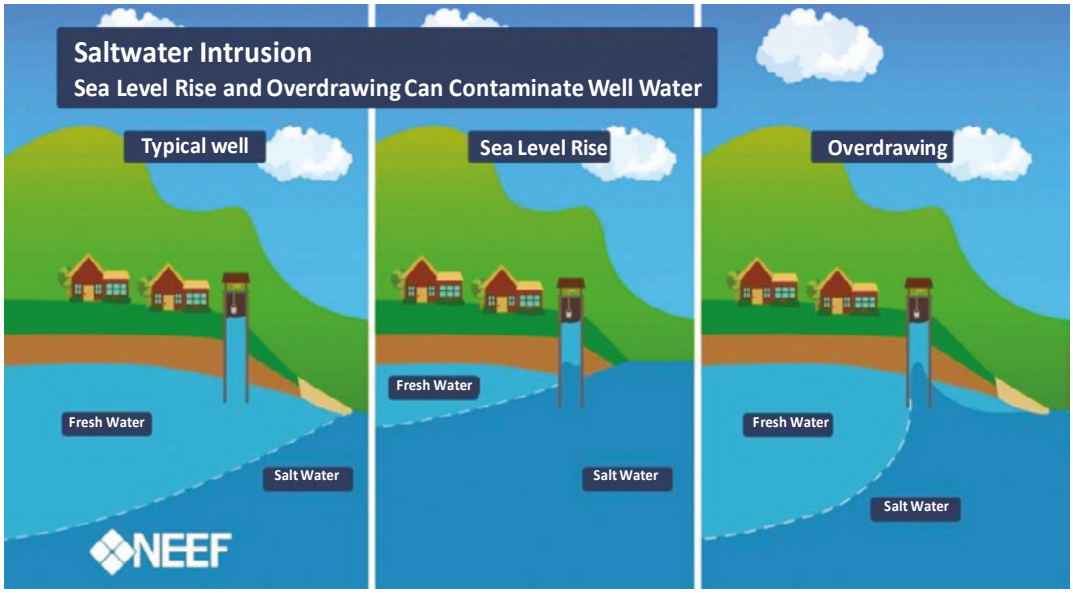

Figure 12. Freshwater and saltwater interaction. Source: The National Environmental Education and Training Foundation (NEEF) - https://www.neefusa.org/file/saltwater-intrusion.

B-1-5. Wetland change and loss, dry land loss

A combination of climate change, natural changes inflicted by saltwater intrusion, erosion and subsidence, and man-induced factors has significantly caused wetland change and dry land loss in the CAS. Human-induced actions generally cover wetlands conversion for housing, industrial development, expansion of highways, etc. with consequential net loss of these resources (M. et al., 2009). Coastal erosion either due to natural processes or induced by human behaviours has been the main culprits in most countries of the region, with the most disturbing cases found in the Democratic Republic of the Congo. By 2100, the proportions of land lost in the DRC with the decline of the shoreline due to erosion will eventually be doubled (200 metres to Nsiamfumu [Figure 12] and 100 metres between Moanda-city and Banana), and even more than double, following an erosive process exacerbated by the current excessive deforestation of mangroves (MECN-EF, 2007).

Enormous pressures from the human population, which is heavily concentrated in the coastal strip and in urban centres, as well as unsustainable agricultural practices have contributed to the overexploitation of the soil and, in turn, led to erosion, soil exhaustion and desertification (UNDP, 2007). The combination of these changes has resulted in vegetation stress and wetland deterioration of substantial magnitude in the coastal habitats including saltmarshes, brackish and freshwater marshes, and the predominantly mangrove forests (M. et al., 2009).

In Angola, the cutting of coastal forests for international timber sale and domestic use as fuel contributes to the destruction of land (Kuedikuenda and Xavier, 2009). The most easily observable interference on the wetlands of Cameroon's coastal zone is the process of wetlands conversion into reclaimed land. The percentage coverage of the categories of wetlands studied area of Douala-Tiko for example have shown a reduction from 18% to 12.1% over a 20-year period. The erosive process will lead to the destruction of sandy beaches in mangroves (Cameroon Cape, Kangue), (M. et al., 2009).

Agriculture has also played a role due to its significant effect on the native forests. As land has become scarce in Equatorial Guinea, people have turned to the forest to sustain their livelihoods. At the same time, the government has licensed large areas of forest to commercial interests. In the past few years, it has handed 5% of the country to oil palm production and 5% to commercial cocoa producers (Faustino de Lima and Dallimer, 2016).

Other natural processes are also responsible for wetland and dryland loss in the CAS, which includes rising sea level and desertification. Rise in sea level will have significant consequences on wetlands existing in the coastal fringes of Equatorial Guinea, while a transgression of the inland ocean will cause a regression of the waterfront, loss of beaches, wetlands and infrastructure located in the coastal and urban areas (CIMA & UNISDR, 2018; MINEPDED, 2015). The scenarios on the level of the sea and the results of investigations by the Ministry of Fishing and Environment show that there has been a significant sea penetration in Guinea Equatorial, especially on the island of Bioko, which affects the development of wetlands and estuaries (MPMA, 2013). Other degradation problems relate to the expansion of the hyper-arid systems and sand dune stabilisation. The coastal province of Namibia in southern Angola is characterised by hyper-arid climates and desert ecosystems. A major "classic" desertification issue has emerged: the movement and perceived expansion of the desert to normally marginally suitable agricultural production areas[9].

Figure 13. Coastal land loss in Muanda, DRC exacerbated by shore erosion. Source: UNDP http://oneocean.undp.org/img/drc/gallery-drc-modal-02.jpg

9 Angola's forests and woodland declined 3.1% between 1983 and 1993 (UNDP, 2007)

Figure 14. Desertification in Angola. Source: https://landportal.org/pt/news/2017/03/governo-cria-órgão-nacional-para-combater-desertificação-e-efeitos-da-seca-angola

B-1-6. Marine pollution, water quality change

Marine pollution and water quality change in the CAS emanate from different sources, among which: discharge from functioning industries, such as oil mining, cement factories and soap, edible oil and breweries manufacturers, detritus, marine debris and solid wastes; sewage from urban, domestic origin, in addition to port installations and the oil refinery.

However, the main causes of pollution and low water quality is primarily due to the intense exploration and exploitation of oil and the transport of hydrocarbons. Oil refineries and other oil production facilities are located on numerous places along the CAS coast and are likely points of origin for the heavy metals and oils in the marine environment (UNEP/GPA, 2006). Although their actual impacts are yet to be known (Kuedikuenda and Xavier, 2009), activities undertaken in order to produce this resource put some pressure on marine biodiversity due to constant oil spills and use of dispersants, notably in the Cabinda province (Angola) (UNEP, 1999). Likewise, the region is susceptible to pollution in view of the abundance of hydrocarbon resources, and its geographical location which favours a route for ships in transit, sometimes causing domestic discharges in ports or losing crude oil during transport or unloading. According to studies (GIZ, 2003), it appears that the most polluted points of the Cameroonian coast are the Bakassi peninsula, Port of SONARA in Limbé, Ebomé in Kribi, with the floating terminal of unloading and storage of Chadian crude oil where several oil leak scenes were noted and reported by local communities.

Although little information and data are available in the region, reports have it that major sources of pollution come from domestic and industrial sources. In Angola for instance, the marine environment is polluted by domestic waste and effluents from the few industrial areas which are still functioning (oil mining in Soyo, oil refineries, a cement factory, soap plants, port infrastructures and breweries in Luanda, and harbour and port infrastructures in Lobito) (UNEP, 1999). According to 1982 figures, the highest annual total values of oil and grease releases was 3,766 tons and Chemical Oxygen Demand (COD) from industries was 2,076 tons (UNEP, 1999). The increase in the volume of untreated sewage and associated nutrients entering the marine environment, particularly in the vicinity of Luanda and other coastal towns, would

have increased markedly over the past 10 years, consistent with the estimated population increase (UNEP, 1999).

Inefficient urban and municipal waste management has also embroidered marine pollution and poor water quality in the region. Current level of urban waste production on the Congolese coast poses serious threat to the coastal and marine environment. According to the World Bank[10], Congo will produce about 3,193,587 tons of household waste per year by 2050 against 894,237 tons in 2016. It is also noted that in the absence of proper urban sewerage sanitation network, Gabon produced in 2016 a mass of waste at 403,931 tons per year, and it is projected to increase to 578,036 tons per year by 2030 and 924,679 tons per year by 2050[11].

B-1-7. Reduction of marine stocks

Biodiversity of natural resources is facing serious threats including reduction in marine lives and rapid loss of forest cover due to agricultural and infrastructural development activities, overexploitation, illegal, unreported and unregulated (IUU) fishing, habitat degradation, pollution and climate change.

In Sao Tome and Principe, fish stock is generally on the decline as a result of illegal fishing nets with extremely tight meshes, causing serious ecological disasters. Eighteen vertebrates are threatened endemic species and four bird species are listed as critically endangered (including the Dwarf Olive Ibis, São Tomé fiscal, São Tomé Grosbeak and the Príncipe Thrush) (Faustino de Lima and Dallimer, 2016). In Congo, mangroves water are exposed to the danger of rapid depletion of fish due to fishing with fine mesh nets and dynamite by the inhabitants (IUCN/PACO, 2012). Also, the cutting of mangroves for the production of charcoal and building materials has led to the depletion of different species of oysters in the mangroves and marine coast, with the consequent threat of severe extinction (GCLME Programme, 2011). Meanwhile, overfishing and changes in hydrological conditions have strongly reduced the fishing potential for industrial fisheries in Angola (FAO, 2014)[14], where the important commercial stocks (particularly mackerel Trachurus trecae) are between fully exploited and overexploited (not always as a result of historical overexploitation rather than current excesses (Códia, 2018; FAO, 2016; MoE, 2012)), with notable exception of the Sardinella stocks which are considered to be slightly underexploited (FAO, 2014). The overexploitation and depleted status of the marine fisheries of Equatorial Guinea has also been documented (Belhabib et al., 2015).

IUU fishing has been a major concern in the CAS, including all activities by vessels that are not authorised to fish in the countries' EEZ. This act has proliferated partly because the countries have a low level of control, monitoring and surveillance of fisheries, hence the high rates of illegal fishing (Belhabib et al., 2016).

Wildlife species degradation due to excessive hunting for bushmeat and poaching for trophies, insecurity, disease, overexploitation of crustaceans and mollusks (Fuhnwi, 2017; Micha Ondo Angue, 2014) are of concern in the CAS. The knack for "bushmeat" consumption and uncontrolled harvesting of wildlife in Equatorial Guinea's forests (including mangroves and coastal forests) is also posing serious threats to the biomass of marine and coastal stocks (Fa et al., 1995).

10 - 13 World Bank «Waste: what a waste 2.0»: an updated inventory of the issues of waste management, September 2018. http://datatopics.worldbank.org/what-a-waste/

14 In that country, the important commercial stocks (particularly mackerel Trachurus trecae) are between fully exploited and overexploited (not always as a result of historical overexploitation but rather current excesses [Códia, 2018; FAO, 2016; MoE, 2012]), with the notable exception of the Sardinella stocks which are considered to be slightly underexploited (FAO, 2014). The overexploitation and depleted status of the marine fisheries of Equatorial Guinea has also been documented (Belhabib et al., 2015).

A study on the impact of commercial hunting on forest mammals in Bioko and Rio Muni points to the unsustainable exploitation of wildlife (East et al., 2005; Fa et al., 1995).

The 5th National Report on Biodiversity in Angola 2007–2012 revealed that most landward mammals are under the "Red List" category excluding elephant (African Loxodonta), seals (Arctocephalus pusillus) and hippos (hippopotamus amphibius) (MoE, 2012). This is an indication that landward mammals are declining at a critical rate in Angola. Non-animal stocks such as mangroves and other coastal forests are also declining. Mangrove degradation is specifically high along the coastline in Benguela, Cambida, Zaire and Luanda, while their distribution is still intact around Cunene, Huambo, Huila, K. Norte; K. Sul, K. Kubango, Luanda Norte, Luanda Sol (MoE, 2012).

B-1-8. Urban sprawl and coastal/maritime infrastructure development

More than half of the urban population in the CAS lives in coastal cities, including areas that are poorly served by basic needs and municipal services such as housing, drainage, water supply and sanitation. In Cameroon alone, there are about 3,600,000 inhabitants in and around mangrove ecosystems, of which 300,000 (7.6%) reside in mangrove formations (Ajonina, 2010). Aside from the concentration of population in coastal cities, ineffective urban planning/management and the geographical location of many CAS cities also put them and inhabitants at a disadvantage.

For example, many of Angola's major coastal cities are located at the mouths of river basins, which places these settlements in particularly high-risk sites (Cain, 2017). However, the top-down territorial planning system in Angola does not manage to influence sustainable management of urban land in Luanda (Aires and Chissola, 2015), resulting in serious urban sprawl. This is particularly exemplified by the rural migration to Luanda in search of a safe-haven during the war. These populations did not settle in an organised way and in some cases occupied environmentally risky sites (such as those along riverbanks or drainage courses) with limited coping abilities, making them susceptible to severe erosion and chronic public health crisis (Cain, 2017) (Figure 15). Over 400,000 people live in an area of 40 km^2 in Cazenga, a poor area in the west of the capital Luanda with no tarred roads and where many houses lack electricity (Figure 16).

Figure 15. Flooding following heavy rain in Western Angola, 2015. Source: Samaa.tv.

Figure 16: Stagnant water gathers across a road in a Luanda slum. Credit: AFP Photo/AMPE ROGERIO.

Although the number of critical maritime infrastructures such as ports, terminals and jetties are on the increase in the region as a result of revenue from hydrocarbon production, other communal infrastructures and services such as roads, houses, drinking water and drainage channels are inversely experiencing collapse. The combination of these stressors escalates the occurrence of urban spray in most coastal cities of the region.

Urban/rural migration has also been a trigger for urban sprawl in coastal areas amidst dividing force and inequality. In Sao Tome and Principe, most of the national infrastructures and jobs are in cities located in low-lying areas along the shoreline, including a port, airport, oil reservoirs and hotels. This has sparked rural-urban migration as people are expected to move from rural areas to urban areas where economic activities and infrastructures are concentrated (World Bank, 2018). Therefore, apart from available infrastructures and services being directly exposed to sea level rise, existing municipal infrastructures are over-stretched beyond their capacity, causing poor water delivery and sanitation and exacerbating habitat degradation (World Bank, 2018). Due to visible erosion on the upper part of the Ribeira Afonso village beach profile, a sea wall and a rudimentary revetment with rocks have been built (Bettencourt et al., 2012). Consequently, most people leaving Sao Tome and Principe's rural areas often have trouble keeping up with the shift and fall into a pattern of poverty.

B-1-9. Sea level rise

Generally, several reports have documented that temperatures in Africa are projected to rise faster than the global average increase during the 21st century. However, in tropical West Africa (including the CAS), the occurrence of these unprecedented climates are projected to be one to two decades faster than the global average because the relatively small natural climate variability in this region generates narrow climate bounds that can be easily surpassed by relatively small climate changes (Niang et al., 2014). Figure 17 shows projected temperature increases based on the Coupled Model Intercomparison Project Phase 5 (CMIP5) ensemble.

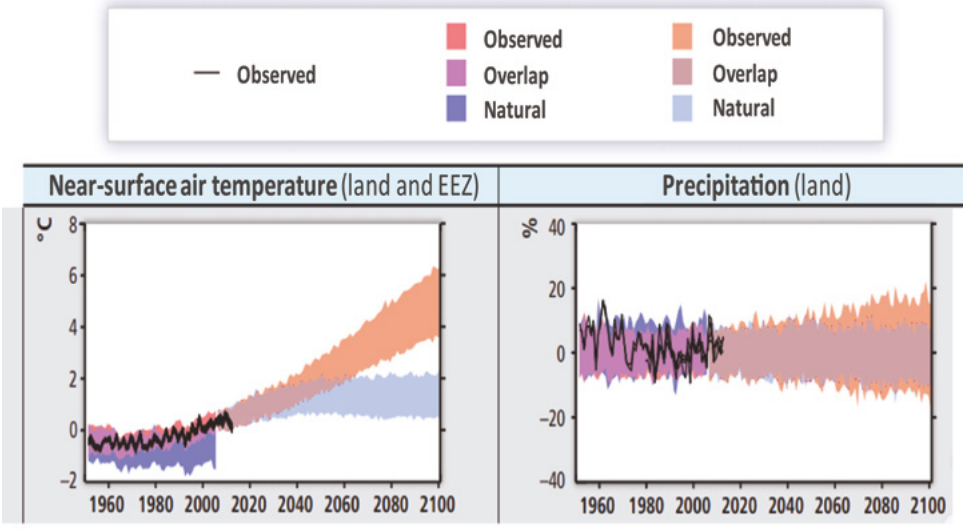

Figure 17. Observed and simulated variations in past and projected future annual average temperature over Economic Community of Central African States (ECCAS). *Source:* Niang et al. (2014).

Taking this information into account, coupled with the effect of global warming on polar ice, the CAS will be devastated by sea level rise—a sub-region with a large and growing coastal population, including several important coastal cities. With rising sea levels, cases of erosion, flooding and inundation of coastal areas are already taking place, creating issues for infrastructure, transportation, agriculture and water resources within the coastal zone. In the face of difficult choices under changing climate patterns and highly constrained public financing, the effect of sea level rise in the CAS is expected to increase with more significant threats to society and livelihoods.

Sea level in Angola is projected to rise between 13-56 cm by 2100 (USAID, 2018) and have significant impacts on coastal settlements, where 50% of the country's population lives, as well as on road networks and industrial and commercial infrastructure (UNDP, 2007). More so, as shown in Figure 18, food security and public health is envisaged to be at jeopardy as rising sea level is expected to reduce the potential for agricultural and fisheries activities in coastal areas due to salinisation and rainfall projections (UNDP, 2007), as well as spread of waterborne diseases due to flooding.

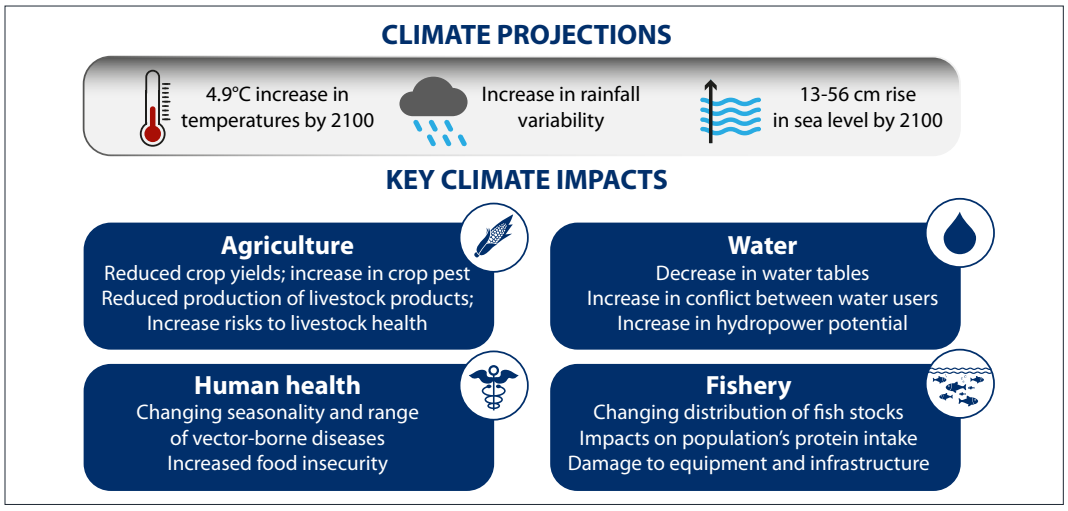

Figure 18. Key sea level impact in Angola. Source: USAID (2018).

Cameroon's coastal lowlands are expected to be impacted by the rising sea level as highlighted in several documents. A projected sea level rise between 9 and 38 cm in 2050 (M. et al., 2009) and at 86 cm in 2100 (GIZ, 2003) will accelerate the disappearance of trees in the future decades, which will in turn accelerate erosion and result in the degradation of mangroves and several ecosystems and habitats (MINEPDED, 2015).

Anticipated impacts of sea level rise on species abundance, distribution and diversity in the wetlands and aquatic ecosystems are also worthy of note in the region. For Equatorial Guinea, a growing percentage of its coastal urban extent will fall within surge zones, with sea level rise and intensified storm surges (Dasgupta et al., 2009). Sea level rise in the country is expected to have an incremental impact on a land area of about 22 km^2, with a projected impact of 17.28% as a percentage of coastal area (Meehl et al., 2007). In fact, the country's capital city is expected to be moved from Malabo on the island of Bioko to Oyala on the mainland partly due to its vulnerability to the effect of sea level rise (BBC, 2017). The impact of sea level rise on biodiversity in Equatorial Guinea has already been documented. Beach profiling datasets from Bioko's five southern sea

turtle nesting beaches estimate habitat loss, with predicted increases in sea level by the years 2046-2065 and 2081-2100: an average of 62% of Bioko's current nesting habitat could be lost by 2046-2065 and 87% by 2081-2100 (Veelenturf et al., 2019).

Figure 19. A view of the main port leading to the Equatorial Guinea capital Malabo, a city under sea level rise siege. Source: Wikipedia.

B-1-10. Other potential vulnerability factors in the CAS

Storm is also one other observed impact and vulnerability in the CAS. Though tropical storms are frequently formed off the coast of Africa without impacting the continent (McCloud, 2019), the experience from Cyclone Idai that tore into southern Africa gives credence to the potential impact of storms in the CAS. In fact, historical records have shown that rising temperatures have resulted in increased evapotranspiration, leading to more frequent and more violent storms in Cameroon with the most devastating cases occurring in 2000, 2003 and 2007 in the Southwest Coastal Highlands (Coastal AEZ) with significant material losses. It is anticipated that the storms will be even more frequent in the coming decades and will occur regularly on the Cameroonian coast with serious damage (MINEPDED, 2015). In Gabon, it is possible that three more storms per year could occur by 2050 on the country's coastline, an increase of seven more days in terms of annual storm duration (MHUEDD, 2011).

Moreover, being one of the most active effusive volcanoes in Africa and with a last record of eruption in 2012, Mount Cameroon (4,095 m) poses an existential danger to the lives and properties of about 500,000 people living or working around its fertile flanks—as the areas around the mountain are susceptible to important lava flow inundation (Favalli et al., 2009). According to Wantim et al. (2013), the risk of lava flow inundation from Mount Cameroon is greatest in the most inhabited coastal areas, specifically the town of Limbe (which constitutes the centre of Cameroon's oil industry and an important commercial port). Buea, the second most important town in the area, has a much lower risk although it is significantly closer to the summit of the volcano. Non-negligible risk

characterises many villages and most roads in the area surrounding the volcano.

Also worthy of mentioning is the dynamics of insecurity that is pervasive in coastal communities of the sub-region. On the one hand, there is an inclination for tension and conflicts as coastal communities would have to compete in order to survive as a result of increasingly depleting marine resources upon which their livelihood depends (Stop Illegal Fishing, 2016; Okafor-Yarwood, 2018; Okafor-Yarwood and Belhabib, 2019; Okafor-Yarwood, 2019). In Sao Tome and Principe, people's food security is at stake amidst the disappearance of some fish species such as the Madeiran sardine (Sardinella maderensis) and the cassava croaker (Pseudotolithus senegalensis) due to illegal fishing and overfishing and the impacts of fossil fuel extraction (IUCN, 2016).

On the other hand, in addition to maritime pirates finding abode in already distressed coastal communities, long-standing maritime boundary disputes between some countries, in conjunction with internal conflicts and pseudo-civil wars in many countries, also pose significant threats to the peace, security and stability of coastal areas in the sub-region. Agitations and infightings in the coastal English-speaking region of Cameroon since 2016 and the Cabinda region of Angola for example have been reported to have displaced thousands of people and created fast-growing humanitarian emergency (Crisis Group, 2020; UN, 2019).

B-2. Adaptation experience

Coastal zones in countries of the Central Africa Sub-region have an elevated susceptibility to several observed impacts and vulnerability arising from both socio-economic, natural and climate change stresses, with severe consequences on agriculture, housing, food security, water supply, ecosystems and health sectors. Responding to these impacts and vulnerability requires integrated management and development strategies that take people, nature and climate change into account. Though the level of vulnerability of countries to various impacts varies, there is a perceived low capacity to adapt to these consequences (UNFCCC, n.d.; MPMA, n.d.; Niang et al., 2014). Few pathways toward effective strategies for enhancing societal resilience and adaptation to these stresses in general have received attention at local, national and regional levels thus far. The focus of this section is on the related national and transboundary adaptive responses to the effects of anthropogenic and climate change induced impacts and vulnerability of coastlines in the CAS region.

B-2-1. Adaptation in the policy arena

Policies and planning instruments in the CAS are beginning to consider adaptation in their processes and operations. All countries in the region have conducted comprehensive medium and long-term climate adaptation planning within their National Adaptation Plan (NAP) under the UNFCCC's Cancun Adaptation Framework (CAF)17[15], thereby helping to integrate climate change into national decision-making. Evidence of the countries' commitment to adaptation is also enshrined in the various Intended Nationally Determined Contributions (INDC) that outlines what post-2020 climate actions they intended to take under the Paris international agreement. For example, Angola prioritises[16] the implementation of adaptation measures in the main sectors of agriculture, coastal zone, land-use, forests, ecosystems and biodiversity, water resources and health, as presented in Box 2.

15 https://unfccc.int/process/conferences/pastconferences/cancun-climate-change-conference-november-2010/statements-and-resources/Agreements

16 https://www4.unfccc.int/sites/submissions/INDC/Published%20Documents/Angola/1/INDC%20Angola%20deposito.pdf

Box 2. Excerpt from the Angolan Draft Intended Nationally Determined Contribution (INDC), November 2015.

ANGOLA'S ADAPTATION CONTRIBUTION

This Adaptation Intended Contribution is included for the purposes of Information of other Parties and the Public that this is part of the country's intended climate actions, and it does not constitute international obligations of the country.

The Angolan economy has been hit hard by the impact of climate change expressed as prolonged drought, damaging flash floods, forest fires, reduced crop production, reduced water resources, impacted fishing resources, etc. Many of the economy sectors of Angola have been impacted by climate variability in the last thirty 30 years, namely Agriculture, Coastal Zone, Land-Use, Forests, Ecosystems and Biodiversity, Water resources, Health. However, there are economy sectors which are extremely vulnerable to impacts resulting from the extreme events and which will pose not only serious livelihood and direct health risks but can also affect the economic potential and national food security. The need for adaptation seems thus obvious. The vulnerability increases for higher temperature increases, so adaptation needs will depend on the expected temperature rise.

The Republic of Angola ratified the UNFCCC in 2000 and the Kyoto Protocol in 2007. Angola completed its National Adaptation Programme of Action (NAPA) in 2011. In 2012 Angola submitted its Initial National Communication to the United Nations Framework Convention on Climate Change (UNFCC). Among the priorities identified in the NAPA, two policy measures are noteworthy: revise sectoral laws for proactive adaptation; national institutional mechanism for adaptation planning and mainstreaming. Accordingly, Angola has developed in recent years various national plans and strategies which include activities relevant to climate change, including the:

- *National Strategy for Climate Change (2008);*
- *National Afforestation and Reforestation Strategy (2010);*
- *Strategic Plan of Disaster Risk Management (2011);*
- *National Action Programme to fight Desertification (2014); and, above all,*
- *The Strategy of Long-term Development for Angola (2025).*
- *Many of the actions envisaged in these plans and strategies, particularly in the energy sector, are linked to both adaptation and mitigation.*

Objectives and Sectoral Intervention for Adaptation

Within the context of this INDC, Angola prioritises the implementation of Adaptation measures in the following main sectors:

1. *Agriculture*
2. *Coastal Zone*
3. *Land-Use, Forests, Ecosystems and Biodiversity*
4. *Water resources*

B-2-2. Adaptation in the planning arena

In addition to efforts under the UNFCCC[17], countries are also leveraging on existing activities to build adaptive capacity across marine, coastal and terrestrial domains. Area-based planning approaches such as marine protected areas have been embraced to enhance the adaptive capacity of these domains in order to foster collective learning and self-organisation, encourage and motivate action in the face of uncertainty and complexity, mediate between rationality and intuition, and enable gradual and adaptive adjustment. Key challenges to these approaches in the region have been how to develop political and collective conviction, facilitate equitable processes and outcomes, and transform planning systems from passive to proactive. Further to these challenges, governments also face scarce financial and human resources.

An example of this approach is the Mangrove Marine Park, an integral nature reserve at the mouth of the Congo River established in the Democratic Republic of the Congo in 1992, covering 76,000 hectares up to the Lukunga River near the town of Boma.

17 https://unfccc.int/process/conferences/pastconferences/cancun-climate-change-conference-november-2010/statements-and-resources/Agreements

Box 3. The Mangrove Marine Park is in Central Kongo Province, Democratic Republic of the Congo

The Mangrove Marine Park is in Central Kongo Province, not far from the city of Muanda. The nearest cities are Soyo and Cabinda (in Angola), as well as Boma historical capital of the Congo Free State (1885–1908). It is an integral nature reserve backed by the Atlantic Ocean, in the extreme Centre-West of the Democratic Republic of the Congo, covering an area of 76,000 ha including a 2 km strip in the Atlantic Ocean, extending from the coast to the seaward and bordering the entire Congolese coastline of 37 km.

Located at the mouth of the majestic and mythical Congo River, this reserve justifies its need for conservation with its unique ecosystem in the Democratic Republic of the Congo. It consists of a mangrove forest whose importance is crucial to ensure the stability of the entire coastal area. In addition, it is neither more nor less than the largest nursery ensuring the sustainability of the fishing reserve of the Congolese littoral.

This singularity challenges and calls on the national and international community to ensure the preservation of this fragile biotope, covering both the delta of the Congo River and the Congolese Atlantic coastline. At a time when water is becoming an increasingly precious resource, this protection becomes a necessity that will guarantee the availability of this wealth for future generations.

Mangroves Marine Park is a wetland of international importance and as such was included in the Ramsar Convention on 18 January 1996 (Ramsar, Iran, 1971). Since 11 April 2000, the Park has been included in the Montreux Record, a register of Ramsar Sites whose ecological features have known, are known or are likely to change.

The exceptional fauna of the Mangroves Marine Park includes the African manatee, a mermaid frequenting fresh waters bordering the Atlantic Ocean (between Senegal and Angola) and a cousin of the Florida Manatee. This aquatic mammal is at the origin of the European myth of the sirens. By cons, the famous African siren named «Mami Wata» seems to be a recent legend because its name actually derives from the English «Mamy Water».

Of the seven species of marine turtles in the world, two species regularly breed on the Congolese coastline, an integral part of the park, while three other species are seen sporadically. Among these two species is the Luth turtle (Dermochelys coriacea) whose largest specimens can weigh more than 950 kg, making it the world's heaviest reptile. The meeting with this giant of the seas is an unforgettable experience. Many freshwater and saltwater fish inhabit the mangroves. Recent studies have shown that 80% of fish species consumed by humans are found in the mangrove for at least one cycle of their life (birth, growth, reproduction).

The flora of the Park consists mainly of mangroves and plants endemic to the coastal region of the Gulf of Guinea. This maritime flora is of great importance in the stability of the coastline, ensuring protection against erosion following the rise of ocean waters. Mangrove forests are composed of very specific plants. These, mainly woody and unusual in appearance, are perched on aerial roots in arches similar to stilts. The mangrove thus fixes the soil thanks to this multitude of roots. These trees, which are permanently rooted in water, rest on loose, unstable and fertile soil. Mangrove soils are enriched by both river sediment and tidal sediment from the ocean. This permanent supply of nutrients triggers a process comparable to digestion. A very unpleasant odour consisting of sulphides emerges and proves this permanent transformation but vital for the health of the mangrove.

Source: https://mangroves-congo.net/

B-2-3. Adaptation in the programmatic arena

In collaboration with international development partners and NGOs, projects and strategies that take coastal vulnerability and adaptation into account in their planning and design are ongoing or already implemented in countries of the region. Most of these projects are often tied with a specific overarching plan or strategy and are sectoral in nature, e.g. focusing on forest management, biodiversity conservation or fisheries.

For instance, in 2016, the Government of Equatorial Guinea launched an extensive 18-month project to develop its national investment plan, which was aimed at involving the country in the international initiative for Reducing Emissions from Deforestation and Forest Degradation (REDD+) and foster sustainable development. However, in 2019, with the technical support of the Food and Agriculture Organization (FAO) and funding from the Central African Forest Initiative (CAFI), Equatorial Guinea launched a National REDD+ Strategy (NRS) structured around four sectors and four cross-cutting issues. The aim is to reduce GhG emissions by 20% by 2030, maintain the current forest cover of 93% and reduce the annual forest degradation rate from 0.9% to 0.45%.

Box 4. Equatorial Guinea National REDD+ Strategy

The vision of the National REDD+ Strategy is to «contribute to the global fight against climate change and to the sectoral development of the country, to achieve the welfare of the people of Equatorial Guinea through REDD +, with an emphasis on competitiveness, sustainability, integrated territorial management, food security, and social and gender equity». Its concrete goals are to:

1. ***Reduce GhG emissions** from the sector of agriculture, forestry and other land uses (AFOLU) **by 20% by the year 2030** (compared to 2010, in line with the reference year in the country's Nationally Determined Contribution), and by 50% for the year 2050;*
2. ***Maintain the forest area close to 93% of the national territory;***
3. ***Reduce the rate of forest degradation to 0.45% per year** (from 0.9% over the 2004–2014 period);*
4. *Strengthen the **National System of Protected Areas;***
5. *Increase the area of **productive forests with sustainable management plans to up to 80% for the year 2030;***
6. *Achieve sustainability and improve efficiency of the forestry and agricultural sectors; and*
7. ***Mitigate possible negative consequences on forests of future productive activities,** including infrastructure, and compensate for them.*

*To achieve its objectives, the country plans to develop policies and measures for REDD+ structured around eight strategic axes. Four of them are sectorial: **agriculture, forests, priority ecosystems, and mining, energy and infrastructure.** Four are cross-cutting, to address underlying drivers: **land use planning, governance, economic opportunities and knowledge**. To finance this ambitious strategy, the country proposes a mixed financial framework with six potential sources that include national, international, public and private resources.*

The NRS was formulated through a consultation process. Likewise, during its implementation, special emphasis will be placed on active stakeholder participation, both men and women.

Source: Estrategia Nacional de REDD+ de Guinea Ecuatorial.
http://www.fao.org/3/CA2911ES/ca2911es.pdf

B-2-4. Adaptation at the institutional and coordination arena

Many countries have made progress or are actively involved in putting in place institutional arrangements for leadership and coordination of their national process, as well as engaging with external stakeholders. Several countries have developed statutory laws to fortify the process within their national systems. Much of these were achieved through existing national resources and institutional arrangements:

- In 2004, the Democratic Republic of the Congo created the Environmental Unit under the Emergency Multisector Rehabilitation and Reconstruction Project (EMRRP) to order and coordinate environmental impact assessment, under the supervision of the Ministry of the Environment. In April 2017, a decree on the creation, organisation and operation of a National Agency for Implementation and Coordination of Integrated Development Canters (AN-CDI) was promulgated. Likewise, in November 2018, the country promulgated a decree establishing, organising and operating a steering committee for the territorial development project in DRC.
- In May 1994, Cameroon established the National Consultative Commission for the Environment and Sustainable Development (NCCESD), while in February 2005 an order establishing, organising and operating the inter-ministerial committee responsible for monitoring the management of the case of twenty fishing vessels previously operated by the Cameroon Maritime Leasing Company (the Committee) was released. In April 2019, the country came up with a decree reorganising the Interregional Committee for Drought Control in the North.
- Sao Tome and Principe's Order No. 11/2012 created the National Committee for Monitoring Activities related to the National Strategy and Plan of Action for Biodiversity Protection. In 2018, the country also created the National Maritime Authority.
- In July 1991, Equatorial Guinea created the Internal Regulations of the Special Body of the Forest Nursery.
- In 2010, the Gabonese Government inaugurated the National Council on Climate Change with a mission to develop the strategic direction of the national policy on climate change. A National Council of National Parks has also been established. Decree No. 000925/PR/MEFEPEPN of October 2005 established the organisation and operation of the National Commission for Sustainable Development, while decree No. 0672/PR/MISPID of 16 May 2011 established the National Platform for Disaster Risk Reduction and Prevention.
- Congo through decree No. 2009-304 in 2009 instituted the Inter-ministerial Committee of Concentration in Case of Superimposed Uses in the Natural Ecosystems. In 2017, the Agency for Planning, Promotion and Development of Special Economic Zones was established.

B-3. The decision-making context

It is true that society might encounter grave challenges while responding to global change. Meanwhile, those in charge of decision-making are often too quick to attack these challenges by simply drawing up adaptation as a decision problem, in a manner that solutions to impacts and vulnerability are proffered in line with existing decision-making mechanisms that are based on identifying the problems, defining them and selecting options.

According to Gorddard et al. (2016), this type of decision-making approach is confronted by societal values and principles, regulations and norms and the state of knowledge, and therefore unsuitable for addressing complex, contested, cross-scale problems. Hence, an attempt at addressing the impacts and vulnerability of the constantly changing and unpredictable coastal environments will necessitate adaptation strategies that are in tune with changing coastal system dynamics and increasing risk (Lawrence et al., 2019). This calls for governance arrangements, decision tools and processes that incorporate both the changing risk profiles and potential uncertainties in order to enable timely, sustainable and cost-effective adaptation. This section therefore aims at highlighting decision-making pathways to support decision-making for effective adaptation in the CAS.

Coastal zones in the CAS will be exposed to a broad range of direct and indirect socio-economic and climate change impacts. For example, sea level rise will exacerbate the impact of storm surge events resulting in increasing damage to built assets. It will also lead to the salinisation of soils on the coastal zone, flooding of low-lying areas and intrusion of seawater further into estuaries, changing their ecology and human use values (e.g. recreation, fisheries). The coastal zone will also be impacted by increasing intensity of rainfall which will influence storm water discharge and hence flooding and water quality. Extreme heat will influence how communities interact with the coastal zone and the ability for natural and built assets to maintain condition. The nearby coastal zone will be exposed to warming ocean waters and increased acidification, which will cause changes in marine ecosystems.

A key aspect of this challenge is to know when to implement adaptation options given that increasing sea levels over the coming century will mean that the options required for protection from, for example, storm surge now may not be the same as in the future. The choice of when to act has a major impact on investment decisions on the one hand, and potential risk exposure on the other. This indicates that, for coastal zones in the CAS to be adaptive to impacts and vulnerability, complex decision-making is required, one that does not only consider the impact of climate change but takes into account the impact of future population expansion, industrialisation, urbanisation, technological advancement, consumption pattern, behavioural change, culture, values and tradition within which these changes take place.

Box 5. Key points for decision support strategies for effective adaptation

Decision support strategies and products need to reflect the needs of different adaptation contexts and communities of decision-makers. They require:

- *co-design between developers and end users; and*
- *joint ownership of tools to guarantee continuing use and support.*

There are common user needs for decision-support tools and knowledge, which can be best met through shared, centralised and standardised services. The model should be sustainably-funded, tailored to the needs of adaptation decision-makers, and accompanied by provision of expert advisory services. This approach leads to maintenance of quality, comparability of outputs, financial efficiencies and on-going support. Effective decision-making for adaptation is risk-based, and takes account of:

- *the best and most up-to-date information on future climate change;*
- *the context of this information in terms of national and international socio-economic and demographic trends;*
- *uncertainties in this information; i.e. retaining flexibility on future options, not locking into inappropriate and costly financial investments, and seeking out low-regrets actions;*
- *the need for effective engagement with all parties involved, including policymakers, businesses, scientists and civil society;*
- *examples of adaptation best practice as a benchmark; and*
- *the need to evaluate performance on an on-going basis.*

Source: National Climate Change Adaptation Research Facility, Australia.

https://www.nccarf.edu.au/sites/default/files/attached_files_publications/DECISION_070313_A4.pdf

B-3-1. Information on the future for decision-making on coastal impacts and vulnerability in the CAS

In the future, countries in the region will increasingly be confronted to greater coastal hazards and risks than currently experienced due to present-day socio-economic stressors and climate variability, with potentially greater impacts and costs for the economy, society and the environment. Thus, it is important to focus now on sound decision-making frameworks and tools to equip decision-makers with approaches that provide resilience to future socio-economic and climate change. Coastal population is expected to continue growing in the region, and there is high confidence that human interference is changing the climate. Therefore, uncertainty in future climate change projection should be critically looked into along the decision-making ladder.

Box 6. Uncertainty in future climate change projections

Information on future climate change derived from climate models is a fundamental building block of adaptation decision-making. Some of the sources of uncertainty in future climate change projections are:

- *Different models will give different answers;*
- *The behaviour of the atmosphere is partly random – two runs of the same model with the same starting conditions will not end up in the same place;*
- *Uncertainties about how greenhouse gas emissions will change over time;*
- *Climate models are not able to realistically capture all atmospheric processes including, for example, the formation of some cloud types.*

Attempts have been made to overcome some of these issues by, for example, developing probabilistic scenarios tailored to the needs of end-users. These can work well where users have a good understanding of the information presented, for example, catchment managers working with hydrologists.

Others, without the scientific and statistical understanding, have struggled to make use of these sometimes-complex presentations. The disconnect between the reality of model data and the expectations of users remains an issue in developing knowledge on future climates to underpin adaptation decision-making. Decision-makers should ask themselves whether there is a real need for complex, detailed, and often time consuming and expensive to produce, information on future climates that may have a low degree of certainty. In fact, broad-brush information on climate changes may be sufficient to do an exploratory examination, which may in turn be highly revealing of where the exposure and sensitivities to climate change lie.

Source: National Climate Change Adaptation Research Facility, Australia.

https://www.nccarf.edu.au/sites/default/files/attached_files_publications/DECISION_070313_A4.pdf

B-3-2. Framework for decision-making

Risks arising from socio-economic as well as climate change are complex and strategic, requiring decisions concerning policies, strategies, plans and projects that will deliver a well-adapted CAS. Example of principles of 'good' adaptation is herewith provided. Particularly for climate change risk, the Australian National Climate Change Adaptation Research Facility believes that any decision-making that is mindful of these ten principles should deliver effective adaptation to climate change.

Principles to deliver effective adaptation to climate change
(Australian National Climate Change Adaptation Research Facility)

1. Work in partnership – identify and engage the community and keep them well informed.
2. Understand risks and thresholds, including associated uncertainties.
3. Frame and communicate SMART[18] objectives/outcomes before starting out.
4. Manage climate and non-climate risks using a balanced approach – assess and implement your approach to adaptation in the context of overall sustainability and development objectives.
5. Focus on actions to manage priority climate risks – identify key climate risks and opportunities.
6. Address risks associated with today's climate variability and extremes as a starting point to addressing risks and opportunities associated with longer-term climate change.
7. Use adaptive management to cope with uncertainty – recognise the value of a phased approach to cope with uncertainty.
8. Recognise the value of no/low regrets and win-win adaptation options in terms of cost-effectiveness and multiple benefits.
9. Avoid actions that limit future adaptations or restrict adaptive actions of others.
10. Review the continued effectiveness of adaptation decisions by monitoring and re-evaluating risks.

Principle 1 should be particularly emphasised as stakeholders are very important in strategic decision-making, and their exclusion may discredit the process and its implementation. More specifically, stakeholder involvement may help to ensure that the Decision Support Framework better meets user needs and expectations as well as provides legitimate, relevant and trusted information. Involving users also helps to support social learning and build a community of adaptors (Leitch et al., 2019).

Following the steps of a structured framework should enable decision-makers to identify and evaluate the risks and opportunities presented by a changing climate, make the best use of available information about the impacts and available adaptation options, identify and implement appropriate adaptive responses, and monitor and evaluate the performance of those responses. A possible framework for structured decision-making is shown in Figure 20.

18 SMART objectives are objective that are Specific, Measurable, Achievable, Relevant and Time bound.

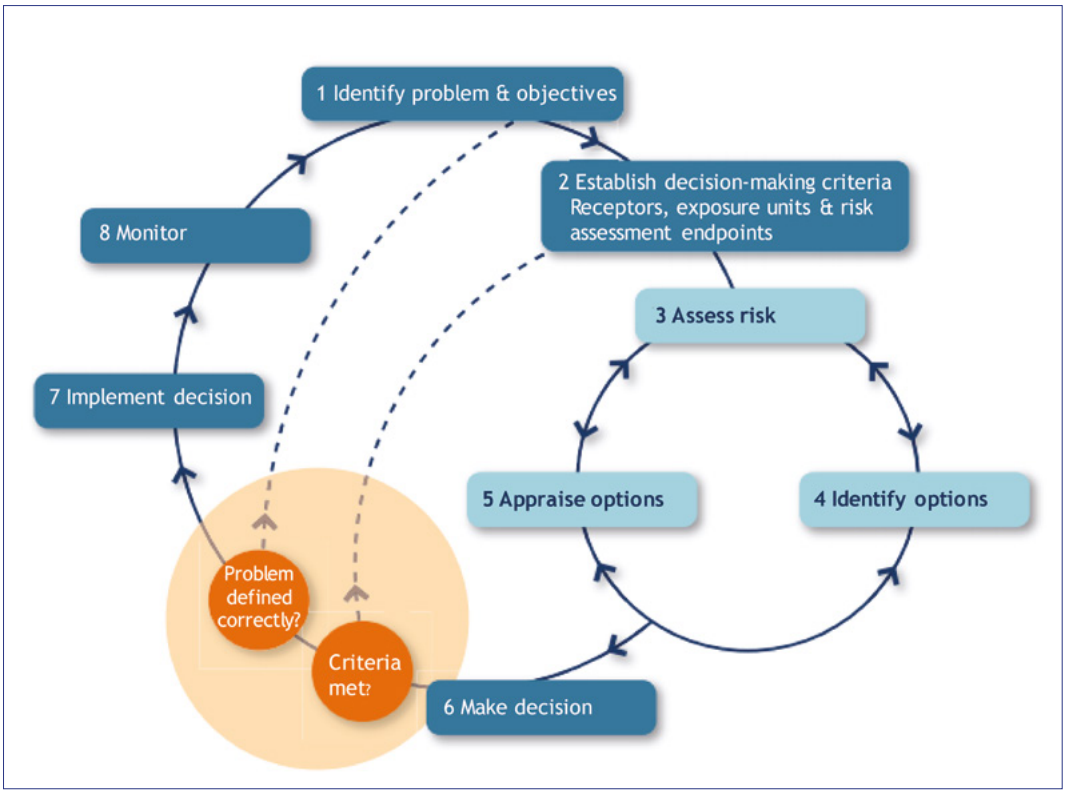

Figure 20. Decision-making framework produced by the UKCIP. Source: NCCARF, Australia.

Section C
Opportunities for regional adaptation

Coastal processes, especially seaward, have intensive transboundary implications. In this regard, effective coastal resource management and governance, including adaptation processes, transcends spatial, sectoral and jurisdictional boundaries.

Participating experts at the Technical Workshop on Coastal Vulnerability in Central Africa organised in Libreville, Gabon, on 5-7 November 2019 (hereafter referred as the ICAM Workshop), acknowledged that climate change impacts and other coastal challenges in Central Africa region are transboundary, similar and shared. Current coastal erosion was identified as the most common threat to the environment, livelihood, economy and population (especially fishing communities) of all seven counties in the region. Still, the population was noted to be equally exposed to a number of risks with strong influence across environmental, economic, social and political sectors that would have severe impacts in the few decades to come.

Oversighting regional approach to adaptation opportunity logically called for a systematic evaluation of national efforts and individual commitment to regional integration and cooperation. Risk transmission and/or transition belt across sectors, boundaries and adaptation policies (mechanisms) would drive a closer view on the need for this regional approach. This section presents several adaptation opportunities that could be shaped at regional scale in light of currently existing initiatives.

C-1. Key risks across sectors and the region

In line with the above definition of terms, a risk is herein considered key due to its societal and systemic impacts with respect to associated high hazard or high vulnerability. In this context, out of the assessed threats presented in section A above, national experts retained risks associated with exposure to erosion, pollution, overexploitation of marine resources, salinity intrusion, mangrove destruction, sea level rise and flooding. Based on their individual judgement, these risks were identified with high confidence to span across environmental and socioeconomic sectors, and across countries in the region. Logically, the impacts of changing climate risks in one sector could affect other sectors significantly.

It was noted that in the decades to come, the transport sector for example could face the disappearance of coastal terrestrial road system in many countries, while the maritime transport would accelerate erosion, pollution, habitat and biodiversity loss, with demands in port construction and expansion. The tourism sector would have its own strong impact on biodiversity through increased marine litter with reduced ecosystem services. The overall urban waste production scenario is projected by Kaza et al. (2018) to reach 74,455,185 tonnes/year by 2050 and distributed as shown in Figure 21 below. There will be an increase in food insecurity in the fishery sector due to overexploitation and exacerbating IUU fishing practices. Mangrove destruction

in the environmental sector for boat construction or household energy generation would lead to human health threat with increase in atmospheric CO_2, the extinction of many terrestrial and marine species (both plants and animals), as well as increased coastal erosion. Dredging or sand extraction for construction from the mining sector will also continue to accelerate increase in coastal erosion.

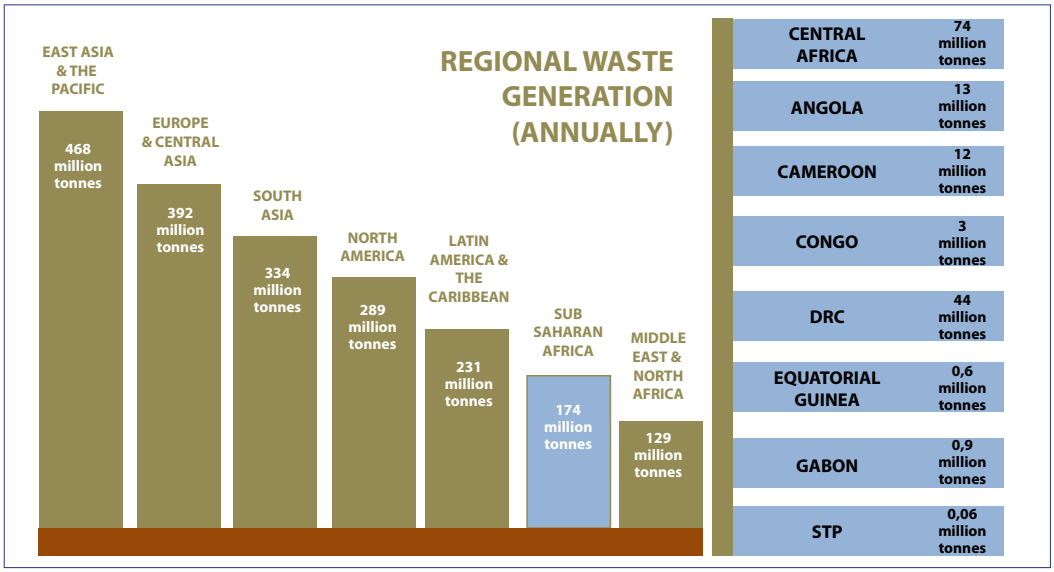

Figure 21: Projected regional waste generation by 2050. Source: World Bank data, 2018.

It could therefore be extremely challenging to dissociate sectoral risks from their spatial implications across borders. However, regarding the CAS, risks that could have been identified to directly influence cross-border could be summarised in the table below.

Vulnerability factor	Associated risk	Concerned sector	Cross-border/ Regional
Erosion	Death, infrastructure destruction, habitat destruction, agricultural land loss, food insecurity	Tourism, health, environment/forestry, dredging, transport, agriculture	Identified
Pollution	Mortality, ill-health, disrupted livelihoods, food insecurity, insufficient access to safe drinking water, habitat degradation, ecosystem loss	Environment, tourism, transport, oil and gas, water	Identified
Overexploitation of resources	Impairment of natural system, resource depletion, food insecurity	Environment, tourism, social, oil and gas	Identified
Salinity intrusion	Habitat destruction	Environment, social	Identified
Mangrove destruction	Biodiversity loss, ecosystem service loss	Environment, tourism, social	Identified
Sea level rise	Death, injury, disrupted livelihood, increased flooding, erosion, Infrastructures damages	All sectors	Identified
Flooding	Mortality, food insecurity, breakdown of food system, infrastructure damages	Tourism, environment, social	Identified

Table 3. Identification of cross-border risk in CAS.

Bearing in mind projections related to future climate impacts at global, regional or national levels, it could be anticipated that key risks associated with the vulnerability factors presented in the above table will have extended impact across borders. Increased erosion and flooding would contribute to intensive population mass movements (both human and animal) between countries, exacerbated by a drop in national economic potentials due to the loss of coastal protection materials (e.g. salt marshes, rocks, etc.) and infrastructure (e.g. road networks, buildings, etc.). Pollution and salinity intrusion would reduce the carrying capacity of many coastal areas, thereby prompting species to migrate into adjacent country waters or further towards the high seas. As a result, there will be increased food insecurity and more potential for social violence (Carleton and Hsiang, 2016).

C-2. Sectoral risks and adaptation potential

As a global situation, it is projected that climate change threats would amplify climate-related risks and eventually create new risks for natural and human systems. At the same time, human activities in coastal areas would inevitably increase with associated risks. Many of these risks will be limited to specific sectors, countries or regions, while others will be experienced by all. Sector-based organisations play a significant role in national and regional decision-making processes and are therefore evident focus for adaptation actions. Sector programmes, policies and plans are relatively interrelated both horizontally and vertically at national or regional scale. This part provides an overview of a few key risks with potential for cross-border inclusion in the CAS, as well as potential for adapting in the context of climate change.

C-2-1. Transport: Port and shipping

According to the United Nations Conference on Trade and Development, maritime transport, like other coastal and marine activities, faces a dual challenge in respect of climate, notably the need to reduce its carbon emissions and, at the same time, adapt to the potentially wide-ranging impacts of climatic changes. Considering the relative vital importance of maritime transport in national economies for Central African coastal countries, meeting climate challenges and adapting to climate risks would be imperative through enhancing regional capacity and enforcing legislations regarding environmental impact of port activities across borders.

C-2-2. Fishery and aquaculture

Redistribution of fishing catch potential in Central Africa, along with projected population growth and increased demand for food, poses a risk in the supply of resources, incomes and jobs in different countries, which can also imply a food security risk for coastal populations.

Therefore, small-scale fishing, coastal aquaculture and fish processing industry would require adequate adaptation through training, information campaigns and updated regulations towards the sustainability of fishing and the conservation of the marine environment.

C-2-3. Energy

Energy sources and technology will be highly affected by severe and frequent climate events and population pressure in future years. Production of energy from forest and mangrove trees for domestic needs will be reduced with the projection concerning high rate of deforestation. Sustainable sources such as wind energy production are non-existent and solar

energy technology is still in its infancy stage. Adaptation actions in this context would include large-scale public-private risk reduction initiatives and economic diversification at national levels.

C-2-4. Infrastructure development (onshore and offshore)

Many key risks associated with climate change or human induced changes in Central Africa are concentrated in coastal urban areas. This situation is expected to intensify in the future with more demand in the production system and development of more coastal infrastructure. In the absence of essential and adequate infrastructure, there will be amplification of risks with retro impact on the environment and more vulnerable infrastructures. Opportunities for adaptation measures include improving housing, building resilient infrastructure systems, improving coastal governance systems with implementation of existing policies and incentives with better community adaptation capacity building in coastal and ocean science and management, etc. Also, the need to enhance synergies with the private sector, and sustainable financing and institutional development.

C-2-5. Forestry and agriculture

Increased tree mortality and forest destruction due to drought and human deforestation would pose the irreversible risk of poor carbon storage capacity, degradation of water quality, deficient biodiversity carrying capacity and even loss. Adaptation measures would include sustainable policies taking into account coastal (rural) communities into decision-making, although civil society appears less present in the decision-making context in Central Africa and the number of environmental NGOs with interest in coastal and marine affairs are few. Other measures could include trade reform and investment with strong potential in improving market access for agricultural and forestry products, including small-scale farms.

C-2-6. Coastal ecosystems

It is certain that the next few decades will face the threat of extinction of a large portion of coastal terrestrial and marine species due to habitat degradation, loss, overexploitation, modification and pollution. Even if it could be said with low confidence that certain species would resist and adapt to new environments and conditions, there is high confidence that many will continue to significantly decrease in abundance or go into extinction in part or all of their range. A wide spectrum of ecosystem services will then be lost, in addition to the high impact on the tourism and health sectors for example. Ecosystem-based management action which includes restoration and protective action for habitats and species would offer a great opportunity for adaptation in this sector. Potential activities of the Mount Cameroon volcano would need to be taken into serious consideration in a regional ecosystem-based adaptation plan.

C-2-7. Food and nutrition

Projected increase in temperature in the next decades will have severe impacts on crop production in some coastal areas of Central Africa and, in conjunction with overexploitation of fishery resources, may aggravate food insecurity and undernutrition, all of which will be exacerbated by the intrusion of land-based pollutants. There will be a huge decline in food quality and availability, exacerbated by agricultural decline in productivity.

C-2-8. Water

Projections reveal that reduced surface and groundwater resources in the Central African region will increase

drought frequency in many countries and significantly intensify competition for water among many sectors. Water quality is also expected to reduce with increased temperature and increased intrusion of sediments, nutrients and various forms of pollutants, thereby aggravating exposure to health risks, including increased morbidity and mortality. Under these scenarios, the adaptive water management approach could help create resilience to uncertain hydrological changes and impacts. This approach generally includes scenario planning, learning-based mechanisms and flexible solutions. However, there is no strong evidence of availability of this tool to secure vulnerability of this sector.

C-2-9. Dredging

Dredging remains one of the key resource exploitation activities in the CAS, characterised by extensive sand extraction for building construction and urban development. These activities mostly take place along coastal rivers, canals, estuaries, beaches, etc. The dredging community, which can be understood to be composed of contractors, manufacturers, port and water authorities, policy-makers, regulators and many other stakeholder groups, have all but significant responsibility in the observed vulnerability and management of dredging activities, which have included as specified earlier remarkable risks to coastal erosion or wetland and habitat loss amongst others. Adaptation measures in this context would require the establishment of strong regional instruments (policies, regulations, strategies) reframing dredging activities in terms of volumes, locations, tools used and methodologies.

C-2-10. Oil and gas exploration and exploitation

Globally, the oil and gas extraction and processing sector is already financially vulnerable to extreme weather events, and climate change would have significant impact on the oil and gas production system in the CAS. All countries are oil and gas producers, which contributes to a very considerable share of the countries' respective GDP. While exploration activities would be impacted by wave loading, loss of surface water access or species migration on the one hand, production activities on the other hand would face challenges in pad damages, production delays and also loss of surface water access. Moreover, the oil transport and terminal operation would be threatened by damages to coastal facilities, shipment interruptions, improved or reduced shipping lanes. Land pipeline would also face the risk of thaw subsidence, frost jacking and effect of wildfires due to temperature rise. Coastal refineries would be exposed to flooding, erosion, loss of access to water and loss of peak cooling capacity. Adding to all of these would be the impact on the materials, operation equipment and infrastructures.

C-2-11. Humans and health

Human health in Central Africa due to environmental pressures continues to be a major concern with the potential of being exacerbated by future projections in the years to come. Small island states and low-lying coastal systems will experience increased adverse impacts, such as submergence, coastal flooding, erosion and decreased water quality. A large portion of the population expected to further grow and be concentrated in coastal areas will face exposure to these threats in addition to facets of urban heat island processes. Increased diseases will be expected in context of low grade health infrastructure, food and water-borne diseases which would bring about the high risk of increased morbidity and mortality. Adaptation measures would include development and improvement of basic health infrastructures, provision of clean water and sanitation measures, increased capacity for disaster preparedness and

response and building efforts towards alleviating poverty.

C-2-12. Human security

Projected extreme climate events would increase displacement of people and indirectly impact on national and regional integrity and prosperity through increased risks of violent conflicts in the form of civil war and inter-group violence. It would amplify drivers of these conflicts, such as poverty and economic shocks (confidence level). Slowed down economic growth due to climate events makes systematic and formal poverty reduction difficult and prompts communities to seek other means of survival, including any form of violence driven by illegal activities. According to the International Maritime Bureau (IBM), the Gulf of Guinea and the Central African region have been characterised as the world's hottest pirate spot since 2018, and these illegal acts would be associated to climate trends as reported by Carleton and Hsiang (2016) and EJF (2016). These would have strong influence on national and regional adaptation and security policies and require adequate actions, such as a framework for fighting against corruption at regional scale and involving actors across borders.

C-2-13. Democracy and Sustainable Governance

Climate change would have very negative implications on efforts regarding good governance in the case of a lack of governmental opportunities to support affected populations during a period of disaster or hardship, such as flood or water shortage. Advances in sustainable actions could significantly enhance the effectiveness of adaptation planning and actions. Promotion of rules of law, good governance policies with intensive participation of local/domestic communities in decision-making processes would therefore be an invaluable asset for adapting to impacts. In this context, adequate actions such as a framework to fighting against corruption at regional scale - involving actors across borders - would be highly recommended.

C-3. Regional key risks and potential for adaptation

C-3-1. Regional key risks

As mentioned and illustrated earlier, coastal risk and level of exposure would vary through time, space and population or culture. In this context, impacts would be felt across regions and would depend on several factors, including the extent and potential of adaptation. Normally, as suggested by the FAO, a "no regrets" adaptation approach would be suitable for the CAS due to high impact uncertainty underlined by the large gap in datasets. This approach actually relies on building general resilience without a heavy reliance on specific climate impact projections. However, proper adaptation activities need to align with exposure to risk as shown in Figure 22 below.

The identification of regional key risks was driven by the selected expert judgement on key vulnerability factors during the ICAM workshop (Libreville, 2019). Qualifying the risk level was set by contextualising probability and consequence over the widest possible range of potential outcomes, based on the available literature. Risks of aggravating social insecurity, human morbidity and mortality, loss of ecosystem services, increasing atmospheric CO_2, facing regional economic meltdown were identified amongst others to be of key regional concern in the CAS.

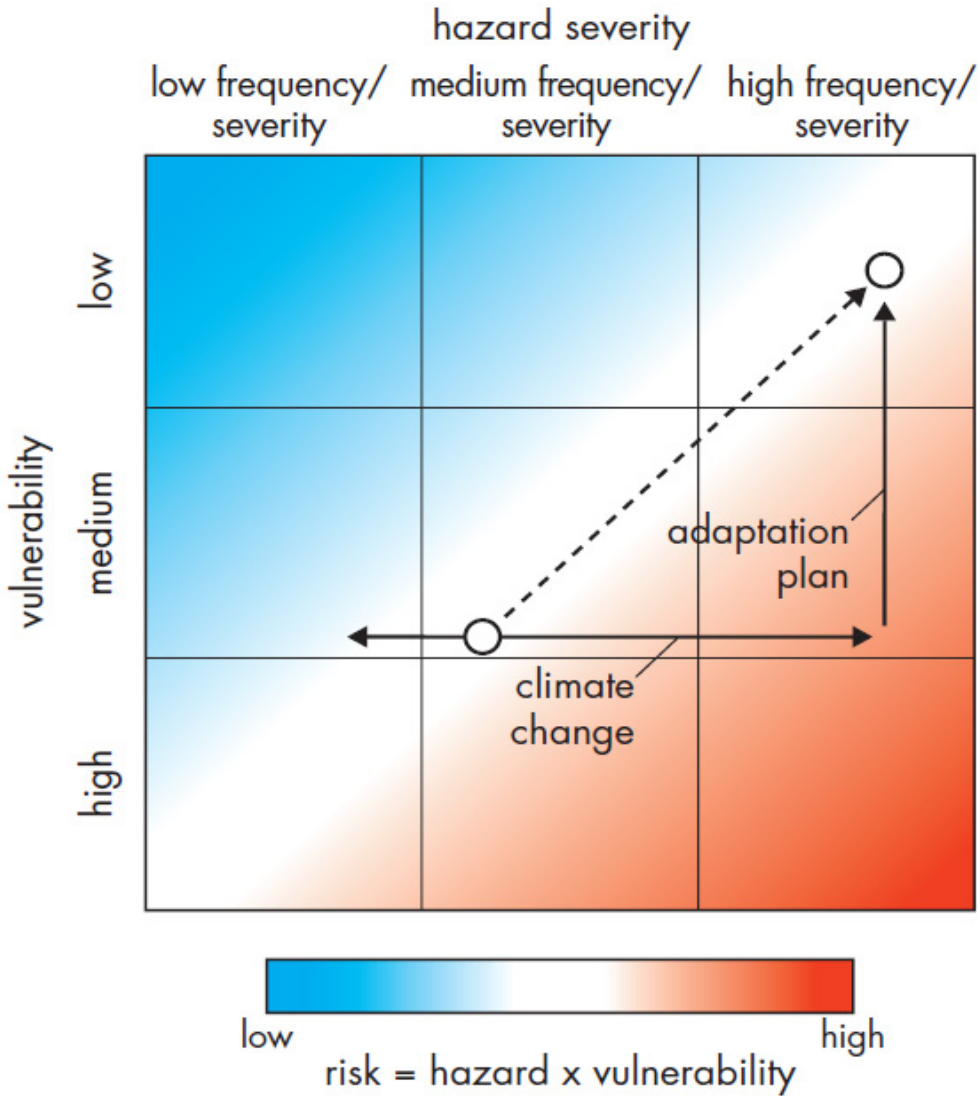

Figure 22. Relationship between vulnerability, hazard and adaptation performance[19] (Source: IPIECA, 2013).

C-3-2. Regional adaptation potential

Cross-border cooperation and a Central African regional approach to coastal resource management would be highly recommended. In fact, with reference to Articles 35 and 36 of the additional protocol to the Abidjan Convention on Integrated Coastal Zone Management, transboundary cooperation and transboundary environmental assessments are encouraged between parties to the Convention: parties are urged to, "directly or with the assistance of the Organization or competent international organizations, bilaterally or multilaterally, endeavor to coordinate and/or harmonize, where appropriate, their policies and strategies, their national coastal plans and programmes regarding transboundary zones". Regarding the observed and projected climate challenges and existing individual country efforts to tackle diverse pressures, it would make good sense to share a common agenda

19 IPIECA: The global oil and gas industry association for environmental and social issues, in "Addressing Adaptation in the oil and gas industry". http://www.ipieca.org/news/addressing-adaptation-in-the-oil-and-gas-industry/

with coordinated activities rather than expanding on mechanisms that would repeatedly conflict with adverse impacts from neighbouring activities.

In addition to national adaptation efforts as presented in section B-2 of this report, a number of global and regional policy and legal instruments (Box 7) are already in place, conferring substantial regional adaptation potential for the Central African Sub-region. These instruments equally have high potential to drive better adaptation opportunities for the CAS.

Box 7. Policy and legal instruments in support of regional adaptation potential in the CAS

Policy instruments:

- *2030 Agenda for Sustainable Development of the United Nations*
- *UN Decade of Ocean Science for Sustainable Development (2021-2030)*
- *IOC-UNESCO/European Commission Joint Roadmap to accelerate Maritime/Marine Spatial Planning worldwide*
- *African Union's "Agenda 2063: The Africa We Want"*
- *African Union's "2050 Africa's Integrated Maritime Strategy"*
- *Africa's Blue Economy: A policy handbook*
- *Cross-Border Diagnostic Analysis Document and Strategic Action Programme of the GCM-CG*
- *Convergence Plan / Sub-Regional Action Plan to Combat Desertification for Central Africa (PASR-AC-2000, 2005) - Developed and implemented by COMIFAC*
- *Convergence Plan / Sub-Regional Action Plan to Combat Desertification for Central Africa (PASR-AC-2000, 2005) - Developed and implemented by COMIFAC*
- *Blue Fund and Climate Commission initiatives for the Congo Basin*
- *Central Africa Regional Strategy for the Prevention of Risks, Disaster Management and Climate Change Adaptation (2016)*
- *Regional Strategic Action Plan for the Environment and Biodiversity Resources of the Congo Basin Ecosystems*
- *African Strategy on Climate Change (2015)*

Legal instruments:

- *United Nations Convention on the Law of the Sea*
- *United Nations Convention to Combat Desertification (UNCCD)*
- *Convention on the Conservation of Migratory Species of Wild Animals*
- *United Nations Convention on Biological Diversity (CBD)*
- *Ramsar Convention on Wetlands*
- *Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES)*
- *International Convention on Oil Pollution Preparedness, Response and Co-operation*
- *International Convention for the Prevention of Pollution from Ships (MARPOL)*
- *Basel Convention on the Control of Transboundary Movement of Hazardous Wastes and their Disposal*
- *United Nations Framework Convention on Climate Change (UNFCCC)*
- *Convention for Cooperation in the Protection, Management and Development of the Marine and Coastal Environment of the Atlantic Coast of the West,Central and Southern Africa Region (Abidjan Convention)*
- *Kyoto Protocol*
- *International Convention on Oil Pollution Preparedness, Response and Co-operation (ICOPPRC)*
- *African Maritime Transport Charter*
- *African Charter on Maritime Security, Safety and Development in Africa (Lomé Charter)*
- *Treaty on the Conservation and Sustainable Management of Forest Ecosystems in Central Africa and to establish the Central African Forests Commission (COMIFAC)*
- *Conference on Dense and Humid Forests Ecosystems of Central Africa (CEFDHAC)*

Although there are national and a few regional universities and research centres in the CAS, there is still very limited potential to develop and strengthen community and climate-induced risk information and early warning systems for preparedness, resilience development and adaptation. Risk knowledge, monitoring and prediction would be developed and enhanced in the region with systematic collection of risk data and quantitatively assessing likelihood of exposure. Yet, there is a lack of instrumentation and capacity in support of coherent adaptation mechanisms for the region.

Section D
Conceptual framework for future action

Actions for the effective management of climate and human-induced vulnerability and risks involves mitigation and adaptation measures and decisions which would integrate implications for future generations, economies and environments; across countries and regions globally, and Central Africa in particular. In this section, adaptation actions to build socio-economic and environmental resilience are considered with a potential target on adjusting and reducing projected impact on the region while equally considering their limits, pathways and transformation mechanisms. The section provides a summary of the process by which policy-makers in the CAS can seek to develop interventions that will enhance commitments in adaptation to the range of climate change-induced risks, hazards and vulnerabilities in coastal zones of the region. It outlines a set of seven principles that may be used as a guide during the climate change policy formulation process.

While every country in the CAS is unique in its specific circumstances - economic profile, actors, challenges and opportunities - there are several challenges that cut across all countries in the region such as coastal erosion, oil pollution, degradation of mangrove forest, etc. Likewise, regional priority actions and recommendations by participants during the ICAM Workshop (Libreville, 2019) point to the similitude of certain critical issues in the region. Accordingly, strengthening stakeholder engagement in adaptation might be adopted as a stand-alone policy objective or as part of a larger adaptation policy process, such as the formulation of a National Adaptation Plan (NAP). It might also constitute an element in efforts to address a specific climate-resilient development objective, such as installing drainage facilities or providing alternative sources of livelihood. Whatever the circumstances, it is hoped that the principles described (see Figure 23) in this section can be regionally applied and prove useful in the climate change policy formulation process.

This section focuses on the principles of identifying drivers and barriers and designing interventions, stakeholder engagement, sector prioritisation and implementation and scale-up. Also based on these principles and ideas enshrined in climate-resilient pathways and transformation thinking, the section accentuates on what the short and long-term vision for delivering a climate-resilient future in the CAS should look like, including how the vision can be actualised. This includes strategies, choices and actions that reduce climate change and its impacts as well as actions that guarantee that effective risk management and adaptation can be implemented and sustained over time.

D-1. The "nine" principles for effective adaptation in the CAS countries

Nine principles required for effective community and ecosystem-based adaptation frameworks in Central Africa Sub-region are herein grouped as shown in Figure 23 and described below, irrespective of their order of priority.

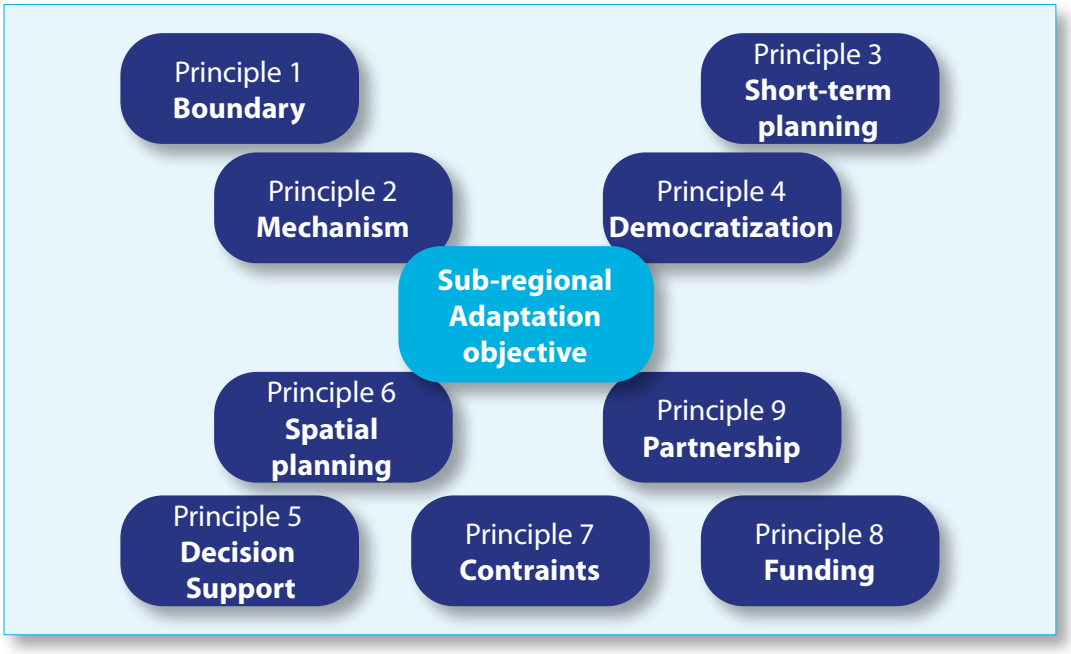

Figure 23. Nine principles for effective adaptation in the CAS countries.

Principle 1: Clearly define coastal zone boundaries

A clear knowledge of coastal zone boundaries is imperative for its sustainable management. Coastal zones need to be defined in the legal context to avoid misunderstanding or misinterpretation. In the absence of such boundary definition, it becomes quite challenging to logically drive an ICZM activity.

Principle 2: Adequately contextualise adaptation mechanisms

It can be agreed with high confidence that addressing adaptation mechanisms and actions would take into account the specific context related to space (where), time (when) and means (how). To be effective, adaptation strategies would consider the dynamics of vulnerability and exposure and their linkages with many other factors, including environmental and socio-economic processes.

Principle 3: Reduce exposure to currently assessed vulnerability factors ("low regret" planning)

A key initial step towards adaptation to future vulnerability in the region is the considerable reduction of vulnerability exposure to current key risk factors, as illustrated in the previous section. This stage would imply the strong commitment of national governments in preparing, defining and coordinating adaptation efforts to be carried out by local communities.

Principle 4: Include and enhance participation of all stakeholders (favour democratisation of adaptation system)

Planning and implementation at this level would therefore be regarded as a joint effort and actions across all levels of stakeholders from civil society, NGOs, private bodies to government entities.

In this context lies the appeal of the sub-region's coastal and marine experts for improving capacity building in the various aspects of ocean science and technology.

Principle 5: Build a strong decision support system

Decision systems would be most effective if replicated from global to regional context of decision types, decision processes and constituencies, taking into account all adaptation and implementation levels of governance contingent on social values, objectives and risk perceptions. Geographic information systems (GIS) and strong national and regional coastal and marine spatial data infrastructure need to be built and supported by legislation.

Principle 6: Establish a coherent coastal spatial planning framework

Intensification of activities and urban sprawl within coastal zones would bring about competitive interests in the use of the coastal space. As such, establishing a coherent spatial planning framework would guide sustainable use of space while enhancing adaptation potentials.

Principle 7: Examine constraints in adaptation planning and implementation

Constraints, either human or natural, constitute a significant impediment to planning adaptation and implementation in the Central African region, a poor planning with limited knowledge would consequently increase vulnerability and exposure. These constraints include uncertainty regarding future and projected impacts, which are different to risk and exposure in a particular area, for example:

- Competing interest with respect to environmental benefits
- Limited availability and access to technological tools for adaptation and risk monitoring
- Limited financial and human capital (capacity),
- Limited participation, transparency and governance approach.

Principle 8: Design interventions to catalyse sustainable funding/ investment mechanisms in adaptation

Governments at national, regional and local levels should design policies and interventions that create an enabling environment for nature-based investment towards climate change adaptation. This is necessary for successful private sector engagement, and it is an integral part of addressing the barriers facing the implementation of adaptation programmes. A range of possible interventions could be used to help incentivise adaptation in different contexts:

- Blue/Green Climate Bond,
- Market and business development,
- Partnerships and cooperatives,
- Financial instruments: Cost-benefit analysis might be helpful in determining which intervention to choose, including the use of ecosystem service valuation where appropriate. Based on such analyses, policy-makers can more easily assess the cost of each intervention at various scales.

Principle 9: Build a strong partnership among national, regional and international organisations

Financial institutions and existing emerging economic instruments, such as public-private finance and research partnerships, have the potential to foster adaptation by providing incentives for anticipating and reducing impacts. There is a need for a well-shaped assessment of adaptation costs, funding and investment in the region.

D-2. Climate-resilient pathways and transformation

Climate change is one of the major challenges facing coastal communities in the CAS and a deciding factor to achieve sustainable development. The latest IPCC Special Report on Oceans and Cryosphere in a Changing Climate highlights the urgency of prioritising ambitious and coordinated actions to address the unprecedented and continuing changes that are taking place in the ocean and cryosphere (Earth's frozen lands). For communities and developments in the region's coastal zone to be resilient and adaptive to climate, there is a need to include choices and actions that reduce climate change impacts and sustain development efforts over time in any related strategy or policy.

This thinking also aligns with global commitments set out in different international high-level agreements and frameworks such as the 2030 Agenda for Sustainable Development, the Paris Agreement on climate change and the Sendai Framework for Disaster Risk Reduction. Various recommendations from the ICAM Workshop (Libreville, 2019) and the resolutions from the Loango coastal erosion workshop underlined that climate change offers huge challenges, one which calls for new approaches that take into account both short and long-term time horizons in the frame of the "so-called" 'climate resilient development pathways'.

According to the IPCC (2014), pathways for climate change are those developmental trajectories which combine mitigation and adaptation in order to attain sustainable development goals and to forestall dire interference with the climate system. However, these pathways must be addressed through the lens of a transformative approach (see Figure 24) because climate resilience is complex, requires a holistic view of the challenges that ecosystems face, and calls for solutions at the intersection of society, environment and economy.

Figure 24. A people-centred approach to climate resilience[20]. Source: DeBacker et al. (2015)

20 According to DeBacker et al. (2015), this anthology grew from the Pathways to Resilience (P2R) Initiative, launched in late 2013 by the Movement Strategy Centre (MSC), in partnership with The Kresge Foundation, the Emerald Cities Collaborative and the Praxis Project. Through interviews, research, and convening—which we call the P2R Dialogues—this effort produced a vision of climate resilience, grounded in the realities of low-income communities and communities of colour, and pragmatic pathways to achieve it.

In the context of adaptation to climate change in the region, adaptation pathways have been proposed as a promising decision-focused approach for planning under uncertainty as well as to help decision-makers to sequence measures for flexible implementation with limited undesirable and mal-adaptive consequences. In addition, the participatory development of pathways proposed in this section will have the potential of "priming" stakeholders' capacity for change and facilitating transformations.

D-2-1. Navigating towards the future: Approaches and pathways

Erosion, drought, flooding, pollution, saltwater intrusion, etc., these are some of the easy-to-predict challenges that coastal areas in the CAS must face considering the current level of global warming and sea level rise. Others such as heatwaves and hurricanes are more difficult to predict. Then, what will be the success factor when dealing with current climate challenges, and how should/can countries in the region take proactive actions in preparation for an uncertain climate future? In full consideration of the socio-economic, political and environmental realities in the region, limited governance structures and low scientific capacity to respond proactively to changes, we identified two general approaches and six strategic pathways that countries can use to advance climate resilience. In this regard, climate resilience requires to pursue two distinct approaches that operate in parallel and sometimes in opposite ways.

First: Transform existing systems into shifting policy and regulatory environments in ways that incentivise efforts to promote resilience and discourage non-regenerative practices. Following Karen & Sygna (2013), transformation for coastal resilience in the CAS has been conceptualised as a process that must take place across three embedded and interacting spheres[21]: the practical, political and personal as illustrated in Figure 25. Viewing these spheres together gives the possibility of seeing the breadth and depth of transformations as well as the multiple entry points for sustainability outcomes. For example, carbon trading using mangroves and coastal forests can make funds available for mitigation and adaptation efforts.

21 The practical sphere represents both behaviours and technical solutions to climate change. These include behavioural changes, social and technological innovations, and institutional and managerial reforms. The political sphere includes the social and ecological systems and structures that create the conditions for transformations in the practical sphere. The personal sphere includes individual and collective beliefs, values and worldviews that shape the ways that the systems and structures (i.e. the political sphere) are viewed, and influence what types of solutions (e.g. the practical sphere) are considered "possible".

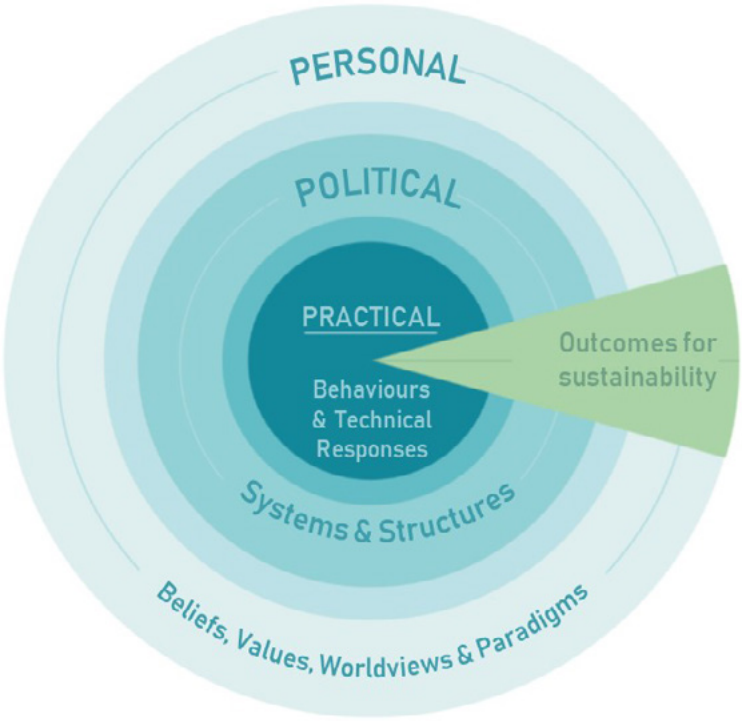

Figure 25. The three spheres of transformation based on Karen & Sygna, (2013).

Second: Build climate resilience through social protection interventions. Interest has grown over the years about the utility of strong social and protection schemes to support people with less resources in coastal communities who are on the frontline of climate change and most vulnerable to its effects to enhance their resilience. These sort of programmes are interventionist in nature and encompass initiatives ranging from safety-net programmes to social insurance programmes that can improve the beneficiary's resilience to stresses by transferring income or assets to the poor, protect the vulnerable against livelihood risks and enhance the social status and rights of the marginalised. Its overall objective is to extend the benefits of economic growth and reduce economic or social vulnerability of the poor, vulnerable and marginalised groups.

Type of resilience instrument	Form of intervention	Social protection instrument	Potential co-benefits for climate change resilience
Reactive resilience (short-term)  Proactive resilience (long-term)	Proactive (coping)	• Social service provision • Social transfers (food/cash), including safety nets • Social pension schemes • Public works programmes	• Protection of those most vulnerable to climate risks, with low levels of adaptive capacity
	Preventative (coping)	• Social transfers • Livelihood diversification • Weather-indexed crop insurance • Social insurance	• Prevention of damaging coping strategies as a result of risks to weather-dependent livelihood
	Promotive (adaptive)	• Social transfers • Access to credit • Asset transfers or protection • Starter packs (drought/flood-resistant) • Access to common property resources • Public works programmes	• Promotion of resilience through livelihood diversification and security to withstand climate-related shocks • Promotion of opportunities arising from climate change
	Transformative (adapting)	• Promotion of minority rights • Anti-discrimination campaigns • Social funds • Proactively challenging discriminatory behaviour	• Transformation of social relations to combat discrimination underlying social and political vulnerability

Table 4. Possible benefits of different types of social protection. Source: Adapted from Davies et al. (2009)

Six strategic pathways

Six strategic pathways have been identified, indicating areas where concentrated efforts can advance climate resilience. These pathways were informed by the identified vulnerabilities contained in the country profiles and themes that emerged from the ICAM Workshop (Libreville, 2019), including from:

a. Three grouped priority actions selected following the votes organised during the workshop

b. Potential activities jointly selected by participants

c. Final recommendations as contained in the workshop report

The six pathways are:

1. Build power, foster expert networks, build capacity, increase community voice and promote information sharing.
2. Craft a comprehensive strategy that is capable of "walking/working" the talks for climate resilience.
3. Create a new economy/finance for the new climate reality.
4. Advance the climate resilience legal and policy agenda.
5. Strengthen regionalism and bioregional identity.
6. Align and expand scientific/technical infrastructure building.

1. Build power, increase community voice, foster expert networks, build capacity and promote information sharing

Communities are at the forefront of climate risks but also the first line of defence against disasters, therefore they are important agents of transformation towards climate-resilient pathways for sustainable development. One way to drive resilience thinking includes increasing the capacity for self-governance, objectivising it to promote a more democratised decision-making process—ensuring that civic responsibility and leadership are widely distributed. This is also essential to boost public stewardship, increase genuine participation and engagement and build public ownership of resilience initiatives. In many countries across the world, community-led interventions are already transforming public planning processes.

Local communities have a role to play in these three spheres of transformation. Potential roles of local communities as agent of transformation include:

- Knowledge generation and application through action-research and climate risk monitoring,
- Advocacy and alliance building,
- Changes in behaviour and application of appropriate climate-resilient technologies,
- Collective action on environmental protection and management.

However, for the CAS, another level of participation and engagement is required and which involves building a community or network of experts. By connecting and aligning their efforts, it is possible to leverage change at a larger scale. Also, capacity building in the areas of fish stocks assessment, management and planning of marine and coastal areas, mapping of the seabed and coastal zone, tropical marine ecology, blue economy, data collection and management, etc. would have to be taken as a critical priority to enable experts to perform optimally. Having a network of regional experts can foster capacity building and information sharing, as the quest to solve common challenges will require greater exchanges and cross-fertilisation of ideas.

The scale and uncertainty of the long-term impacts of climate change, its complex and cross-cutting nature, the urgency of action required and the power asymmetries that exist between different actors at national and regional level mean that managing climate change poses an acute individual, institutional and systemic capacity challenge. Most countries in the region are struggling to build these capacities, particularly institutional capabilities required to ensure climate resilience across different levels of government (Elasha et al., 2006). Though there may be a lack of an appropriate framework for strengthening climate resilience capacity at institutional level, Shakya, Cooke, Gupta, & Bull (2018) in Figure 26 offer an example derived through analysis of ACT's[22] most significant success stories of institutional change, identify the common variables that supported success, and reflect on what differewd in less successful experiences.

For any coastal climate resilience efforts to be successful in the region, capacity needs to be built on three broad levels:

- Individual: developing educational, training and awareness-raising activities.
- Institutional: fostering the development of organisations and institutions, including their missions, mandates, cultures, structures, competencies and human and financial resources, as well as the cooperation between organisations, institutions and sectors.
- Systemic: creating enabling environments through economic and regulatory policies and accountability frameworks in which institutions and individuals operate.

22 ACT (Action on Climate Today) is an initiative funded with UK Aid by the Government of the United Kingdom and managed by Oxford Policy Management.

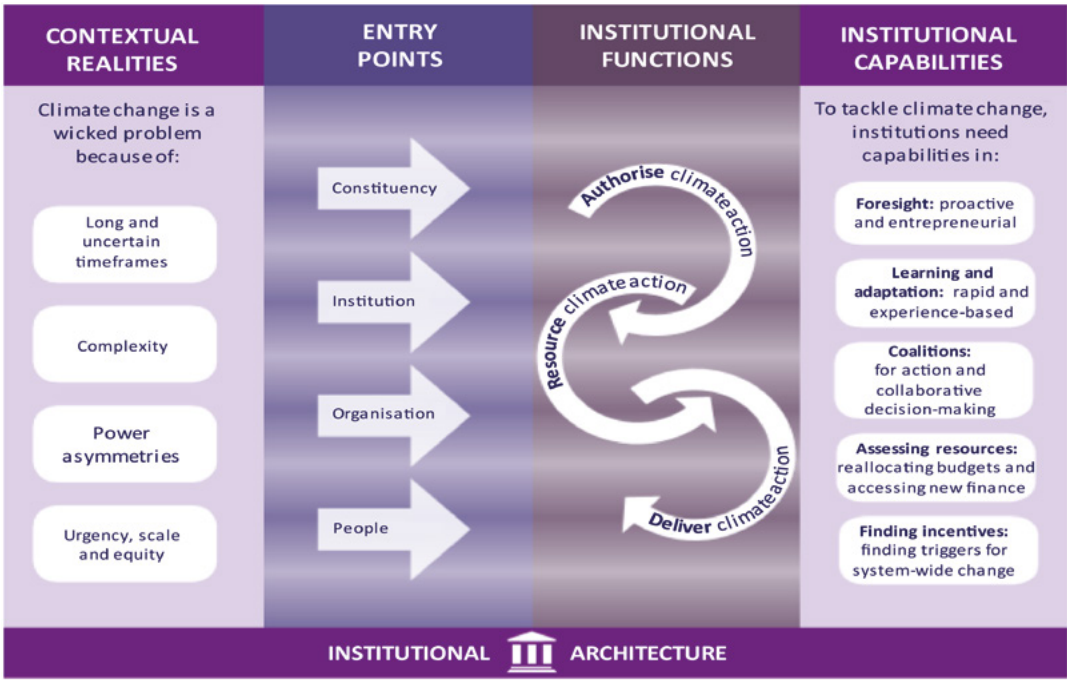

Figure 26. Action on Climate Today (ACT)'s framework for strengthening climate capabilities in institutions. Source: Shakya et al. (2018).

Considering this pathway, it is possible to:

- Build the bigger "we" by boosting the power of historically marginalised coastal populations and creating alignment with partners from other coastal communities and systems. This means engaging new constituencies, such as local/traditional chiefs, religious leaders or elected officials, who may not have taken up climate as a primary issue for their communities yet.
- Create "super organisers" by crafting leadership training strategies that are place and population-specific to ensure that key communities have trained organisers to help guide the transition.
- Build technical and professional know-how by enhancing the capacity of experts and institutions in the region to be able to deal with 21st century coastal and oceanic challenges holistically, including Integrated Coastal Zone Management.
- Create multipliers and models by developing new ways for regional experts to network and new approaches to data and information sharing, and ensuring that resilience initiatives in one place help inform and support efforts in other places.

2. Craft a comprehensive strategy that is capable of "walking/working" the talks for climate resilience

Advancing climate resilience in the CAS would require a paradigm shift, completely different from what is obtainable currently. Considering the present socio-economic and environmental realities in coastal communities across the region, a need to craft a narrative strategy that flows from an overall social-change strategy is imminent. In the face of blooming coastal population, rising sea levels, growing income disparity, anthropogenic habitat degradation, resilience strategies must be put in place as a vehicle to reshape policy and political will. This type of strategy must

go beyond crafting a sector-by-sector or top-down intervention and take up the work of addressing widely held frames underlying concepts of nature, social integrity, climate and economy. Without changing those frames, it will be difficult to achieve the degree of public and social consensus needed to assure climate resilience at scale. Also, it is imperative to clearly distinguish between the actions and measures required to transform the climate-resilience political buy-in at national and regional levels from those required to engage and move the public.

Such a comprehensive strategy would require deep understanding of the complex socio-ecological condition of the coastal zone, as well as vertical and horizontal integration of knowledge (including scientific and indigenous) about the frames we are advancing and countering. When that alignment is achieved, strategies can be built to move all stakeholders to a deeper awareness of the solutions that need to be advanced and a recognition that success requires implementing solutions that address root causes.

The points below showcase a few key dimensions to keep in mind moving forward:

- **Address inequality and income disparity.** Socially, climate resilience requires more than technical fixes for climate impacts such as hardening coastlines against erosion and flooding. It calls for addressing the inequalities that create and exacerbate community vulnerabilities. As the various country profiles have indicated, there are disparities of income levels between coastal populations, which implies asking the general public to care about low-income people and to recognise a sense of shared fate with them. This, in turn, requires greater empathy, a more nuanced analysis of the economy and a clearer understanding of the crisis and what can be done about it.
- **Put everyone in the same ship—Speak to the base, and beyond.** The ability of countries in the region to achieve their goals on climate resilience in the coastal environment will obviously be predicated on building a broad and committed base of support (both at local and national levels, as well as technical and political). That means rigorous engagement and networking with diverse stakeholders, communicating with potential champions and mobilising them to action. To that end, a set of interlocking narratives must be crafted to help them make sense of the climate crisis, the climate clock and opportunities to take principled and effective action.

3. Create a new economy/finance for the new climate reality

Societal consumption patterns and drive for resources and energy has in part brought about the current climate crises. Available economic policies and financial operations in the region are skewed towards unsustainable extraction of natural resources and monetary gains, putting the natural environment in jeopardy and undermining community resilience. Hence, an economic transition will be a first step toward any meaningful action on climate change - a significant shift in the economic paradigm from an extractive to a regenerative economy - one that is people-centred, puts ecosystem-based approach at the heart of change and regenerates (rather than degrades) natural and human resources.

Also considering the national and regional realities, a real economic transition would mean localising the economy and building wealth at the local level. This will also require thinking outside the box, taking advantage of science, technology and current innovative sphere to build effective alternatives that can, over time, become the core drivers of a new economy, and this has to proceed with an initial investment in research, development and innovation.

The need to connect climate resilience efforts to economic justice efforts must be laid because pathways to economic wellbeing must put climate vulnerabilities at the centre.

Successful implementation of adaptation measures often requires large investments. Lack of financial resources and capacity to support climate resilience initiatives and projects is a common challenge for countries in the CAS and this poses barriers to planning, integration, implementation and learning from adaptation efforts. Nonetheless, eschewing from the various National Adaptation Strategies, governments in the region are already aware of this deficiency. However, given the countries' vulnerability to climate change, climate financing is a high priority and increasing the efficacy of climate change funds both from the government and donors in tackling the impacts of climate change in the region is very crucial.

Though conventions such as the Kyoto Protocol and the Paris Agreement call for financial assistance from Parties with more financial resources to those that are less endowed and more vulnerable, countries in the CAS must also be proactive in 'taking their destinies in their own hands' by pursuing alternative sustainable finance mechanisms to invest in climate sensitive activities, both for mitigation and adaptation, set up or expand existing Public Finance Mechanisms (PFMs) to mobilise commercial financing, and build commercially sustainable markets for activities, such as blue carbon sequestration and trading. Examples of several efforts and approaches necessary to support the transition to a new climate economy are given below:

- Localise the economy, particularly food systems and energy, tie localisation to policy incentives that stimulate new and sustainable forms of community-led economic activity that promotes regional and global ecological balance;
- Integrate public and private sector resources, including direct capital investment, regulatory environments and direct incentives and disincentives such as tax policies and government subsidies;
- Capture and redirect disaster funding, reallocate resource flows for disaster preparedness, response and recovery, ensuring that those resources stimulate "next economy" activity and build local wealth that can stabilise communities;
- Shift conditions so that it is more costly and unprofitable for the private sector to engage in economic activities that exacerbate climate change;
- Democratise, decentralise, redistribute and reduce consumption of resources;
- Promote adaptation and mitigation efforts that generate jobs and meaningful work, while shifting the management and ownership of core systems into the hands of local communities;
- Build partnerships between communities, labour, green enterprises and the public may have a social impact by investing to reduce greenhouse gas emissions and generate local enterprise and jobs;
- Encourage greater transparency and information sharing and set up mechanisms to facilitate public disclosure of information to promote transparency on climate change funds and finance in line with the current political climate.

4. Advance the climate resilience legal and policy agenda

Countries in the CAS have several direct and indirect legal and policy instruments applicable to climate change resilience. However, most of these instruments are sectoral, outdated, not target-driven and lack the robustness to attend to a 21st century climate crisis. In fact, countries in the region have not been able to effectively implement most high-level policy documents with climate change components (including the National Adaptation Strategy for climate change and the Convention for Biological Diversity's (CBD) National Biodiversity Strategies and Action Plans), mostly because their conception, processes and operation is hindered sometimes by incoherent legal

and policy agenda, weak governance, lack of political will, low funding and technical capacity. Hence, there is an increasing need for these instruments to be enlightened, harmonised and purpose-driven on climate decisions and priorities, and on the societal framework and ethical basis for economic development and applications of the new sciences and technologies to inform climate resilience.

Enlightened policy can drive far-reaching change, not only in the public sector but in industry and enterprise. Governments can incentivise economic activities that create climate resilience while discouraging activities that contribute to environmental breakdown, for example by trading in blue carbon and using the revenue to subsidise distributed, community-controlled, alternative energy.

Box 8. Some food for thought in moving forward

Analyse the implications of policy

Because climate change mitigation + adaptation + deep democracy = resilience, all policies must be viewed through the lenses of both climate and democracy if resilience is to be socially just. Community members and civic leaders can consider these questions as they make decisions that will shape the form and function of their neighbourhoods, cities and regions.

Climate

- *How will climate change affect a particular issue - housing, food, childcare - as well as the solutions that I am putting into place?*
- *Does the proposed policy/course of action have implications (positive or negative) for the severity of climate change? How will negative implications be addressed?*
- *Will the expected consequences of climate change affect the viability or durability of a proposed policy/course of action? If yes, what should be changed?*

Democracy

- *Does the proposed policy/course of action reflect the knowledge and priorities of the communities that are most impacted?*
- *Who benefits and who is negatively affected by the proposed policy/course of action?*
- *Will the existing disparities and disproportionate impacts be lessened or exacerbated?*

Change policy to shift funding flows

Funding is crucial for bringing resilience to scale. In addition, funding deployed for disaster relief or for adaptation can be designed to advance climate resilience by helping communities "bounce forward" rather than "bounce back". Funds can be used to build climate-resilient infrastructure and to ensure community leadership in disaster preparation, response and recovery. Existing resources that can and should be captured and focused on climate resilience include: public funding for climate action plans; resources flowing from the fossil fuel divest/invest movement out of universities, pension funds, and foundation endowments; and social impact investment funds looking to address climate change. New sources could include local bonds and a federal carbon tax. It is important that financing mechanisms can be community controlled.

Craft policy that reflects geography of opportunity and impact

Policy and legal strategies must map the ways in which opportunity and threat unfold differently in different places. Without a shift in the power that shapes the policy, we cannot get the policy we need. This means that it is necessary to target new and existing resources in communities that are vulnerable but not already engaged in climate resilience. Thus, special attention, as noted above, must be given to resilience efforts in vulnerable areas where people are likely to suffer disproportionate impacts and where the current state of civic and economic infrastructure may compromise the community's capacity to respond.

Adapted from DeBacker et al. (2015)

5. Strengthen authentic regional cooperation and partnership

Climate change affects the wellbeing of people and the survival of plants and animals in the region. Impacts are becoming evident all over the region and in many nations through sea level rise, increasing frequency and magnitude of floods and droughts, spreading diseases, economic damage, etc. Availability and accessibility of resources, information and technology to respond to climate change are inadequate in countries. Response instruments such as the UNFCCC and its Kyoto Protocol require coordinated response. Likewise, considering that ecosystems are connected and do not respect legal national and legal boundaries, coastal and marine systems within national domains must be pictured as an interconnected whole of a larger whole into which they are embedded. This also applies to climate resilience, because ecosystems where society derives various services often transcend jurisdictional boundaries.

However, for the CAS, it appears difficult to advance shared decision-making when there are so many countries with varied governance and decision-making processes. Moreover, existing regional instruments and bodies are mostly sectoral-focused and often are weak or limited in mandate. Acknowledging that climate change and coastal environmental degradation are major issues in the region, it is imperative for governments within the Central Africa regional setting to collaborate on initiatives, harmonise their policies and develop strategies to counter threats. Though there are some transboundary initiatives focused on nature protection, there is no record of any attempt made to create a common framework for action in implementing synchronised policies for climate change resilience, mitigation and adaptation in the region.

At the operational stage of climate resilience, the various steps of planning, designing, setting up and implementing climate resilience programmes will require authentic partnership to deliver the multicomponent and multi-level projects required to support climate resilience building, and to achieve a sustainability of impact within complex and changing environments. Bong & Braced (2019) highlights that "No one organization has all the skills necessary to tackle a specific problem and with the challenge of resilience-building in complex environments, multiagency consortia are the best approach to building resilience in practice". This partnership could be either intra- or inter-organisation or departments within a country or transboundary.

Potential benefits of regional cooperation and partnership for climate resilience in the CAS coastal areas:

- Polycentric governance approach,
- Strengthening the national capacity in negotiation in Conference of Parties (COP),
- Facilitation of substantial flows of investment, technology transfer and human resources management,
- Mobilisation and pooling of resources,
- Sharing of experience and best practices,
- Information networking,
- Coordination of emission inventories and assessment,
- Coordination of research activities,
- Development of common scenarios for evaluating impacts,
- Mechanisms for capacity building and technology transfer,
- Adaptation strategies,
- Development of institutional mechanisms for strategy implementation.

6. Align and expand scientific/technical infrastructure building

The 2015 Paris Agreement enshrines a commitment to building long-term, in-country capacity to address climate change. It also states that capacity building must operate through appropriate institutional arrangements and be an iterative process that is participatory, cross-cutting and gender-responsive. For the CAS, the urgent need for governments to build climate resilience has frequently led to a piece-meal approach: a reliance on short-term and ad-hoc efforts to boost infrastructure capacity. In a like manner, multi/international organisations have embraced a 'helicopter[23]' mechanism for climate resilience infrastructure development in the region as, often, actual facilities are not provided on ground but one-off training sessions and workshops are provided and have yielded limited impact. In such situations, local institutional capacity to deal with climate change remains constrained.

The capacity assessment carried out during the ICAM Workshop (Libreville, 2019) revealed that actors at national level have inadequate understanding of resilience and climate programming because of several factors, including insufficient training and lack of monitoring and observation equipment. Moreover, if this is the case for national experts, what could be said about climate resilience understanding and knowledge at sub-country level. All these put together would mean that there is a huge gap for technical staff to understand their mandates and roles related to climate change action, ability of actors to access climate information for decision-making and identify actions that promote climate resilience. In the absence of these, governments will similarly lack the technical capacity to formulate laws and policies that support climate resilience.

Still, a critical driver for capacity building and eventual delivery of climate resilience actions is infrastructures and technologies. Regional reports (e.g. Elasha et al., 2006; Niang et al., 2014) already stressed the requirements for increasing the contribution of the CAS to the global climate observing system to include: improving and sustaining operational observing networks; recovering historical data; improving national and regional coordination; education, training and capacity building; and improved national planning and reporting.

However, these requirements are still lacking, simply because more stations are needed and, of those that are in place, many are not reporting or are reporting at a substandard level. Countries in the region also have a low density of WMO World Weather Watch real time weather stations; in fact, one of the lowest of any region in the world. For instance, droughts observed in coastal areas of the region have highlighted the need to understand and forecast the resilience of water supplies to climate variability. To facilitate this understanding, both soft and hard infrastructures such as disaster services and climate adaptation equipment and systems are essential to gather long-term measurements and observation necessary to inform evidenced/science-based decision and long-term planning. The inadequacy of equipment to collect data has in turn resulted in a lack of official statistics. Hence, people and government tend to downplay the significance of disasters and 'uncounted' impacts in the coastal and marine domain. According to Kjorstad (2019), **infrastructure plus technology is equal to resilience.**

23 Helicopter mechanism has nothing to do with aircraft; it typically describes when multi/international organisations from wealthier countries fly to a developing country to organise workshops with already prepared template that has no input from the visited country, then fly out, analyse the workshop elsewhere, and publish the results with little involvement/ acknowledgment of local participants.

Box 9. A typical way to align scientific/technical infrastructural building

Infrastructure + Technology (or InfraTech) is a system that can be imagined through a pyramid. The bottom layer is physical infrastructure—still the foundation of delivering public services. Above physical infrastructure is the data architecture to support decision-making and optimise service delivery. The data architecture establishes what is needed in the next layer up: connectivity infrastructure (including broadband and, soon, 5G). This layer utilises sensors, QR codes and communications technology to feed information up into the digital platform layer with specialised software designed to secure and manage data. These content management systems can also be used to provide user-friendly interfaces for consumers and stakeholders, creating more opportunities for people to engage productively with infrastructure. Finally, at the top of the pyramid is artificial intelligence (AI). AI would utilise the speed of computing to enable decisions in real time. This would close the system and complete the digital transformation of delivering better public services via Infrastructure + Technology.

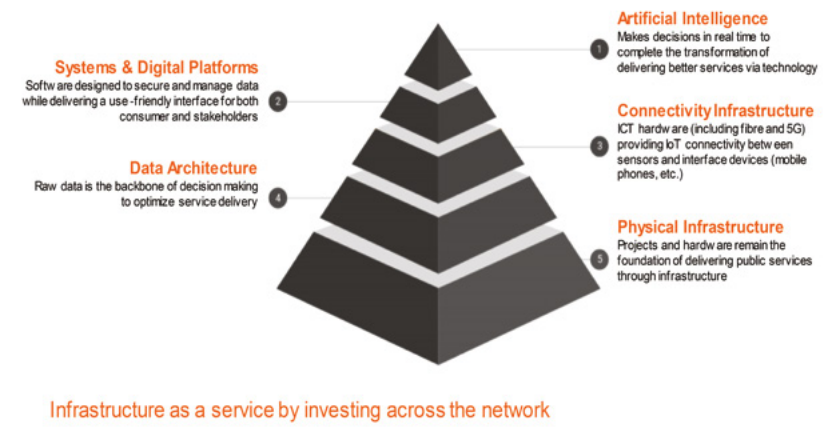

Figure 27. Infrastructure as a service by investing across the network (Adapted from Kjorstad, 2019)

General Conclusions

From what precedes, it is clear that predicting the true nature of future impacts of climate change in Central Africa is not a simple task due to a wide range of challenges, including availability of technological instruments for climate and vulnerability monitoring. Considering that all places within the Central Africa sub-region do not face identical exposure to climate change risk at a time, evidence remains that these risks are in most cases exacerbated by community activities in the absence of strong adaptation mechanisms, such as coastal and ocean capacity building and enforcement of environmental legislation.

With regard to the shortage of significant information and various factors, the data and information gaps with high potential to influence confidence and conclusions derived from the coastal vulnerability assessment in Central Africa region were highlighted in section A-4-3. However, it is clear that CAS coastal zones will be exposed to a broad range of direct and indirect impact and vulnerabilities from natural human and climate change factors. Sea level rise as a result of climate change will exacerbate the impact of storm surge events resulting in increasing damage to built assets. It will also lead to the salinisation of soils on the coastal zone, flooding of low-lying areas and intrusion of seawater further into estuaries, changing their ecology and human use values (e.g. recreation, fisheries). Increase in coastal population, particularly in urban areas, will be steady over the next decade, and the demand for basic needs such as water, housing and food will put significant strain on coastal and marine resources. Coastal erosion will be on the increase with current and future climate change predictions, leading to loss of wet and dry lands, biodiversity and critical infrastructures.

Due to inadequate long-term data, the status of marine stocks in the region is uncertain, however, potential impacts of reduced stocks are already being experienced. The coastal zone will also be impacted by increasing intensity of rainfall which will influence storm water discharge and hence flooding and water quality. Extreme heat will influence how communities interact with the coastal zone and the ability for natural and built assets to maintain condition. The nearby coastal zone will be exposed to warming ocean waters and increased acidification, which will cause changes in marine ecosystems. A key aspect of this challenge is knowing when to implement adaptation options, given that increasing sea levels over the coming century will mean that the options required for protection from, for example, flooding now may not be the same in the future.

In readiness for these impacts and vulnerabilities, countries in the region are already taking steps via existing instruments, for example the UNFCCC National Adaptation Plan and several sectoral strategies, policies and programmes. To sustainably adapt to the range of complex coastal risks, hazards and impacts, there is an urgent need to consolidate existing adaptation experience to drive an integrated approach that is ecosystem-based and people-centred. This approach would have to holistically consider all sectors, encourage polycentric governance and prioritise stakeholder participation.

Noting that the region will increasingly be confronted to much greater socio-economic and climate change risks, with potentially greater impacts on coastal economy, society and environment, it is imperative for governments at national and local levels to focus now on sound decision-making frameworks and tools to equip them with approaches that provide resilience to current and future anthropogenic and climate change, at least for the survival of humans. That section has however highlighted key challenges to effectively adapt the CAS to a variable and changing society and climate, and explored how the decision-making context for coastal adaptation in the region can be better understood and delivered through provision of frameworks, knowledge and criteria for performance evaluation and comparison.

The diverse geophysical, socio-economic, socio-political and climatic characteristics of the CAS makes its coastal zone susceptible to a wide range of extreme natural hazards such as coastal erosion and flooding that pose significant threats to communities, nature and businesses. This report, however, takes into consideration the uncertainty in relation to the observed risks, hazards and vulnerability, as there is a lack of significant information and data. Hence, the data and information gaps with high potential to influence confidence and conclusions derived from the coastal vulnerability assessment in Central Africa region were highlighted in section A-4-3.

It has been established that natural hazards coupled with human and climate change induced risks have significant impacts on coastal zones throughout the CAS. For coastlines in the region to effectively adapt to forces of nature, human interaction and climate, vertical and horizontal integration of adaptation across all sectors, spatial domain and scales at local, national and regional levels are highly required in the face of high future uncertainty. Recognising that the costs of emergency action, remediation and prevention can often represent a significant burden across different sectors and communities in the region, coupled with local and national authorities having limited resources to counter them, this report made it clear that the impacts of anthropogenic and climate change are real and pose serious risks within the region and across different sectors in the coastal areas. The current level of risks that emanate from the different vulnerability factors (erosion, pollution, overexploitation of resources, salinity intrusion, mangrove destruction, sea level rise and flooding) has therefore been identified, including their implication(s) on selected sectors. Impacts were observed to be felt on key economic sectors (fishery and aquaculture, energy, oil and gas, housing and infrastructure, etc.), natural systems (forestry and agriculture, coastal ecosystems, water, etc.), with consequences on salient human issues such as human security, food and nutrition and democracy.

This understanding establishes the need to implement integrated sustainable policies to reduce or manage those risks across the different sectors. Despite several grey areas, the potential for a regional adaptation to the highlighted risks is high, particularly when existing regional instruments are leveraged and improved on. For example, if countries in the region can adopt the recent additional protocol to the Abidjan Convention on ICZM, transboundary cooperation and transboundary environmental assessments, coordinated efforts and actions can be galvanised towards the development of a transboundary ICZM. Likewise, existing regional, supra-regional and international initiatives such as the 2030 Agenda for Sustainable Development, UN Decade of Ocean Science for Sustainable Development (2021-2030), IOC-UNESCO/ European Commission Joint Roadmap to accelerate Maritime/Marine Spatial planning worldwide, African Union's

Agenda 2063 and Integrated Maritime Strategy, etc. are all veritable instruments that can accelerate regional adaptation.

Driven by several common challenges in the CAS, nine principles to guide policy and decision-making processes for climate adaptation have been recommended. These principles touched on the need to define clear adaptation goals, contextualise adaptation efforts, act to reduce risks, improve stakeholder participation, boost funding, strategic and frameworks for planning and cooperation. Applying these principles would allow the identification of drivers, barriers and designing interventions, sector prioritisation and implementation and scale-up of adaptation efforts. Also based on these principles and ideas enshrined in climate-resilient pathways and transformation thinking, the short and long-term vision for delivering a climate-resilient future in the CAS, including how the vision can be actualised, has been elaborated considering two approaches:

a. A transformative system for the CAS that promotes paradigm shift in policy and regulatory environments in ways that climate resilience efforts are pronounced against degenerating practices, considering practical, political and personal spheres.

b. Instilling social protection programmes and projects to support poor people in coastal communities who are on the frontline of climate change and most vulnerable to climate effects.

To explore the ambitious actions and transformational systems that countries need to use in order to adapt to human and climate pressure, six pathways for resilience have been proposed. These pathways do not only emphasise the need for robust decision-making within adaptive processes in the face of uncertainty and inter-temporal complexity, or focus only on contexts with clearly identified decision-makers and unambiguous goals. Rather, they explore a broader conceptualisation of "resilience pathways" that draws on 'pathways thinking' in the sustainable development domain to consider the implications of path dependency, interactions between adaptation plans, vested interests and global change, and situations where values, interests or institutions constrain societal responses to change. This re-conceptualisation of adaptation pathways aims to inform decision-makers about integrating incremental actions on proximate causes with the transformative aspects of societal change.

The six pathways proposed could provide a hands-on guidance for the opening up of the policy processes through participatory deliberation and negotiation and trigger the creation of mechanisms for long-term vision for delivering a climate resilient future for the region. This could be achieved through the funding and implementation of pilot innovative adaptation alternatives in order to build the evidence base for integrated/multi-scale effective transformative responses, as well as support self-organisation and social networks so governments and communities can exploit coastal risks and hazards as triggers of transformational change. In this context, an ambitious path for long-term visions for delivering a climate resilient as illustrated by the least developed countries (LCD) 2050 Vision (Figure 28 below) would be more challenging. Comparably, the proposed pathways would help explore a more integrated approach in the National Adaptation Programme of Action under the UNFCCC. It can be deduced that the capacities required to develop and implement this broader conceptualisation of resilience pathways for the CAS will be heavily influenced by the extent to which all stakeholders are involved in processes and how they can cross-fertilise ideas at local, national and regional levels via experts, social and organisational networks.

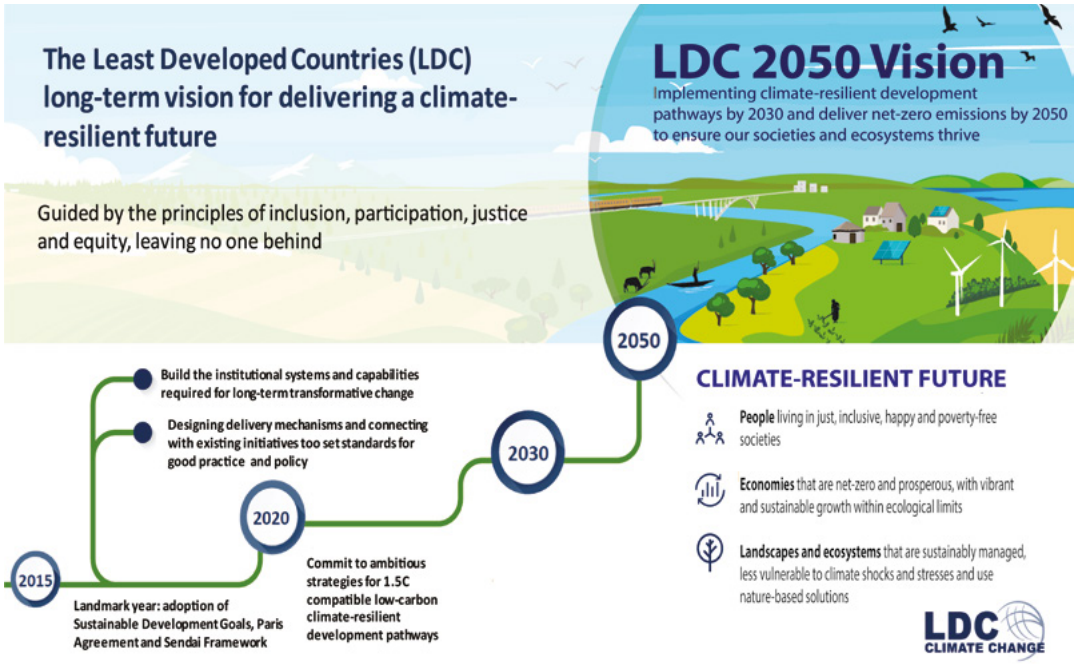

Figure 28. Example of a long-term vison for delivering a climate resilience future. Source: Least Developed Countries (LDC) Climate Change, http://www.ldc-climate.org/

Overall, the need to adapt to socio-economic stressors and climate change in the CAS has been established, with emphasis on the uncertainty of their impacts as social and natural systems grow and global warming continues unabated. Moreover, implemented actions in the region have been mostly incremental and focused on proximate cause; there are far fewer experience of more systemic or transformative actions. One of the key reasons for this is that there are no strong legal, institutional and regulatory frameworks to encourage and support coastal adaptation processes in one specific sector and country impacted by climate and human induced changes. Another challenge is the absence of instruments to offer opportunities for systematic data collection effort that can inform regular vulnerability and risk assessments.

In the context of observed challenges and existing individual national efforts to tackle diverse pressures, it would make good sense to share a common agenda with coordinated activities rather than expanding on mechanisms that would repeatedly conflict with adverse impact from neighbouring activities. In navigating towards a more resilient and adaptive future, cross-border cooperation and a Central African regional approach to coastal resource management would be highly necessary, supported by mechanisms that give access to more sustainable and consistent sources of financing to identify and implement required adaptation options. To maximise opportunities for progress by addressing cross-sectoral and multi-level governance concerns in the region, area-based tools such as Integrated Coastal Zone Management or Marine Spatial Planning would be ideal to implement recommended pathways, as they have the potential to coordinate a diverse range of stakeholders across sectors and levels of governance, with a view to integrate national requirements of adaptation planning in the context of local, national and regional policy.

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Annex 1

Country coastal vulnerability assessment profile

Description of the coastal areas of the country

With an extent of about 1,650 km of coast characterised by Benguela Current (cold waters) and warm waters coming from the north, the Angolan coastal zone is abundant in species from phytoplankton to osseous fishes. Recent studies indicate more than eight different habitatsw along the coast [1]. It extends some 800 nautical miles along the south-eastern Atlantic, from 5° to 16° S, to the Cunene river mouth. The coastal area is typical of a tropical regime in the northern part and a more temperate one in the south, where the southward warm Angola Current and the northward cold Benguela Current meet and form the Angola-Benguela front, with an average position at 17° S. As pointed by Shannon et al., 1987 (in [2]), this front extends to at least 150 km offshore and shifts about 2° S during the first quarter of the year, and north during the third quarter [2]. Although the front is strongest in the near-surface layers, it may extend to a depth of several hundred meters and its dynamics are thought to be influenced by a large cyclonic eddy, the Angolan Dome [2].

The seasonal translocations of the frontal zone are important for the distribution of fish. Two different faunal complexes are characterised along the Angolan coast, the "Guinea-tropical fauna" in the northern and central region and the "Benguela fauna" predominant off southern Angola [2]. However, elements from both faunal complexes may occur around 14-15° as suggested by the distribution of some species, such as the horse mackerels and hakes [2]. The Benguela Current is one of the world's major eastern-boundary current systems and is rich in pelagic and demersal fish populations, supported by plankton production driven by intense coastal upwelling [2]. According to Hampton et al., 1999 (in [2]), these populations have been heavily exploited by man, particularly since the Second World War.

More than 420 fish species have been identified and 655 crustaceous species have been found in Angolan waters. Some cruises have made the observation of whales and dolphins possible in the marine zone [1]. The presence of sea turtles on the Angolan coasts (Luanda, Soyo and Cabinda) is a testament to the region's wealth of diversity.

Human pressure is mainly felt on the coast; therefore, animals in these areas are always under a huge anthropogenic stress [1], namely uncontrolled recreational activities, exploitation of living and non-living resources, construction and pollution. The open sea area is subject to the exploitation of living (semi-industrial and industrial fishing) and non-living resources (petroleum, gas and minerals) [1].

Compared with the sea area, the marine environment of shallow and intertidal waters has the richest diversity. There is a relatively large population of sea turtles distributed along the coast, especially five different species that increase their presence in coastal waters during their spawning period in the rainy season between October and April [14]. Samples collected along the coast from 16 locations show the presence of 87 fish species representing 18 families. The analysis of the multiple variety indicated a biogeographic structuring of the ichthyologic fauna on the intertidal area along the Angolan coast, where the Baía dos Tigres' fauna is different from the other areas due to the high densities of grey mullet (Lisa richardsonii) and sparid (Diplodus sargus sp). In general, it was noted that the north and center presented the largest number of species compared to the south of Angola [1]. The impact of the cold Benguela Current on the coast of Angola is evidenced by the desert conditions of the Skeleton Coast and Namibe province, the semi-arid conditions south of Benguela and the persistent fogs along the southern coast of Angola [3]. With a predominantly semi-arid climate, the coastal regions of Angola in their entirety have a relatively limited agricultural potential. This implies that, in the absence of other income-generating opportunities, the population relies increasingly on the sea for its livelihood or subsistence [4].

COASTAL VULNERABILITY – PRELIMINARY ASSESSMENT

Floods

Floods in Angola are a recurrent phenomenon. The succession of floods may be attributable to a combination of factors, including increased variability due to climate change, environmental changes induced by settlement in vulnerable zones and the removal of natural vegetation in upstream river basins [5]. The city of Luanda has been affected since 2007 and the cities of Benguela and Namibe have suffered floods in certain years which have generally resulted in the flooding of houses and commercial buildings and the interruption of transport for long periods, in part due to the growth of cities in risk areas [3].

Floods affect on average about 100,000 people every year, more or less 0.4% of the total population of the country, concentrated in the most urbanised provinces: Luanda, Cabinda and Huambo.

The affected GDP in flooded areas is also high, cumulating on average 0.7% of the total GDP every year at the country level [5].

The direct economic loss in Angola is distributed geographically in line with exposure values but provinces in the central part of the country are the ones that show the biggest losses in this case. The pattern changes in future climate projections, where a sensible increase of losses is visible in the northern provinces, which now account for the highest losses [5].

The value of direct economic losses in terms of Average Annual Loss (AAL) amounts to 490 million USD or roughly 0.26% of the total exposure value in the present climate. Most of the losses come from the housing and critical infrastructures aside from transportation (i.e. health and education), which account for about 70% of the overall loss, while the other sectors have a similar share in the overall direct loss [5].

The proportion of the different sectors to the overall loss does not change significantly in future conditions. The pattern for future flood risk shows an increase in the northern and northeastern regions of Angola, while a considerable reduction is projected in the southern part. The annual average number of kilometers affected by floods tends to decrease in the future, assuming that the road and railways network will not change significantly over time. However, as already discussed for GDP and population, the increase in the risk figures is dominated by future changes in exposure [5].

The comparison between present and future climate AAL shows a consistent pattern across all sectors, with an increased concentration of losses in the northern provinces (Zaire, Cabinda, Urge, Malanje, Lunda Norte) and a clear decrease of risk in terms of AAL in the southern part of the country [5]. The AAL distribution for housing identifies hotspots in Huambo and Bié. Despite the evident concentration of assets, the Luanda province shows smaller losses in absolute terms [5].

Droughts

Concerning present conditions (1951-2000 climate), precipitation is expected to slightly decrease while a strong increase in temperature is foreseen in the future (2050-2100 climate), increasing the severity of droughts [5].

The proportion of GDP exposed to droughts is expected to increase by more than a factor 6: while presently 4% of the GDP is exposed on average to droughts annually, this is expected to rise to 27% [5]. Currently, 4% of the livestock are on average annually exposed to drought; in the future, this figure will be multiplied by 6 and reach 27% [5].

Currently, an average of just over 1 million people (3%) per year are exposed to droughts. In the future, this number is expected to increase to 29%; (almost 13.5 million people if population growth is accounted for) [5]. Losses in agricultural production are projected to more than double in the future, while losses in hydropower are even expected to increase by about 4 to 5 times in future climate conditions [5]. Whereas now agricultural production is the dominant part of the direct losses (roughly three-quarters), in the future, hydropower will hold a relatively more important part of total direct economic losses (roughly one-third) [5]. Cassava is the dominant crop in determining losses due to its agricultural production in the present and future climate. In future conditions, losses in production are expected to double for cassava, potato and maize, while the losses for beans and bananas increase by a factor of 4 [5].

Erosion

The coastal plain consists of alluvia, chalk and sand, underlain by oil-bearing formations over the northern two-thirds. A crystalline bedrock of Precambrian age (between about 540 million and 4 billion years old) emerges along the escarpment and mineral deposits sometimes lie close to the surface. Considerable erosion has occurred in this area and laterite formations are common [6]. Most of the plateau in the eastern two-thirds of the country lies buried under deep deposits of infertile windblown Kalahari sands. The river gravels of the northeast contain diamonds and rare kimberlite pipes occur in this area [6].

Clearing for small-scale dryland crops is high in most areas as a result of poor soil fertility, therefore erosion is causing severe widespread losses of topsoil, soil nutrients and groundwater [7]. The rates of erosion are greatest in areas with steep slopes, sparse plant cover and high numbers of people, as well as around diamond mines in Lunda-Norte [7]. Patterns of river flow and water quality have been changed, largely as a result of soil erosion and plant cover loss, as well as large irrigation schemes and dams [7].

Salinity intrusion

Local and river flooding, erosion, inundations from sea level rise and saltwater intrusion are all common risks in these urban coastal areas [8]. Unnamed small aquifers (Cretaceous–Tertiary) along the coast of Angola have been described to be relatively highly mineralised, sometimes associated with salt-bearing formations. And in some deltas and low parts of alluvial plains, the quality of groundwater is reported to be influenced by saltwater [9].

Wetland change and loss, dry land loss

There are three direct causes of land degradation in Angola: declining fertility and productivity of agricultural lands due to unsustainable agriculture, deforestation/unsustainable use of forests, as well as overgrazing of rangelands and forest pasture destruction or degradation by fire and climate change [10].

Likewise, land degradation is largely a result of enormous pressures from the human population which is heavily concentrated in the coastal strip and urban centers, due to insecurity resulting from four decades of armed conflict. This has contributed to overexploitation of the soil and, in turn, has led to erosion, soil exhaustion and desertification [10]. The cutting of tropical rain forests for international timber sale and domestic use as fuel contributes to the destruction of the land. Angola's forests and woodland declined by 3.1% between 1983 and 1993.

Other degradation issues related to the expansion of the hyper-arid systems and dune stabilisation [10]. The coastal province of Namibia in southern Angola is characterised by hyper-arid climates and desert ecosystems. A major "classical" desertification issue has emerged: the movement and perceived expansion of the desert to normally marginally suitable agricultural production areas. Province specific guidance on land use and management options are currently absent and pose a key barrier to unlocking the development potential of the area. This is causing severe soil degradation in these areas due to overgrazing, resulting in the development of less edible pasture [10].

Overall, Angola has a low deforestation rate relative to its total forest cover. Between 1990 and 2005, the country lost only 3% of its forests and the rate of forest conversion has remained steady [11], though some areas are reportedly showing the effects of land clearing, including severe soil erosion, heavy siltation of rivers and dams, and desertification [11].

Marine pollution, water quality change

The coastal zone of Angola is exposed to physical degradation and various forms of pollution, among which:

- Sewage from urban, domestic origin;
- Detritus, marine debris and solid wastes;
- Discharge from functioning industries, such as oil mining in Soyo and Malongo, cement factories and soap, edible oil and breweries manufacturers in Luanda, in addition to port installations and the oil refinery;
- Physical modification, including coastal erosion of the littoral, particularly in Porto Amboim and Sumbe [12].

This pollution constitutes one of the major types of marine environmental degradation taking place around Angola's large cities [7]. Although little information and data are available, the main sources of pollution are domestic wastes and the few industrial effluents which are still functioning (oil mining in Soyo, oil refineries, a cement factory, soap and edible of manufacturers, port infrastructures and breweries in Luanda, and harbour and port infrastructures in Lobito) [13]. Using the estimated population increase of Angola as a proxy, the volume of untreated sewage entering the marine environment, particularly in the vicinity of Luanda and other larger coastal towns such as Benguela, Lobito, Namibe and Cabinda, would have increased markedly over the past 10 years [4].

According to 1982 figures, the highest annual total values of oil and grease releases were 3,766 tons and Chemical Oxygen Demand (COD) from industries was 2,076 tons [13]. Oil refineries and other oil production facilities are located in numerous places along the coast, mainly from Luanda northwards, and are likely sources of heavy metals and oils to the marine environment [14]. Although their actual impacts are yet to be known [1], activities undertaken to produce this resource have put pressure on marine biodiversity due to constant oil spills and the use of dispersants, notably in the Cabinda province [13].

Estimating the level of this pollution and the exact nature of pollutants from industrial effluents has been difficult because of the lack of data; however, it is clear that the Luanda coastline is affected. Indeed, terrestrial water run-off, as well as sewage and other industrial waste waters, are discharged directly into the sea without any treatment [13].

Also, the Luanda Bay is getting increasingly poor in fish, with a similar situation in Lobito where there is a port with a naval site [13]. The overall water quality of the Luanda Bay was assessed for the first time and the main sources of pollution were identified and related to the distribution and speciation of metal ions in water, suspended particles and bottom sediments [15].

Land and various watercourses are contaminated by heavy metals resulting from mineral washing which are disseminated in the environment through water and air. This pollution has adverse effects on several animal and plant species.

Angola is one of the countries in the southern African region where a large proportion of people still uses unimproved water sources due to stress brought about by climate variability and wider governance issues [4]. No data on the volume of sewage disposed of in the marine environment (either directly or through river outflow) could be found for Angola.

As a result of poor urban infrastructure, untreated sewage is most likely discharged into the sea in increasing volumes.

Reduction of marine stocks

Overfishing and changes in hydrological conditions have strongly reduced the fishing potential for industrial fisheries. [16]. In Angola, the most important commercial stocks are between fully exploited and overexploited (not always as a result of historical overexploitation but rather current excesses [17], but with the particular exception of the Sardinella stocks which are considered to be slightly underexploited [16]. Fishing of mackerel (Trachurus trecae) strongly worries the fisheries sector [18]. This species has suffered excessive fishing which greatly affects their biomass [18]. Possible causes are pointed out, including the variability of oceanographic conditions and increased fishing mortality [16].

The 5th National Report on Biodiversity in Angola 2007–2012 revealed that most landward mammals are under the "Red List" category excluding elephants (African Loxodonta), seals (Arctocephalus pusillus) and hippos (hipopotamus amphibius) [18]. This indicates that landward mammals are declining at critical rate in Angola. For bird species, stocks are fairly stable with species such as the red-backed mousebird (Colius catanotus) commonly found around Zaire, Bengo, Kwanza Sul and Benguela provinces, while species like Boita (Cisticola buliensis), white-fronted wattleeye (Platysteira albifrons), and bare-cheeked babbler (Turdoides gymnogenys) are very rare along the coastline in Cabinda, Benguela, Namibe and Kwanza Sul [18].

Mangrove degradation is specifically intense along the coastline in Benguela, Cambida, Zaire and Luanda, while their distribution is still intact around Cunene, Huambo, Huila, Kwanza Norte, Kwanza Sul, Kwando Kubango, Lunda Norte and Lunda Sul [18].

Urban sprawl and coastal/maritime infrastructure development

More than half of all Angolans and almost two-thirds of the country's urban population now live in the coastal provinces. These are also areas that experience lower rainfall than inland areas and are subject to sudden storms and high annual variation [8]. In urban coastal areas, poorer communities of formerly war-displaced communities have purchased and settled on peripheral land beyond the water and sanitation network that is often at risk [8].

Many of Angola's major coastal cities are located at the mouths of river basins, which places these settlements in, particularly high-risk sites. There is consequently a concentration of people with limited coping abilities in these low-lying areas [8]. Decades of conflict progressively deteriorated the environmental situation in Angola's peri-urban districts. These peri-urban areas can be considered to be in a chronic public health crisis. Rural populations that migrated to Luanda in search of a safe-haven did not settle in an organised way and in some cases occupied environmentally-risky sites, such as those along riverbanks or drainage courses susceptible to severe erosion [8].

Most Angolan slum residents bought their land on the informal market and can demonstrate declarations of purchase or sale contracts [19][20]. Due to rapidly rising property values [21], the poor have relocated into areas of increasingly higher risk out of economic necessity [8]. This is sometimes due to forcible removal by government authorities [22] or voluntary relocation after buy-outs from private real-estate developers [8]. According to [8], the new settlement areas are without piped water service and lack formal sanitation means as sewage pollutes the groundwater and uncollected refuse usually dumped in valleys or drainage channels.

Transport infrastructure in Angola is mainly concentrated around the capital Luanda and along the coast. While roads connect the three port cities of Luanda, Lobito and Namibe, railway lines have also been rehabilitated or are under construction, so the transport of goods continues to congest Angola's road network, especially around Luanda, putting much stress on the existing infrastructure [23].

The coastal areas of Angola are now beginning to harbour large-scale housing development. One example is the Caio Verde, a new sustainable city currently under development in the Angolan province of Cabinda. Unfolding around three large indigenous coastal forests, the city, bordered by the Atlantic Ocean and two Congolese republics, consists of 265 hectares and will be home to an anticipated population of 35,000, making it the largest city in Cabinda [24].

Coastal land reclamation projects are also underway or near completion in some parts of Luanda to help solve the city's urbanisation challenges in a sustainable manner. For example, in the area of Samba, Corimba and Futungo de Belas, an area of 400 ha will be reclaimed along the coast of Luanda and protected by rock revetments and breakwaters. The new area will allow the construction of the Marginal da Corimba highway, a fishery port, a marina and real estate development [25].

The supply of urban services to coastal urban areas has not grown in line with the growth in population. Water supply networks, built in the colonial period for relatively small urban populations, have not been maintained adequately nor upgraded regularly to meet the rapid growth in city size [8].

Angola has four operational seaports [26]:

- Port of Luanda: Angola's main port, it has a capacity of 11,166 twenty-foot equivalent units (TEUs) and handles more than 70% of the country's imports. It is located adjacent to the Luanda Railway (CFL) and includes five specialised terminals: Multiterminais (breakbulk terminal), Unicargas (multipurpose terminal), Sogester (container terminal), Sonils (oil and gas terminal) and Soportos (multipurpose terminal);
- Port of Cabinda: it is situated in the province of Cabinda in the furthest northwest part of the country and provides services primarily to the oil and gas industries that dominate business in the province;
- Port of Namibe: it is close to the southern border with Namibia and mainly focuses on fishing activities in the region;
- Two new greenfield ports were initiated several years ago to increase cargo capacity and competitiveness:
- Port of Caio is a public-private partnership project for the complete development of a new port, with a 30-year concession from the Ministry of Transportation that started in 2012. This deepwater natural port located in the Cabinda province, adjacent to the Democratic Republic of Congo and the Republic of Congo, is positioning itself to facilitate regional and international commerce;
- Port of Dande: in 2011, the Angolan government approved the construction of the deepwater Port of Barra do Dande in Bengo Province, 50 km north of Luanda, to shift cargo from the Luanda Port, which at that time was reaching full capacity. With basic engineering preparations completed, the project is on hold due to a lack of government funding and a significant slowdown in cargo flows resulting from the country's economic challenges.

Sea level rise

Sea level rise (SLR) is projected to have significant impacts on coastal settlements, where 50% of the country's population lives, as well as on road networks, industrial and commercial infrastructure [10]. SLR is also expected to reduce the potential for agricultural activities in coastal areas due to salinisation [10]. Due to uncertainties in rainfall projections, it is not clear what the impact of SLR on food security in Angola will be [10]. Based on information about sea level from 1980-1999, three possible scenarios have been projected for the year 2090, with the first pointing to a rise of 0.13 to 0.43 m, the second of 0.16 to 0.53 m and the third of 0.18 to 0.56 m [3].

Changes in SLR for Angola under future climate change conditions are projected to be between 13 cm and 56 cm in 2100 [27]. This indicates that many low-lying areas may be subject to flooding, including areas of Luanda, the country's capital, and other low-lying coastal cities. Low-lying coastal lagoons, which play a key role in regulating the coastal environment, may likely become inundated. Also, this may increase saltwater intrusion in river deltas and estuaries which, combined with an increased propensity towards flooding, would have a tendency to create inward and outward flooding around major rivers and therefore implies a significant impact on populations, infrastructure, road networks, building and properties as well as industrial and port infrastructures.

SLR and storm surge affect 346,973 people(65.3% cumulative) in Luanda, making the city 8th highest impact in terms of city population in Africa following Alexandria, Lagos, Monrovia, Port Said, Abidjan, Cotonou and Conakry, and 18th on the list of Top-25 city population impacted by SLR and storm surge [28].

The incremental impact of SRL on land area in Angola is about 457 km2 and a projected impact (% of coastal total) of 29.10%. On wetlands, SLR will have an incremental impact of 129 km2 and a projected impact of 14.81% of coastal total [29].

Others

No information

INTEGRATED COASTAL AREA MANAGEMENT

Identification of coastal management policies at national, subnational or local levels, including cities/metropolitan plans.

Identification of national/local pilots with the objective to establish or improve coastal management plans.

- Constitution of the Republic of Angola 2010 (Lei Constitucional da República de Angola).
  The Constitution of the Republic of Angola was signed into law in 2010 and replaces the earlier version of 1992. It provides the basis for the Environmental Framework Act through Articles 12 and 24 that enable environmental protection and conservation, and the right to a healthy and unpolluted environment.
- National Adaptation Programme of Action Under the United Nations Framework Convention on Climate Change (UNFCCC) adopted in 2011.
  This signifies efforts of the Angolan Government in honouring its international commitments within the scope of climate change adaptation, and of its responsibility in the area of sustainable development, the fight against poverty and Millennium Development Goals.

- National Biodiversity Strategy and Action Plan (2007-2012).
  This is an important instrument that guaranteed the conservation of biodiversity in Angola, as well as equitable sharing of the benefits of its use. The plan presented actions to ensure that adequate measures are tailored into development policies and programmes to prevent the degradation of ecosystems and loss of biodiversity.
- Angola Environmental Framework Act (Lei de Bases do Ambiente) n° 5/98 of 19 June 1998.
  The Environmental Framework Act is based on Articles 12 and 24 of the Angolan Constitutional Law (see Section 3.1). Article 19 recognises the seriousness of pollution as a by-product of economic development and makes provision for strict measures to be taken to eliminate or minimise its effects.
- Angola Environmental Protection Audit 2010.
  Enshrined in Decree n° 1/10 of 13 January 2010, this instrument will allow the regular or occasional examination and evaluation of the performance of certain projects as they relate to the environment.
- Law on Aquatic Biological Resources (Law 6-A/04) of October 2004.
  Replaces the previous Legislation on fisheries (Law 20/92). The new legal framework aims at establishing "regulatory measures that seek to guarantee the sustainable conservation and utilisation of the aquatic biological resources existing in the waters under the sovereignty of the Angolan State, as well as general bases for the exercise of activities related to them, particularly fishing and aquaculture activities." The legislation covers territorial waters, the Exclusive Economic Zone (EEZ), tidal waters, estuaries and inland waters. It also covers the activities of Angolan fishing vessels in the high seas (without prejudice to the laws of other States) when fishing in waters under other States' jurisdiction.
- Decree on Environmental Impact Assessment (Decreto sobre Avaliação de Impacte Ambiental) n° 51/2004 of 23 July 2004.
  Ensure better environmental protection, particularly of human activities likely to have an impact on the environment (e.g. mining, civil construction, exploration of natural resources, etc.)
- Territorial Sea, Contiguous Zone and Exclusive Economic Zone Act n° 21/92 of 28 August 1992.
  This act has the objective to define the sovereignty of Angola over its internal waters and territorial sea and to establish a contiguous zone and EEZ. It explains that the territorial sea extends up to 12 nautical miles from the low water line or straight baselines as indicated in Decree n° 47,771 of 27 June 1967, or as may be defined by the Government of Angola under Article 3 of the Act. It further delineates the internal waters and the contiguous zone and establishes an EEZ of 200 nautical miles.
- Biological Water Resources Act n° 6-A/04 of 8 October 2004.
  The Biological Water Resources Act has only recently been approved by the National Assembly but is not being implemented as it has not yet been published in the Government Gazette. This act is a comprehensive and updated version of the Fisheries Act. It draws on articles in the Constitutional Law, Environmental Framework Act and the Angolan Business Act.
- Environmental Impact Assessment Decree (Decree n° 51/04 of 23 July 2004).
  The decree is a response to Article 16 of the Environmental Framework Act, which states that appropriate environmental impact assessment regulations will be developed.
- Fisheries Act n° 20/92 of 14 August 1992.
  Regulates fishing activity in marine and interior waters. It establishes the principle that fisheries resources are for public use and stipulates quotas consistent with the conservation of marine resources, adjusted according to available fishing potential and season. It regulates the fishing industry to achieve sustainable development.
- Decree on Soil, Flora and Fauna Protection (Decree n° 40 040 issued on 20 January 1955 and published in the Official Bulletin on 9 February 1955).
  This is the first legislation on nature conservation and the establishment of protected areas for different purposes (initially for hunting purposes and later for nature conservation). It also covers aspects related to soil, fauna and flora protection, conservation and use of game, the establishment of national parks, nature reserves and controlled hunting areas. Part of this legislation includes:
    - Hunting Regulation n° 2873 of 11 December 1957
    - Decree n° 44 531 on Forestry Regulation
    - Decree n° 10 375 of 15 October 1958 on National Parks RegulationA list of mammal and bird species whose hunting is considered illegal.
- Mining Act n° 5 of 27 April 1979.
  Reflects the new mining policy aiming at creating the necessary conditions to include the development of the mining industry in the national and international context. By doing this, the Act seeks to reduce the dominance of the state-owned companies by eliminating the monopoly of mineral rights and providing opportunities for the private sector, both national and international, to invest in the mining sector leading to a better development of Angola and its economy.
- Land Act n° 21 of 28 August 2004 (currently under revision).
  States that all land is state property. It establishes modalities and basic conditions for concession of title and for use and

exploration of land for agricultural, non-agricultural and special purposes (the latter includes regimes for the total and partial protection of soil, fauna and flora).

- Land Use Planning and Urban Development Act n° 3/04 of 25 June 2004.
  This law adopts a concept of integrated planning, which does not only include socio-economic aspects but also attempts to create synergies between city and countryside. This law calls for the establishment of a decentralised system to coordinate the work of land-use planning.
- Land Act n° 9/04 of 9 November 2004.
  This Act considers the land as a property of the State and proposes the following multiple uses for the land. It presents two land classifications, namely urban land (areas for construction of buildings) and rural land (areas for agriculture, livestock raising, forestry and mining).
- Water Act n° 6/02 of 21 June 2002.
  This Act states the priorities for the use of water resources in Angola, particularly about internal/continental waters, and provides a list of water management principles, particularly the harmonisation of the water management policy with land-use planning. It calls for the development of a General Plan for the Development and Use of Water Resources in Basins.
- Decree n° 4/01 regulating Coastal Management Plans (POOC), 2001.
  This Presidential Decree regulates spatial planning for public lands within the coastal area of the Province of Luanda transferring them to the private sector, according to Law n° 9/98. It regulates the public coastal lands and public territories within the maritime areas destined to the settlement of infrastructures and support equipment, not only limited to beach facilities but also the entire marine coastal zones within the Province of Luanda. This Law applies to the maritime areas as well as to the protection territorial strips with a maximum extension of 500 meters from the Province of Luanda.
- Joint Decree n° 477/07 creating the Permanent Technical Committee of Bengo for Coastal Zone Management (POOC).
  It establishes the composition, duties and responsibilities of the above-mentioned institution entitled to carry out controls and perform coastal zone management.
- Presidential Decree n° 232/11 regulating the expropriation regime of public coastal lands, 2011
  Regulates the expropriation regime of public coastal lands designated to infrastructures and support equipment for beach facilities on the entire coastal area up to the maritime zone (excluding harbours and military areas) and the land protection area with a maximum width of 500 metres, transferring the competencies to the private domain of the respective Provincial Governments.
- National Travel Insurance Memorandum of Understanding of 15 August 2016.
  The Tourism Development Institute (Infotur) and National Insurance Company (ENSA) signed the MoU for the launch of the travel insurance product market dubbed "National Travel Insurance". The initiative is part of the strategy of Infotur to promote domestic tourism meant to safeguard the physical integrity of all those who wish to enjoy the wonders the country offers.
- Angola National Transport Sector Master Plan.
  This is being currently reviewed under the African Development Bank assisted funding and announced to be submitted to the Executive. The updated National Transport Sector Master Plan will incorporate existing plans and studies to formulate an overall strategy and policy for the nationwide transport network, composed of roads, railways, inland waterways, ports and airports in Angola.
- Decree on Oil Activities n° 39 of 10 October 2000.
  Recognises the important role of oil in the Angolan economy and its impact on the environment and calls for the compulsory implementation of environmental impact assessments for any offshore or onshore project.
- Petroleum Activities Act n° 10 of 12 November 2004.
  This Act includes principles of economic policies, particularly for the protection of national interests, promotion of the workforce, valuation of minerals and environmental protection.
- Decree on Environmental Protection for Petroleum Activities n° 39 of 10 October 2000.
  In regulating petroleum activities in a way that ensures the achievement of sustainable development, the Decree recognises the impact of these activities on the natural environment. It also calls for the compulsory implementation of environmental impact assessments as a key instrument to ensure environmental protection in any project.

Other conventions for marine pollution

Approved by the National Assembly as International Conventions listed below, and which have relevance to the protection of marine pollution by hydrocarbons and potentially harmful substances.

- 1996 International Convention on Liability and Compensation for Damage in Connection with the Carriage of Hazardous and Noxious Substances by Sea - HNS 96
  Resolution n° 18/01 of 20 April of the National Assembly approves the accession of the Republic of Angola to this Convention, the text of which was published in the Diário da República n° 19, Series I.

- 1992 International Convention Relating to Intervention on the High Seas in Cases of Oil Pollution Casualties, as issued in 1973 and 1991.
  Resolution n° 29-A/01 of 5 October of the National Assembly approves the accession of the Republic of Angola to this Convention, the text of which was published in the Diário da República n° 46, Series I.
- 1992 International Convention on the Establishment of an International Fund for Compensation for Oil Pollution Damage (FUND PROT).
  Resolution n° 30/01 of 26 October of the National Assembly approves the accession of the Republic of Angola to this Convention, the text of which was published in the Diário da República n° 49, Series I.
- 1992 International Convention on Civil Liability for Oil Pollution Damage - 'CLC PROT 92 or CLC 92' and the Protocol of 1992 to the 1969 International Convention on Civil Liability for Oil Pollution Damage
  Resolution n° 32/01 of 1 November of the National Assembly approves the accession of the Republic of Angola to this Convention, the text of which was published in the Diário da República n° 50, Series I.

ADAPTATION

Adaptation measures under implementation or implemented in the last decade and its effects

Identification of national adaptation plan into force

No information

Identification of specific actions undertaken during the last decade

- Marine Spatial Management and Governance Programme (MARISMA). It began in 2016 with the technical assistance of the Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) to the Angolan government to promote sustainable ocean use in the Benguela Current, focusing on implementing Marine Spatial Planning (MSP).
- The National Biodiversity Strategy and Action Plan (NBSAP) 2007-2012 has enabled the identification of key sectors for the knowledge and conservation of Angolan biodiversity. Eight strategic areas were identified to be implemented between 2007-2012, each one with various objectives and actions. Though the implementation is not effective (only 5% of the foreseen action has been achieved), some outcomes have been carried out which has helped in deepening the knowledge on the country's biodiversity and attaining some Millennium Development Goals enshrined in the Convention on Biological Diversity (CBD).
- In the scope of the fight against sea pollution by hydrocarbons, a National Oil Spill Contingency Plan[1] has been developed and adopted by the Council of Ministers, whose Implementation Committee is coordinated by the Ministry of Environment and includes the ministries of Petroleum, National Defense, Home Affairs, Fisheries, Transport and Finances as well as oil operators in Angola.
- In the south, Angola is part of the Benguela Current Convention. Within this convention, a project on the management and conservation of marine and coastal biodiversity is in course with a focus on the transboundary area between Angola and Namibia (Iona/Skeleton Coast)[2]. The activities thereof include the development of a plan for the management of waters and identification of land sources of marine pollution.
- The Angolan Development Strategy for 2025 includes:
  - Integrated Spatial Development Programme, including the mapping of transportation corridors, development corridors and spatial development initiatives;
  - National Rural and Urban Mobility Programme, including the development of rural and urban transportation;
  - National Infrastructure Repositioning Programme, comprising ports, railroads, highways and airports;
  - National Technical Capacity Reinforcement Programme.
- In Angola's Initial National Communication to the United Nations Framework Convention on Climate Change[3], measures to mitigate coastal vulnerability related to different sectors have been discussed.
- Tourism Master Plan of Cabo Ledo - Government of Angola [30]
- The Ministry of Tourism of Angola and the organising committee of the World Tourism Forum are now updating the National Tourism Master Plan 2011-2020 approved in 2011 to include new measures to boost tourism in Cabo Ledo and Futungo de Belas (Luanda), Calandula (Malanje) and Okavango (Kwando Kubango).
- The Fisheries Sector Support Project (2013-2018) supported by the African Development Bank was aimed at increasing incomes of small-scale fishers and traders (mostly women) through marked improvements in the fish landing and handling facilities, thereby reducing post-harvest losses and improving quantity and quality of fish landed and traded. It was implemented in coastal communities of Gilco, Yembe, Egipto Praia, Salinas Sumbe, Dambe Maria and Ambriz.

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- Water Act n° 6/02 of 21 June 2002. http://extwprlegs1.fao.org/docs/pdf/ang63753.pdf

Adaptation plans

- Angolan Development Strategy for 2025
- Angola's Initial National Communication to the United Nations Framework Convention on Climate Change
- Fisheries Sector Support Project (2013 -2018)
- Marine Spatial Management and Governance Programme (MARISMA), started in 2016. http://www.benguelacc.org/index.php/en/marisma
- National Biodiversity Strategy and Action Plan (NBSAP) 2007-2012
- National Oil Spill Contingency Plan
- National Tourism Master Plan 2011-2020, approved in 2011 to include new measures to boost tourism in the Cabo Ledo and Futu

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Description of the coastal areas of the country

The Cameroonian coast is a zone where important industrial and environmental interests are located. Cameroon, as its neighbouring countries, is an important offshore oil and gas producer. The Cameroon government also invests in important marine projects, such as the industrial Kribi harbour complex and the marine protected areas of Kribi-Campo and Mouanko. Moreover, the country faces other problems in coastal areas: salinity intrusion, increase in sediment transport and coastal urbanisation (sand excavation, mangrove deforestation, road and housing construction) in the Cameroon estuary, which are probably linked to coastal vulnerability [1]. All these issues have led to a growing interest in understanding local coastal dynamics and especially tides.

Geographically, the coast of Cameroon is connected to the equatorial Atlantic Ocean. The shoreline spreads over 402 km (8.3°E - 10.15°E and 3.3°N - 5°N) (see Figure) between Idenau (southwestern region) and Campo (southern region). The coastal zone presents an array of varying geomorphological attributes consisting of creeks, lagoons, sand and rocky beaches, coastal plains, wetlands and mangroves [2]. These varying landforms include the Cameroon estuary which has the particularity to be a vast delta where three important rivers join (Wouri, Sanaga, Nyong).

This coastal zone, which affects three regions of the country (South, Littoral and Southwest), is home to nearly 60% of the national industrial infrastructure and on average 15% of the Cameroonian population (estimated in 2018 at 25,216,237 inhabitants). The urbanisation rate in this area is 80% compared to a national average of about 50%, leading to significant pressure on this environment and adjacent sea.

The area is very convenient to agriculture which contributes to 30% of gross domestic product (GDP). Artisanal and industrial fisheries are practiced there and concern especially small pelagic (such as Sardinella and Ethmalosa), Sciaenidae and shrimp (such as Penaeus notialis sp), Tilapia and Clarias (freshwater species).

Sand excavation is another activity in the coastal zone of Cameroon, estimated at more than 4 tonnes per day [3]. Several institutions of economic nature are present and distributed on both sides of the coastal zone and include among others the seaports of Kribi, Douala, Tiko and Limbé, the National Refinery Company (SONARA), the Cameroon Company of Petroleum Deposits (SCDP) as well as the DANGOTE and CIMENCAM cement factories, SOCAPALM, HEVECAM and CDC.

COASTAL VULNERABILITY – PRELIMINARY ASSESSMENT

Floods

The extremely faint slopes of the geomorphic features of Cameroon are easily flooded by sea incursions, which is projected to worsen due to the impending global sea-level rise [4]. Coastal flooding from saline water incursion results in ecological stress through wetland loss, inundation and erosion, while the lagoon-creek complex is impacted by hydro-geomorphic changes with adverse environmental consequences on the coastal settlements [4].

Under the prism of recognising the influence of sea-level rise on coastal areas, it is clear from [5] that an increase in sea level (90 cm in 2100) would have the potential consequence of flooding 38 of the 72 villages identified in the single-mode Coastal Agro-ecological Zone (CAZ), the demolition of fishermen's houses, the migration of approximately 5,900 fishermen and their families and the loss of 33,000 ha of mangroves (30% of the total area of mangrove forests in Cameroon) [6]. In Cameroon, nearly 30,000 people were affected by the floods in 2012 [7]. In fact, projections show [6] at least 5 to 10 floods per year depending on rainfall intensity. An average of 120,000 people is affected each year by floods in Cameroon, or about 0.5% of the country's total population [8].

With urban populations worldwide expected to witness substantial growth over the next decades, pressure on urban land and resources is projected to increase in response. For policy-makers to adequately meet the challenges brought about by changes in the dynamics of urban areas, it is important to clearly identify and communicate their causes. Floods in Douala (the most densely populated city in the Central African sub-region) for instance are mainly linked to changing rainfall patterns resulting from climate change, at least according to some policy-makers. Indeed, using attributes such as rainfall anomalies, trends in the rainfall time series, daily rainfall maxima and rainfall intensity–duration–frequency, we find no explanation for attributing the increase in the occurrences and severity of floods to changing rainfall patterns. The culprit seems to be the massive population growth of Douala, in association with poor planning and investment in the city's infrastructure. These demographic changes and poor planning occurred within a physical geography setting conducive to flooding. Failed urban planning since the independence of Cameroon has led to the urbanisation of flood-prone areas in Douala. This translates today into a situation in which large portions of the city's surface area and populations are vulnerable to annual floods. While climate change stands to render the city even more vulnerable to this hazard, there is no evidence that current floods can be attributed to the changes in patterns of rainfall being reported in policy and media.

Droughts

The impact of drought is low on the coast of Cameroun, as opposed to the northern part of the country. However, reports have underlined the impact of drought in the central and southern regions and part of the coast on agriculture. Ipsnews1 , for example, has reported that data from the National Cocoa and Coffee Board suggests that there was a drop in cocoa production at a national level with 7,610 tons of cocoa exported in March 2016, 5,780 tons in April and the figure further dropped to 3,205 tons by the end of June of the same year. The report suggests that this decrease was linked to the effects of droughts worsened by the ignorance of people who cut down trees that provided shade to cocoa. According to the NPCC2, northern Cameroon (non-coastal economic activity zone) is expected to experience intensified drought given the aridity of the climate, which would lead to an increase in the number of victims with an average balance of at least 500 deaths for 5 droughts per decade.

Additionally3, Cameroon has been experiencing a complex humanitarian crisis since 2013 with the number of food insecure people doubling since 2015 from 1.1 million to 2.7 million. Currently, 57% of rural people live in poverty. This is partly due to the Lake Chad crisis that has seen unsustainable water management and climate change reduce the lake's surface area by 90%. Due to erratic weather conditions driven by climate change, agricultural production in Cameroon has declined and farmers have struggled to maintain their livelihoods. Cameroon was largely self-sufficient in food 20 years ago but it now imports a large number of basic food supplies. However, a new government-supported initiative is providing farmers with relief through better crop seeds. The Southwest Development Authority, a Cameroonian institution, has partnered with local farmer organisations to offer small-scale farmers seeds that can withstand harsher weather conditions. The project began in 2014 and has since established over 24 seed multiplication farms across Cameroon for crops including maize, cassava, beans, yams and plantain.

Erosion

As pointed out by [9], sea-level rise (SLR) has brought damage to the Cameroun coastline, notably around the Down Beach coastline of the city of Limbé, which has often come under periodic marine erosion provoking the extensive failures and collapse of coastal buildings. We can cite the collapse or the breaking of some parts of the tarred road near the local bank (BEAC) unit, the Red Cross building being washed into the sea, or cracks already identified in some buildings. SLR will increase coastal erosion, and with strong winds and increased rainfall, land erosion will increase as well [6].

The Mount Cameroon coastline is believed [10] to be affected by two main morphological and dynamic environmental problems: the erosion of the Atlantic slopes of the mountains and hills, and the accumulation of sediments on the continental platform. Erosion affects the coastal slopes, as evidenced by the existence of erosion domes observed on both the Atlantic slopes and coastlines. Three factors explain the deterioration of the Cameroonian coastline: (1) its location within a vulnerable region known as the Cameroonian Line, (2) the persistent impact of climate and oceanographic conditions, and (3) the topographic nature of the region. A high percentage of the water in this coastal area infiltrates the soil, weathering the pyroclastic material. The concentrated human population in the area also accelerates some of the erosional processes. In fact, human activity could be the primary cause of degradation; nevertheless, natural erosion processes remain prominent in the ongoing degradation of this fragile environment.

Salinity intrusion

The drowning of the mouths of the major coastal rivers like the Mungo Wouri and Sanaga today describes a broad embayment along the Cameroon coastline as it opens into the Gulf of Guinea, which greatly enhances tidal movements with consistent inflow of saline waters. The immediate effect is the proliferation of the brackish water environment where the mangrove vegetation thrives on the mudflats further inland [4]. According to 2004 observations by Krakstad4 surface salinity varied between 27.5 ppt in Limbé, 23 ppt in the Wouri estuary and 30 ppt in Campo.

Wetland change and loss, dry land loss

The dominant silty composition of sediments in Cameroon accumulating in the tidal inlets of the evolved lagoon-creek system creates salt marshes, which has transformed this rainforest subtype into a rich wetland ecological zone. These wetlands of Cameroon are characterised by a largely homogenous vegetation of the different species of the mangrove [11]. Also in these Cameroon coastal lowlands, the wetlands are essentially marine, lagoonal and estuarine, emphasising the strong influence of tidal actions along the Gulf of Guinea [11].

The most easily observable interference on the wetlands of the Cameroon coastal zone is the process of wetlands conversion into reclaimed land. The human-induced actions generally cover wetlands conversion for housing, industrial development, expansion of highways, etc., while natural changes are caused by saltwater intrusion, erosion and subsidence.

1 http://www.ipsnews.net/2016/08/drought-deals-harsh-blow-to-cameroons-cocoa-farmers/

2 National Plan for Adaptation to Climate Change

3 http://www.climateaction.org/news/farmers-in-cameroon-are-overcoming-drought-with-the-help-of-new-seed

4 In 2004, Krakstad et al. registered surface temperatures variations of 27.5°C in Limbé, 27.4°C in Wouri estuary, 27.2°C in Kribi and 27.2°C in Campo. Salinity varied between 27.5 ppt in Limbé, 23 ppt in Wouri estuary and 30 ppt in Campo this period.

The combination of these changes has resulted in vegetation stress and wetland deterioration of substantial magnitude in the Cameroon coastal habitats, including salt marshes, brackish and freshwater marshes and the predominantly mangrove forests. The consequences are a net loss of these resources [11]. The percentage coverage of the categories of wetlands studied in the Douala-Tiko area [11] for example has shown a reduction from 18% to 12.1% over a 20-year period. The erosive process will lead to the destruction of sandy beaches in the mangroves (Cameroon Cape, Kangue).

Marine pollution, water quality change

Marine pollution in Cameroon is primarily due to the intense exploration and exploitation of oil as well as the transport of hydrocarbons. This pollution is also reinforced due to the geographical location of the country and its coast, with transiting ships sometimes disposing of their waste in ports or lose crude oil during transport or unloading.

According to the studies carried out by [12], it appears that the most polluted points of the Cameroonian coast are the Bakassi peninsula, Port of SONARA in Limbé, Ebomé in Kribi, with the floating terminal of unloading and storage of Chadian crude oil where several oil leak scenes were noted and reported[5] by local communities. Moreover, studies[6] have shown that marine waters close to large cities like Douala and, to a lesser extent, small towns such as Limbé, have become reservoirs for significant quantities of industrial, agricultural and domestic waste, as well as other land-based sources of pollution. Urban expansion and increased household waste would, therefore, pose a major threat to Cameroon's coastal and marine ecosystems in the years to come. According to the World Bank, in 2016 Cameroon produced 3,661,758 tons of waste, and it is projected to increase to 5,865,357 tons around 2030 and 11,858,301 tons around 2050.

Cameroon harbours approximately 2,000 km^2 of mangroves distributed along the coast of the Guinean Gulf [13]. Although mangroves contribute considerably to the social and economic well-being of the Cameroonian coastal inhabitants, their total surface area has decreased by 30% in 20 years [14], mainly due to rapid and uncontrolled urbanisation around Douala [15]. With a population of 2 million people, Douala is the largest city in Cameroon and exerts a huge pressure on the nearby mangroves, with uncontrolled sewage discharge detrimentally affecting the whole ecosystem [16]. Douala is also one of the major shipping ports in the Gulf of Guinea, serving Central Africa as a whole and refueling oil tankers to export locally extracted oil, another significant anthropogenic impact on the mangroves of the Wouri estuary. Due to the lack of policy regulation in the management of Cameroonian coastal ecosystems, sand mining and wood harvesting also play an important role in reducing mangrove biodiversity and the provision of ecosystem services [17].

Reduction of marine stocks

Major threats to fish stock in Cameroon include amongst others IUU fishing, habitat degradation, pollution and climate change. The sector is primarily dominated by foreign industries and production has been reported to decline drastically to one-sixth of its value of the 1970s despite duplication of fishing efforts.

Two types of practice are observed within the marine spatial coverage, artisanal and industrial, which themselves could be divided into sub-classes depending on the material used and the level of catch. Poor monitoring capacities of Cameroon's coastal and marine environments make the zone highly vulnerable to illegal fishing practices and overexploitation, which have degraded the stock significantly from 942 tons in 1970 to 236 tons in 2010 (MINEPIA report). The average annual production for both types of fishing was 53,409.3 kg between 1995 and 2000 [12], with a considerable stock decrease noted for the different species of fish.

Urban sprawl and coastal/maritime infrastructure development

Cameroon's coastal zone is highly populated, with a population of about 3,600,000 in and around mangrove ecosystems, of which 300,000 (7.6%) are resident in mangrove swamps [19]. Infrastructure development is growing, including the recent construction of the Kribi deep-water seaport (KDP), as well as the construction of a new cement manufacturing plant (DANGOTE).

The coastal zone of Cameroon holds great sustainability potential for its growing urban population as it is richly endowed with aquatic and terrestrial resources within the brackish and saline water environments. However, the sustainable development of the urban areas of Limbé and Douala has become increasingly difficult along the Cameroon coastal lowlands, as coastal flood is expected to increase in magnitude while land loss will become more devastating [4].

The mangrove forest vegetation ecosystem in Cameroon has witnessed a considerable reduction in quantity due to exploitation by the rapidly encroaching human population and settlement in the wetland zone [3]. Today, Cameroon has lost an estimated 40% of total mangrove vegetation in the 4 decades following its independence in 1960, a situation that has worsened the socio-economic status of a large fishing population of the coastal area.

Sea level rise

The Cameroon coastal lowlands are expected to be impacted by rising sea levels as highlighted in several documents, however, a number of socio-economic benefits are anticipated for the mounting coastal human population. That a rise in

5 Report of NGO RELUFA, 2010; on second oil leak observed around the offshore Kribi terminal of the Tchad/Cameroun pipeline. https://web.archive.org/web/20140222032735/http://www.relufa.org/partners/jhnewsletter/documents/KribiOilSpill.doc

6 https://www.oceandocs.org/bitstream/handle/1834/5228/overview%20management%20and%20exploitation%20of%20fishery%20resources%20of%20Cameroon.pdf?sequence=1&isAllowed=y

sea level along a predominantly low-lying coast will aggravate sea incursions resulting in flooding, inundation and erosion is but a natural sequence of events [4]. Cameroon experienced a sea-level rise from 1.8 to 2.2 mm per year between 1948 and 2003. The projections show a sea-level rise between 9 and 38 cm in 2050 [20] and at 86 cm in 2100 [21]. This rise will accelerate the disappearance of trees in future decades, which will accelerate erosion and result in the degradation of mangroves and several ecosystems and habitats [6].

SLR, in association with the topography of low-lying coastal areas, hydrology, sedimentology, natural dynamics, and anthropogenic interactions, will profoundly affect the coastal zone of Cameroon in the new century. Anticipated impacts of SLR on species abundance, distribution and diversity in the wetlands and aquatic ecosystems are therefore highlighted [22], focusing on fish and plant species. Such impact assessments are based on time series (1970-1990) of fisheries resource production, projected demands (1990-2010) and economic value as well as the aquatic ecosystems at risks in the case of SLR.

Others

It is anticipated that storms will be even more frequent in the coming decades and will occur regularly on the Cameroonian coast (economic coastal zone with monomodal rainfall) with significant damage [6]. Historically, rising temperatures have resulted in increased evapotranspiration, leading to more frequent and more violent storms. The most devastating cases occurred in 2000, 2003, 2007 in the southwest coastal highlands (economic coastal zone) with significant material losses.

INTEGRATED COASTAL AREA MANAGEMENT

Identification of coastal management policies at national, subnational or local levels, including cities/metropolitan plans.

National policies

- The National Action Plan (NAP) for Marine and Coastal Area Management (November 2010).
- Integrated Coastal Zone Management Plan of Kribi Campo (PGIZC-KC), which is an integral part of the NAP.
- Emergency Action Plan (PAU, 1999).
- National Environmental Management Plan (PNGE, 1996).
- National Energy Action Plan for the Reduction of Poverty (PANERP, 2005).
- National Action Plan to Combat Desertification (PAN / LCD, 2006).
- National Action Plan for the Fight against Marine Pollution from Land.
- National Implementation Plan for the Stockholm Convention on Persistent Organic Pollutants in Cameroon (2016).
- National Governance Programme (PNG, 2000), indicative of good governance and the fight against corruption.
- National Governance Strategy (2015)
  National Participatory Development Programme (PNDP) and Framework on Environmental and Social Management (2018).
- Forest and Environmental Sector Programme (PSFE, 2005-2006).
- Programme of Integrated Development of the Atlantic Coast (PIDAC).
- Poverty Reduction Strategy Paper (PRSP, 2003).
- Growth and Employment Strategy Paper (GESP, 2009).
- Rural Sector Development Strategy Paper (DSDSR).
- National Biodiversity Strategy and Action Plan (NBSAP, 2012).
- 2035 Vision (February 2015).
- National Strategy for the Sustainable Management of Mangroves and other Coastal Ecosystems in Cameroon (June 2018).
- Master Plan for the Development of the Douala Edéa Reserve.
- National Adaptation Plan for Climate Change (NAPCP, launched in October 2012 and effective since 24 June 2015).
- National Investment Plan for Climate Change Adaptation (PNIACC, 2015).

Regional and sub-regional policies

- Regional Strategic Action Plan for the Environment and Biodiversity Resources of the Congo Basin Ecosystems.
- African Union's "Agenda 2063: The Africa We Want".
- African Union's "Africa's Integrated Maritime Strategy".

- Africa's Blue Economy: A policy handbook.
- Transboundary Diagnostic Analysis Document and Strategic Action Programme of the GCM-CG.
- Convergence Plan/Sub-Regional Action Plan to Combat Desertification for Central Africa (PASR-AC -2000, 2005) - Developed and implemented by COMIFAC.
- Blue Fund and Climate Commission initiatives for the Congo Basin.
- Central Africa Regional Strategy for Risk Prevention, Disaster Management and Climate Change Adaptation (2016).
- African Strategy on Climate Change (2015).

Identification of national/local pilots with the objective to establish or improve coastal management plans

- Promotion of the management and sustainable use of fisheries resources.
- Promotion of income generating activities.
- Creation of marine and coastal protected areas.
- Integrated management of the coastal zone of the Bakassi Peninsula.

National legislation

- Law n° 96/12 of 5 August 1996 on a framework law on environmental management in the Republic of Cameroon, in particular Article 31 (1) on the protection of the coastline and maritime waters and Article 94.
- Law n° 96/14 of 5 August 1996 regulating the transport of gaseous and liquid hydrocarbons by pipeline across the national territory from neighbouring countries.
- Law n° 94/01 of 20 January 1994 on the Forest, Wildlife and Fisheries Regime.
- Law n° 78/23 of 29 December 1978 on the protection of national parks.
- Law n° 83/16 of 21 July 1983 regulating the police within port facilities.
- Law n° 81/13 of 27 December 1981 dealing with the Forestry, Wildlife and Fisheries Regime (revised law).
- Law n° 63/14 of 19 June 1963 implementing the repressive code on marine fishing.
- Act n° 99/006 of 14 April 1998 on tourist activities and its implementing Decree n° 99/443/PM of 25 March 1999.
- Act n° 98/021 of 24 December 1998 on the organisation of the port sector and the implementing Decree organise and create the autonomous ports of Douala, Kribi, Limbé and Garoua.
- Law n° 39 PJL/AN of 20 November 1974 fixing the limit of the territorial waters of Cameroon.
- Law n° 2003/006 of 21 April 2003 on the Biosafety Regime.
- Decree n° 94/259/PM of 31 May 1994 establishing the National Consultative Commission for the Environment and Sustainable Development (NCCESD).
- Decree n° 2001/165/PM of 8 May 2001 and its two annexes specifying the protection of surface water and groundwater against pollution.
- Decree n° 002/MINEPIA of 1 August 2001 laying down the procedures for the protection of fisheries resources.
- Decree n° 063/CAB/PM of 8 March 2007 establishing the Ramsar National Committee.
- Decree n° 0070/MINEP of 22 April 2005 setting out the different categories of operations whose implementation is subject to an environmental impact assessment.
- Decree n° 0001/MINEP of 13 February 2007 defining the general content of the terms of reference for environmental impact assessment.
- Decision n° 6069/MINTP of 8 March 2005 establishing the different categories of operators whose activities are related to environmental impact assessment.
- Circular Note n° D.69/NG/DMPHD/SHPA of 20 August 1980 relating to the collection, transport and treatment of industrial, household and sanitary waste.

Sub-regional and international agreements

- United Nations Convention on the Law of the Sea.
- United Nations Convention to Combat Desertification (UNCCD).
- Convention on the Conservation of Migratory Species of Wild Animals.

- United Nations Convention on Biological Diversity (CBD).
- Ramsar Convention on Wetlands.
- Washington Convention on International Trade in Endangered Species of Wild Fauna and Flora.
- International Convention on Oil Pollution Preparedness, Response and Co-operation.
- MARPOL 73/78 Convention for the Prevention of Pollution from Ships.
- Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal.
- United Nations Framework Convention on Climate Change (UNFCCC).
- Abidjan Convention for the Co-operation in the Protection and Development of the Marine and Coastal Environment of the West and Central African Region.
- Kyoto Protocol.
- International Convention on Oil Pollution Preparedness, Response and Cooperation (ICOPPRC).
- Treaty of COMIFAC.
- Statute of CEFDHAC.

ADAPTATION

Adaptation measures under implementation or implemented in the last decade and its effects

Identification of national adaptation

- National Adaptation Plan for Climate Change (NAPCP, launched in October 2012 and effective since 24 June 2015).

Identification of specific actions undertaken during the last decade

- Strategy document to combat global warming (27 September 2019).
- National Environmental Management Plan (NEMP).
- National Forest Development Plan (NFDP).
- National Observatory on Global Warming (NOGW), operational since November 2015.
- National Environmental Awareness and Education Programme (NEAEP, 2014).

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- Africa's Blue Economy: A policy handbook. https://www.uneca.org/sites/default/files/PublicationFiles/blueeco-policy-handbook_en.pdf
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Description of the coastal areas of the country

The coastal zone of Congo is characterised by a relief defined on three large topographical units lowering from east to west, notably the Mayombe mountain range, the uplands and the coastal plain [1]. This coastal plain represents one-third of the vast coastal alluvial basin that stretches from southwest Gabon to north-western Angola. It is 170 km long and 50 km wide with a continental shelf covering about 11,000 km^2 of surface. The plateau is made up of rocky shoals with outcrops of 35 to 40 m depth which are parallel to the 5 to 15 m depth in front of Pointe-Noire. These rocky shoals are composed of limestone with calcium or clay cement, with the presence of phosphate [2]. The altitude is always less than 100 m and slopes gently down from the foothills of the Mayombe to the lagoons, swamps and sandy cords of the coast [1].

The abundance of fish species is subject for strong competition from local and international fishermen. Among these coveted resources are [3] benthic fauna, continental edge fauna, Atlantic slope fauna, pelagic wildlife, trawl and surface fish.

The hydrography dominated by the Kouilou River is influenced by cold Benguela and warm Guinean currents, which largely contribute to the rainfall variability in southern Congo. Rainfall in this area is sensitive to ocean surface temperatures. In the Congolese coastal zone, rainfall is generally less than 1,400 mm per year. The plant and animal biodiversity in this area of the Congo remains typical to that identified in the Tchimpounga Nature Reserve (55,526 ha), located 33 km from Pointe-Noire, and in the Conkouati-Douli National Park (504,950 ha), located along the Atlantic coast.

The latter [4] includes a marine part representing approximately 24% of its total area. It is distinguished by its ecological diversity (lagoon ecosystems, mosaic of savannahs and man-made forests, lakes and rivers, mangroves, raffia swamp forests, dense coastal forest) and habitats with a wide range of terrestrial and marine species, such as elephants, buffaloes, leopards, servals, chimpanzees, gorillas, mandrills, forest duikers, wild crabs, whales, dolphins, African sea lions, hippopotamuses, manatees, sea turtles, etc. According to [4], about 7,000 people lived in 27 villages in and around Conkouati-Douli Park.

COASTAL VULNERABILITY – PRELIMINARY ASSESSMENT

Floods

The altitude of the Congolese coast is about 2 to 5 m and its profile corresponds to a gentle slope sometimes exceeding 1%. It is believed that warming will lead to an increase in flood areas (like Loémé, Kouilou, Noumbi, Conkouati) due to a sea-level rise projected to reach 0,40 m in 2050 and 0,90 m in 2100. The results will affect estuaries and lowland stretches hosting human settlements. According to [5], the slowly rising sea level would cause coastal impacts related to flooding. However, given the uncertainties, climate projections raise concerns that Congo's coastal zone will be flooded by the end of the century.

Droughts

No information

Erosion

The coastal impact due to the erosion process in Congo is quite significant Indeed, marine erosion is very active in Loango, from Pointe-Noire to the Mongolo estuary and Pointe-Mwassa. This erosion is responsible for the visible damage to the landscape, namely the creation of mini-cliffs and mini-bays of erosion, the uprooting of trees, the destruction of bungalows and fishing grounds[2] . This activity, which causes coastline retreat, appears to be due to the new port infrastructures which should have modified the current lines and the swell; in fact, works close to the various beaches built since colonial times on other Congolese coastal sites have so far not been really threatened [5].

Results show that a considerable number of beach areas in the country will be lost due to coastal erosion in case of accelerated rise in sea level. The initial national communication of Congo (2001)[3] underlined that about 2.3% to 4.3% of the beaches around Loango will be lost by 2100, with many villages and public infrastructures threatened.

Salinity intrusion

The initial national communication of Congo (INC) of 2001 addressed that the ingress of saltwater into the Congolese mangrove is expected in future years following the expansion of the ocean and flooding of the coastal zone.

In this situation, a large breach is expected, on the one hand, as in the estuaries of Loemé, Kouilou and Noumbi, caused by intense erosion of the oceanic part which will facilitate a significant penetration of oceanic water upstream, on the other

1 National Action Program to Combat Desertification of the Congolese Republic, 2006.

2 Environmental Audit of the Congolese Coast: Case of the coast of the city of Pointe-Noire. Study Report from 7 to 21 March 2005 (translated from German).

3 https://unfccc.int/sites/default/files/resource/Congo%20INC_French.pdf

hand, to the mortality of mangrove (Crinium natans) and (scleria sp) due to salinity, as the floodable surface swells over a band of more than 150 m all around Conkouati and in the estuaries.

Wetland change and loss, dry land loss

Wetland loss is significant and attributed to sea-level rise, coastal erosion and flooding in the country.

Marine pollution, water quality change

In addition to the pollution associated with maritime transport activities of all kinds on the Congolese coast, it should be emphasised that population growth would also pose a threat to this environment with a strong generation of urban waste in the coming years. According to the World Bank [4], Congo would produce about 3,193,587 tons of household waste per year by 2050 against 894,237 tons produced in 2016.

Reduction of marine stocks

It appears from the 2001 Congolese initial national communication that by 2050-2100, an increase in water temperature and weakening of bottom water will cause low plankton runoff and, in turn, a major disruption in fish production. This will lead to a sharp decline in pelagic resources, such as Sardinella aurita and Sardinella maderensis, whose current production is between 10,000 and 18,000 tonnes per year, as well as to the increase of offshore species, such as tuna, whose production is around 5,000 tonnes per year.

Urban sprawl and coastal/maritime infrastructure development

In the centre of the Gulf of Guinea, Pointe-Noire – known as the economic capital of the country – is located in a strategic position and is an essential host to the biggest port of the country. The port and the city play an important role in the national economy and that of landlocked countries in the sub-region. In 2003, the general traffic experienced in Pointe-Noire was about 10,810,537 tonnes and the total commercial traffic was 1,890,366 tones[5] . The second port, the Djéno oil terminal, is the main terminal for transporting oil with some 8,920,170 tones transferred in 2003. These facilities and other economic opportunities grant the region its value as a hot spot for urban sprawl in the country, despite the adverse effects on the natural system.

Sea level rise

The elevation of the sea level is not very perceptible in Congo yet; the models, however, provide for a possible rise of up to 5, 15, 25, and 50 cm in 2020, 2050, 2080 and 2100 respectively [5]. In fact, in its initial national communication of 2001, the government of Congo noted a gradual rise in sea level, followed up by temporary meteorological conditions. It is acknowledged in this communication that globally, the level of the sea could rise by 50 cm by 2100 following the thermal expansion of the ocean. This could cause floods in the bay of Loango, estuaries and lagoons. In 2100, the anticipated warming will cause an intensification of approximately 27% of rains in the coastal area, which is going to increase the extent of the eroded surface.

Others

No information.

INTEGRATED COASTAL AREA MANAGEMENT

Identification of coastal management policies at national, subnational or local level, including cities/ metropolitan plans.

No information

Identification of national/local pilots with the objective to establish or improve coastal management plans.

National policies

- Poverty Reduction Strategy Paper (PRSP, 2008).
- National Strategy and Action Plan on Biological Diversity (NSAPBD, Revised August 2015).
- Initial National Strategy and Action Plan (SNIPA) for the implementation of the Framework Convention on Climate Change.
- National Forest Action Plan (NFAP, 1992).
- National Environmental Action Plan (NEAP, 1994).
- National Action Plan (NAP, 2008).
- National Development Plan of Congo (2012-2016).
- Economic and Social Recovery Action Plan (ESRAP, 1993).
- Post Conflict Interim Programme (PCIP, 2000-2002).

4 World Bank «Waste: what a mess 2.0»: an updated inventory of the issues of waste management, September 2018. http://datatopics.worldbank.org/what-a-waste/

5 http://fust.iode.org/sites/fust.iode.org/files/public/images/odinafrica/Chapter_7_3_Congo.pdf

- Country Programme for the Protection of the Ozone Layer (1995).
- Water and Sanitation Programme (WSP) of the World Bank (2001).
- National Rural Development Plan (NRDS, 1997).
- National Spatial Planning Scheme (NSPS, 2005).

Regional and sub-regional policies

- Regional Strategic Action Plan for the Environment and Biodiversity Resources of the Congo Basin Ecosystems.
- African Union's "Agenda 2063: The Africa We Want".
- African Union's "Africa's Integrated Maritime Strategy".
- Africa's Blue Economy: A policy handbook.
- Transboundary Diagnostic Analysis Document and Strategic Action Programme of the GCM-CG.
- Convergence Plan/Sub-Regional Action Plan to Combat Desertification for Central Africa (PASR-AC -2000, 2005) - Developed and implemented by COMIFAC.

National legislation

- Law n° 003/91 of 23 April 1991 on the protection of the environment.
- Law n° 16/2000 of 20 November 2000 on the forest code.
- Law n° 4/2005 of the 11 April 2005 establishing the mining code.
- Law n° 9/2004 of 26 March 2004 establishing State territorial code.
- Law n° 10/2004 of 26 March 2004 laying down the general principles applicable to state property and land regimes in the Congo.
- Law n° 48/83 of 21 April 1983 defining the Conditions for the Conservation and Exploitation of Wildlife.
- Decree n° 86/775 of 7 June 1986 making impact studies mandatory.
- Decree n° 99/149 of 23 August 1999 on the organisation and functioning of the fund for the protection of the environment.
- Decree n° 437 of 31 December 2002 laying down the conditions for the management and use of forests.
- Decree n° 93/727 establishing the Nouabalé-Ndoki National Park in the regions of Likouala and Sangha.
- Decree n° 99/136 Bis of 14 August 1999 concerning the creation of the Conkouati-Douli National Park.
- Law n° 37/2008 of 28 November 2008 on fauna and protected areas.
- Order n° 6075 of 9 April 2011 determining fully and partially protected animal species.
- Order n° 835/MIME/DGE of 6 September 1999 setting the conditions of approval for carrying out studies or environmental impact assessments.
- Order n° 1450/MIME/DGE of 18 November 1999 on the implementation of certain provisions on classified installations.
- Decree n° 2012/396 of 23 April 2012 amending and supplementing certain provisions of Decree n° 93/727 of 31 December 1993 establishing the Nouabalé-Ndoki National Park in the departments of Likouala and Sangha.
- Decree n° 2013/178 of 10 May 2013 approving the statutes of the Congolese Wildlife and Protected Areas Agency.
- Decree n° 2014/185 of 30 April 2014 renewing the search permit for liquid hydrocarbons known as "Permit of La Noumbi".
- Law n° 43/2014 of 10 October 2014 guiding spatial planning and development.

Sub-regional and international agreements

- Abidjan Convention for the Co-operation in the Protection and Development of the Marine and Coastal Environment of the West and Central African Region (Law n° 21/85 of 19 July 1985).
- Basel and Bamako Convention on the Ban to Import to Africa and the Control of Transboundary Movement and Management of Hazardous Wastes within Africa (Law n° 27/96 of 26 June 1996).
- Convention to Combat Desertification in Those Countries Experiencing Serious Drought and/or Desertification, Particularly in Africa (Law n° 8/99 of 8 January 1999).

- African Convention on the Conservation of Nature and Natural Resources, known as the 1968 Algiers Convention.
- Lusaka Agreement on Co-operative Enforcement Operations Directed at Illegal Trade in Wild Fauna and Flora (Law n° 32/96 of 22 August 1996).
- AEWA/ACOMAE Agreement on the Conservation of African-Eurasian Migratory Waterbirds (Law n° 7/99 of 8 January 1999).
- Memorandum of Understanding on the Conservation Measures for Marine Turtles of the Atlantic Coast of Africa (29 May 1999).
- The United Nations Framework Convention on Climate Change (UNFCCC) signed on June 12, 1992, and ratified on June 25, 1996.
- Convention on Biological Diversity (Signed in 1992 and ratified in 1996).
- African Maritime Transport Charter (Signed in 1992 and ratified in 1994).
- African Charter on Maritime Security, Safety and Development in Africa (Signed in 2016).
- Treaty of COMIFAC.
- Statute of CEFDHAC

ADAPTATION

Adaptation measures under implementation or implemented in the last decade and its effects

Identification of national adaptation plan into force.

No information

Identification of specific actions undertaken during the last decade.

- National Action Programme for Combating Desertification (NAPCD, March 2006)
- National Action Programme to Combat Land Degradation
- National Reforestation Service (NFS)

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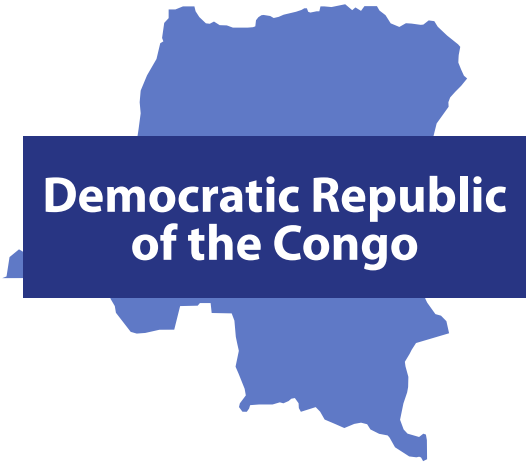

Description of the coastal areas of the country

The coastal zone of the Democratic Republic of the Congo (DRC) [1] is defined as the area between the Congolese marine waters on the Atlantic and the international port of Matadi upstream of the Congo River estuary. It covers administratively the entire district of the Bas-Fleuve. The Congolese coastline is 40 km long and bounded by the enclave of Cabinda (Angola) in the north, and Angola in the south. Average but very variable rainfall is around 772 mm and average temperatures vary between 22 and 24°C. The river system in general is dominated by the Congo River which has its source in Chambezi (Mount Masoli in Zambia) and crosses the country from east to west before pouring into the Atlantic Ocean at the Port of Banana. Its flow at the mouth exceeds an average of about 42,000m3 per second and the extent of its basin is of 3,800,000 km2 [2]. The topographic profile of the coastal shelf includes three cliffs interrupted by two estuaries and a shoreline. The soils are varied in nature, ranging from sandy, clay-sandstone to ferralitic and hydromorphic. Vegetation also varies from grassy tree formations in the Matadi-Inga region to the large Mayombe Guinean-Congolese rainforest and mangroves [1]. Animal and plant species are also very varied and of great importance. The terrestrial part is covered by at least 8,000 km2 of forest, which represents 80% of the forest of the Bas-Congo Province, itself estimated at 10,000 km2 [2]. The fluvial part of the coast (Inga, Matidi) is particularly noted for its potential in fisheries resources including mammals, reptiles, waterfowl, molluscs, crustaceans and fish [1]. This zone includes a mangrove marine park (about 66,000 ha), created by Ministerial Decree n° 044/CM/ECN/92 of 2 May 1992, and located at the estuary of the Congo River, consisting of a zone A of mangroves with total protection, and a zone B with partial protection with wet savanna and coastal strip. In addition to this marine park is the Luki Biosphere Reserve.

With a coastal population concentrated in the cities of Moanda and Banana (the two largest urban areas along the Atlantic coast of the DRC), this natural potential has been the subject of alarming exploitation for several years. The oil industry in this coastal zone remains the most developed in the country, to which is added coastal agriculture, fishing, tourism, energy, etc. Hydropower is generated through the Inga Dam and a refinery (SOCIR) has been operating in Moanda since 1967. Fishing is one of the most important activities of the inhabitants on the coastal zone and is dominated by artisanal and industrial practice. The SOFARMA and SOCOPE companies work respectively in the forest and coastal fisheries resource area.

COASTAL VULNERABILITY – PRELIMINARY ASSESSMENT

Floods

All adjacent lands in the low-lying portion of the coastline are generally flooded in the DRC during high tides. According to [1], ocean waters generally cross the Moanda-Banana road and invade mangroves and inhabited lands, resulting in increased salinity of mangrove water and soil as well as material and agricultural losses. In fact, many areas are located only slightly above the river level and include all the lower islands of the reach – some of which (such as the island of Mateba) are of undeniable socio-economic importance – as well as the city of Moanda, adjacent to the ocean and with no sewer connections. In addition to the sanitation problem presented by these floods, several houses have been washed away and a heavy threat is observed on coastal and marine biodiversity [3][1] . Also, extreme cases of flooding have been observed in the last decade in Boma. This city has a lower topography between Matadi upstream and Muanda downstream on the Congo River. High tides seriously affect water behaviour, especially during heavy rains.

Erosion

According to the MECN-EF report on the profile of DRC's coastal zone [1], the sea has gained in 26 years almost 27 m of land on the continent – a speed of erosion of the order of 1.03 m per year – causing spectacular damage, such as the disappearance of the hotel Maray-Maray which was one of the jewels of the city of Moanda, and the exposure of the second hotel (Hotel Mangrove) whose proximity to the coastline would be reduced to less than 30 m.

At the level of the Moanda cliff (coastline with rugged topography), ocean waters have gained 80 m of land in 40 years, leading to an estimated erosion rate of 2 m per year and danger to the city of fishermen (Nsiamfumu) and the city of Bela Vista. The report states that it is expected that the shoreline would be reduced by nearly 50 m along the coastal strip (Moanda at Banana Point) and about 100 m towards Nsiamfumu, resulting in the disappearance of the asphalted road section that connects the two entities, part of their socio-economic infrastructure, and a strong impact on sea turtles biodiversity [3].

1 Samuel MBUNGU NDAMBA (ACODES), 2017. Activity Report on the Conservation of Marine Turtles on the Coastline of the R.D.C., Ponte Season 2016-2017, August 2017, 19p.

Salinity intrusion

The increasing salinity of mangrove water and soil in the DRC is generally a result of various flood scenarios with a negative impact on ecosystems and surrounding biodiversity.

Wetland change and loss, dry land loss

By 2100, with the decline of the shoreline due to erosion, the proportions of land lost in the DRC will eventually double (200 m to Nsiamfumu and 100 m between Moanda-city and Banana). This could be even more due to an erosive process exacerbated by the current excessive deforestation of mangroves [1].

Marine pollution, water quality change

Significant imbalances in natural ecosystems, particularly at the mouth of the Congo River, are sometimes caused by the presence of alien species such as Eichornia crassipes and Chromolaena odorata, carried by river waters and endangering the existence of several species, including native species. Oil exploitation and marine pollution by vessels incompatible with the conservation of rare species favour their migration to the high seas. In addition, the annual increase of household waste[2] and lack of a robust waste management policy would have strong impacts on water quality and marine biodiversity in the future years.

Reduction of marine stocks

Mangrove waters are exposed to the danger of rapid depletion of fish due to the use of fine-mesh fishing nets and dynamite by the inhabitants [4]. Mangroves are destroyed for the production of charcoal and building materials, leading to the depletion of oysters in the mangroves and on the marine coast, with the consequent threat of severe extinction exacerbated by overexploitation. The different species concerned (Shumway et al., 2002) are the Ostrea sinuata, O. lurida, O. denselamellosa, O. chilensis, O. Stentina, O. puelchana, Crassostrea gigas, C. angulata, C. margaritacea, C. glumarata, C. rhizophora, C. guyanensis, C. cucullata, manatee (Trichechus senegalensis), hippopotamus (Hippopotamus amphibius), Caretta caretta sea turtles, Lepidochelys olivacea, Lepidochelys kempii, Chelonia mydas, Ertmochelys imbicata and Dermochelys coriaceas.

Urban sprawl and coastal/maritime infrastructure development

Population growth and urban expansion are putting strong pressure on the ecosystems and fisheries resources of the DRC. They lead in turn to mangrove exploitation, coastal forest destruction for socio-economic infrastructure installation, and arbitrary exploitation of the fish stock, resulting in stock reduction, exposure to erosion and property damage, flood risk perpetuated by the lack of implementation of a sustainable urban plan, etc.

Sea level rise

Historically, high tides have sometimes raised the sea level by 2 m for 3 months (1915), flooding Camp Quadrature and facilities in Banana only up to 0.96 m [1].

INTEGRATED COASTAL AREA MANAGEMENT

Identification of coastal management policies at national, subnational or local level, including cities/metropolitan plans.

Identification of national/local pilots with the objective to establish or improve coastal management plans.

National policies

- Poverty Reduction Strategy Paper (PRSP).
- National Action Plan on Biodiversity (2002).
- National Environmental Action Plan (NEAP, 1996).
- National Action Programme for Adaptation to Climate Change (NAPACC, 2006).
- National Action Plan for the Sustainable Management of Marine and Coastal Environmental Resources of the Democratic Republic of the Congo.
- National Action Programme for Combating Land Degradation and Deforestation (NAPLDD, 2005).
- National Biosafety Framework (2008).
- National REDD+ Strategy.
- National Strategy for the Conservation of Biodiversity in Protected Areas (2012).
- Land Reform (2012).
- Land Use Reform (2015).

- Rural Development Master Plan.
- Second National Communication on Climate Change (2009).
- National Biodiversity Strategy and Action Plan (2016-2020).
- National Forest Action Plan (NFAP).
- National Emergency Response Plan in case of Pollution by Oil or Any Other Dangerous Substance (2019).

Regional and subregional policies

- Regional Strategic Action Plan for the Environment and Biodiversity Resources of the Congo Basin Ecosystems.
- African Union's "Agenda 2063: The Africa We Want".
- African Union's "Africa's Integrated Maritime Strategy".
- Africa's Blue Economy: A policy handbook.
- Transboundary Diagnostic Analysis Document and Strategic Action Programme of the GCM-CG.
- Convergence Plan/Sub-Regional Action Plan to Combat Desertification for Central Africa (PASR-AC -2000, 2005) - Developed and implemented by COMIFAC.
- Blue Fund and Climate Commission initiatives for the Congo Basin.
- Central Africa Regional Strategy for Risk Prevention, Disaster Management and Climate Change Adaptation (2016).
- African Strategies on Climate Change (2015).

National legislation

- Forest Code of 2004.
- Law n° 007/2002 of 11 July 2002 on the Mining Code.
- Law n° 68-078 of March 1968 on the protection of crocodiles and amending the legislation on hunting and fishing.
- Law n° 82-002 of 28 January 1982 on hunting regulations.
- Law n° 67-514 of 1 December 1967 establishing the Institute of National Parks of Congo.
- Ordinance n° 142 of 15 May 1964 establishing an Institute of Zoological and Botanical Gardens in Leopoldville.
- Order n° 00140/BCG /AGRIDRALE/82 of 15 December 1982 establishing a Restricted Commission for the National Strategy for the Conservation of Nature in the Democratic Republic of the Congo.
- Order n° 52-06899-MAY-1968 on the protection of crocodiles.
- Ministerial Order n° 060/CAB/MIN/ECN-EF/05 of 25 July 2005 establishing the National Commission for the Marine and Coastal Environment.
- Ministerial Order n° 0003/CAB/MIN/ECNEF/06 of 30 January 2007 on the establishment, organisation and functioning of the National Commission for Control and Surveillance for the Preservation of the Environment (CNSE).
- Order n° 061/CAB/MIN/ECN-EF/05 of 26 July 2005 establishing the Steering Committee of the Guinea Current Large Marine Ecosystem Project.
- Interministerial Order n° 001/CAB/MIN/ENVIRO/2010 and n° 409/CAB/MIN /TVC/001 of 21 January 2010 establishing a Marine Pollution Control and Monitoring Center in the Democratic Republic of the Congo.
- Order n° 0003-AGRI-CAB-73 of 12 June 1973 on temporary provisions for the protection of cheetah and leopard and their repopulation on the territory of the Republic.
- Ordinance-law n° 69-041 of 22 August 22nd, 1969 relating to the conservation of nature.
- Ordinance-law n° 81/031 of 2 April 1981 on general legislation on mines and hydrocarbons.
- Ordinance-Law n° 75-023 of 22 July 1975 on the Statute of the Congolese Institute for the Conservation of Nature.
- Ordinance n° 66/413 of 8 July 1966 implementing Ordinance n° 66/413 of June 1966 promulgating the insurance law to the Democratic Republic of the Congo the fullness of its property rights over its domain and full sovereignty in the cession and the concession of its rights land, forest and mining on all the extent of the Republic.

Subregional and international agreements

- Abidjan Convention for the Co-operation in the Protection and Development of the Marine and Coastal Environment of the West and Central African Region (Law n° 21/85 of 19 July 1985).
- Basel and Bamako Convention on the Ban to Import to Africa and the Control of Transboundary Movement and Management of Hazardous Wastes within Africa (Law n° 27/96 of 26 June 1996).
- United Nations Convention to Combat Desertification in Those Countries Experiencing Serious Drought and/or Desertification, Particularly in Africa (Law n° 8/99 of 8 January 1999).
- African Convention for the Conservation of Nature and Natural Resources, known as the 1968 Algiers Convention.
- United Nations Convention on the Law of the Sea (1982).
- United Nations Convention on Biological Diversity (1992).
- Lusaka Agreement on Co-operative Enforcement Operations Directed at Illegal Trade in Wild Fauna and Flora
- AEWA / ACOMAE Agreement on the Conservation of African-Eurasian Migratory Waterbirds
- Treaty of COMIFAC.
- Statute of CEFDHAC.

ADAPTATION

Adaptation measures under implementation or implemented in the last decade and its effects

Identification of national adaptation plan into force.
No information

Identification of specific actions undertaken during the last decade.

- Project for the conservation and management of biodiversity of the mangroves marine park.
- An Environmental Unit was created in 2004 under the Multisectoral Emergency Programme for Rehabilitation and Reconstruction (PMURR) to organise and coordinate an environmental impact assessment under the supervision of the Ministry of the Environment.

Proposed adaptation measures (to be done together with national experts from this country during the technical workshop)

- Improvement of oceanographic data collection system for erosion control and management of marine biodiversity.
- Restoration of marine ecosystems (mangrove).
- Assessment of fish stocks.

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National Policies

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  National Environmental Action Plan (NEAP, 1996).
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  https://www.adaptation-undp.org/sites/default/files/downloads/d.r.c._napa.pdf
- National Action Plan for the Sustainable Management of Marine and Coastal Environmental Resources of the Democratic Republic of the Congo.
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  National Action Program to Combat Land Degradation and Deforestation (NAPLDD, 2005).
- National Biosafety Framework (2008).
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- AEWA / ACOMAE Agreement on the Conservation of African-Eurasian Migratory Waterbirds (Law n° 7/99 of 8 January 1999). https://www.unep-aewa.org/sites/default/files/basic_page_documents/agreement_text_french_final_fr.pdf
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Description of the coastal areas of the country

Equatorial Guinea is a Central African coastal country located within 2 00 N, 10 00 E, bordering the Bight of Biafra [1]. Biogeographically, the Equatorial Guinea coasts are part of the Guinea Current Large Marine Ecosystem (GCLME) [2]. Key features of the coastal ecosystem include a coastline of 296 km long (184 mi) [1], composed of various ecological and economic systems, including mangroves, estuaries, rural settlements, urban and industrial areas, ports, islands, accreted land, beaches and islets.

The coastal zone of Equatorial Guinea consists of three districts on the mainland – Bata, Cogo and Mbini [3] – and the Bioko Island. The coastline is distributed along the continental region of Rio Muni between Cameroon and Gabon on the mainland, five small islands which are Bioko, Corisco, Annobón, Elobey Chico (Small Elobey) and Elobey Grande (Great Elobey), and adjacent islets.

Bioko is volcanic in origin and rises to two main peaks, the higher of which is 9,869 feet (3,008 m) above the sea [4], with its coastal plain overlaid by sedimentary deposits, very irregular in the formation and crossed by a vast network of rivers and channels, with the coastal landform forming many bays and peninsulas. [5]

Rio Muni's coastal plain is composed of sediment which is about 15 km deep with a tiered escarpment of strata at 300 m, 500 m and 600 m, where a granite plateau formed and extended the western slope of the Gabonese Crystal Mountains [6].

Large parts of the coastal plains are covered by fertile soils on which different crops, mainly cocoa and coffee, are grown. Fishing and agriculture are important occupations of the coastal communities of Equatorial Guinea. The Playeros ('beach people', Spanish word used for the Ndowe ethnic group), practice fishing and subsistence agriculture as their main activities [7]. The Bubi live on the island of Bioko and represent 9% of the population. Previously fishers and whale hunters, they have now converted to agriculture (Liniger-Goumaz 1985, in Belhabib et al., 2015).

Freshwater swamps and mangrove swamps occupy large extents of the coastline and the coastal plain is characterised by many estuaries. Extensive coastal mangrove areas are found in the estuaries of the Mbini, Muni and Ntem Rivers [8]. Corsico Bay (shared by Equatorial Guinea and Gabon) accommodates an extensive seagrass ecosystem, which together with nesting beaches south of Bioko are of primary regional importance for the green turtle. The islands and islets are important areas for the feeding and nesting of seabirds, among which many endemic species [9].

On the island of Bioko, there are more than 300 species of vertebrates, of which 2% are endemic species and one third belongs to endemic subspecies. More than 60 species of terrestrial mammals have been identified, including endemic forms (28%) of primates. Among the birds, 138 terrestrial species have been classified, including 45 at the endemic subspecies level, in addition to the birds of passage [10]. 53 reptile species have been identified; 4 species of sea turtles use the southern beaches for spawning. There are 45 freshwater fish species [10].

On the island of Annobón, the composition of the fauna is poor but has a great biological value because of its numerous endemisms [10]. There are 2 species of bat. The birdlife comprises 8 species of birds (except seabirds). Reptiles are represented by colubrids and 2 genetics [10]. There are 7 freshwater fish species, and more than 200 fish species have been registered in the fishing grounds; therefore, it is the main area of artisanal maritime fishing at the national level [10].

As of 2018, around 574,169 people representing 72% [1] of the population lived within 100 km of the coast [11]. The natural ecosystems on the coastal zone have been constantly affected, modified and altered by agriculture and timber harvesting over the last 50 years [12]. Starting in the middle of the 19th century, large coffee and cocoa plantations were established, which led to the widespread modification and destruction of the primary rain forest, though it remains an important habitat for endemic species as they have learnt how to adapt to changes [6].

COASTAL VULNERABILITY – PRELIMINARY ASSESSMENT

Floods

Floods are a natural hazard in Equatorial Guinea affecting on average about 0.17% of the total population of the country. The provinces more significantly impacted by floods are Litoral and Welenzas. The pattern is substantially confirmed under future climate conditions, with an increase in the Litoral province [13].

The local economy is moderately exposed to flooding. On a yearly average, the areas that are affected by floods produce about 0.14% of the national GDP which corresponds to about 30 million USD per year. The value of direct economic losses in terms of annual average loss is estimated at 10.5 million USD, which roughly accounts for 0.06% of the total stock value in the present climate. The largest portion of losses is due to the housing sector while the agricultural sector shows a small impact in absolute terms [13].

Both frequent and extreme flood-related losses will likely increase under future climate conditions, and greater differences are observed for rare and very rare events. For instance, a loss of 300 million USD is expected to be experienced once in 250 years in present climate conditions; in future climate conditions, it may occur once in 80 years. In the same way, the loss

corresponding to a 1-in-50-years likelihood is around 100 million USD in present climate conditions and 180 million USD in future climate conditions (+80%) [13].

Droughts

Concerning present conditions (1951-2000 climate), the probability of severe drought occurrence (precipitation – evapotranspiration deficiency) will probably stay the same or might decrease under future climate (2050-2100 climate).

Under the present climate, on average some 23,000 people (2.2% of the total 2016 population) are annually affected by droughts. Under future climate conditions, this number is expected to decrease to 1.8% (on average 24,000 people if population growth is accounted for). Also, in areas affected by drought, 2% of the total GDP is generated. This is equivalent to about 235 million USD per year which could be impacted by droughts [13]. Under future climate conditions and considering the present exposure, the percentage of GDP in areas affected by drought is around 1.5%. However, this could rise to around 1 billion USD (4 times more than the present conditions) if socio-economic projections are included.

Under present climate conditions, more than 2% of the livestock can be affected by drought (i.e. animals living in areas hit by droughts) on an average annual basis. Under future climate conditions, the number of affected livestock is projected to increase to more almost 3% [13]

Erosion

Erosion along the coast in Equatorial Guinea is a phenomenon that has long been of great concern to the most affected communities. It is significant along the volcanic coast, as displacement of the coastline towards the continent has been observed in the southwest province [4]. During the stormy months of August and October, wave heights can reach up to 3 m along the coast [4]. An eroding coastline is eminent in most areas and broader in the Rio Muni region in the north [4].

Erosion is expected to indirectly impact on bird biodiversity in the Reserva Natural del Estuario del Muni, an ecosystem where at least 20,000 waterbirds can often be found during migration [14]. Likewise, erosion has been documented to affect mangroves and tall vegetation on several of Bioko's nesting beaches, causing green turtles to nest uncharacteristically in front of the vegetation line [15].

Erosion processes in Equatorial Guinea are found to be more prevalent along the coast due to causes such as [4]:

1. Alluvial methods of mining gold and diamond by locals, mostly along the Muni and Campo rivers which consequently affect the sediment deposition along the beach or coastal areas, thus triggering erosion.
2. Sand extraction from the coast for construction purposes which makes the coastline more prone to erosion.
3. Cliffs made of softer material in the northwest part gradually collapse into the sea during intense wave action.
4. The very intensive winds experienced during the rainy season and high winds along the coastline facilitate the erosion of local settlements in most low-lying coastal areas such as Luba, sometimes by several feet during a single storm and depending on its intensity.
5. Erosion of offshore bars and sandy spits parallel to the coast and of various points between Rio Muni and Lake Bihao is caused by the dynamics of sedimentation due to the predominance of the current of the Campo river over that of the Gulf of Guinea, which flows from west to east.
6. Most of the essential infrastructure is found in the coastal region: roads, ports, airports, telecommunication, schools, hospitals, etc.

Salinity intrusion

No information

Wetland change and loss, dry land loss

A rise in sea level will have significant consequences on ecosystems existing in the coastal fringes of Equatorial Guinea. The transgression of the inland ocean will cause a regression of the waterfront, loss of beaches and wetlands, infrastructure located in the coastal and urban areas, as well as the possible biological impact of changes in the structure of ecosystems, among other factors [15][16].

Scenarios on sea level and the results of investigations by the Ministry of Fisheries and Environment show that there has been a significant sea penetration in Equatorial Guinea, especially on the island of Bioko, which can also affect the development of wetlands and estuaries [18]. According to the FAO, the deforestation rate has increased substantially from 58.2 km^2 per year in 1990 to 150 km^2 per year over the period 1990-2005, due to deforestation for agriculture and highly intensive logging. These figures correspond to a deforestation rate of 0.9% [19].

Marine pollution, water quality change

Pollution from shipping and maritime transport constitutes another source of degradation of the marine environment and deterioration of the water quality. It also represents a transboundary problem as the intensified maritime transport has resulted in corresponding pollution and destruction of the marine environment and ecosystem of the GCLME region [16].

Ship-source pollution is mainly from the discharge of ballast water into the sea and oil spillage from ships. The petroleum exploration activities going on within the Equatorial Guinea waters are continuously causing oil spillages in the process of drilling, bunkering and discharging of petroleum products in the Atlantic Ocean as it is common to pollute the ocean and sea while conducting any offshore petroleum exploration [20].

Apart from petroleum exploration, the incessant degreasing activities (washing of chemicals stained on the "quay aprons" of seaports) conducted regularly in the port of Malabo constitutes great harm to both marine as well as human lives to some extent [20].

Reduction of marine stocks

Biodiversity of natural resources is facing serious threats, including the rapid loss of forest cover for agricultural and infrastructural development activities, wildlife species degradation due to excessive hunting for bushmeat and poaching for trophies, insecurity, disease and conflict, and climate change among others [21]. Overexploitation is reducing crustaceans and molluscs [22]. This overexploitation and depleted status of marine fisheries of Equatorial Guinea have been documented [7].

Coupled with the effect of climate change, another threat facing marine stocks in the country is IUU fishing. Illegal fishing encompasses all activities by vessels that are not authorised to fish in Equatorial Guinea's EEZ. The country has a low level of fisheries control, monitoring and surveillance. This suggests high rates of illegal fishing [23]. For more than three years, European Union Members States authorised unlawful fishing activities off the coast of Equatorial Guinea in contravention of common regional laws and policies [24].

The knack for "bushmeat" consumption and uncontrolled harvesting of wildlife in forests (including mangrove and coastal forests) is also posing serious threats to the biomass of marine and coastal stocks [25]. Just like fish, meat is also an important component of the Equatoguinean diet [26].

The impact of commercial hunting on forest mammals was studied in two regions of Bioko and Rio Muni [26][25]. Harvests were assessed from carcass counts in the main markets in the areas. A total of 10,812 carcasses of 13 species were recorded in Bioko, and 6,160 carcasses of 30 species were recorded in Rio Muni [25]. The biomass of harvested mammals was 111,879.63 kg in Bioko and 66,447.87 kg in Rio Muni. For the 12 prey species selected for study in Bioko, harvests totalled 7.15 animals/km2 or 62.93 kg/km2. Harvests for the 17 prey species in Rio Muni were 3.22 animals/km2 or 24.06 kg/km2 [25].

Urban sprawl and coastal/maritime infrastructure development

The rapid urbanisation and development that the country has been experiencing in the age of oil is a considerable threat to environmental protection. Quality housing has also been an issue, particularly near the coasts. Authorities have undertaken a programme to rebuild the infrastructure and main cities of the country and have repeatedly stated their intention to put an end to "shanty town" (housing in slums).

However, some sources indicate that many of the homes demolished during the last two or three years were solid structures in well-established neighbourhoods and that the vast majority of their occupants owned property titles [27]. In July 2006, about 300 families were evicted and their homes destroyed in the neighbourhoods of Atepa and Camaremy, along the road that connects the Malabo airport with the townhall of Ela Nguema, with the aim, to make way for a new road [27].

Infrastructure and construction have been part of the first phase of the government's Horizon 2020 Plan towards the diversification of the economy. In 2011, the country spent 50% of its budget (originally approved for 783 million USD but later estimated at 1.5 billion USD) on urban infrastructure [28]. Large-scale development projects are being carried out throughout the country. For example, the completion of the Luba-Ureca road has opened the way to areas that until now were a refuge for highly threatened species [10]. Oyala (currently a small town in the tropical forest of the Wele-Nzas province) is being developed as one of the main economic sites of the country, which implies a substantial removal of tropical forest areas for the development of the entire city. Most construction projects are carried out with no or few environmental considerations (attributed to the lack of coordination between the ministries) and the infrastructure is still vulnerable to climate change [18].

The Bioko island is progressively being turned into a petrochemical complex, threatening the livelihoods of the local community of Bubi people [29].

Sea level rise

The coastal low-lands of Equatorial Guinea may be vulnerable to sea-level rise (SLR), as the SLR for the Central Africa region is projected by climate models to rise by the following levels by the 2090s relative to 1980-1999 sea level [30]:

- 0.13 to 0.43m under SRES B1
- 0.16 to 0.53m under SRES A1B
- 0.18 to 0.56m under SRES A2

Equatorial Guinea will experience significant increases in the percentage of its coastal urban extent falling within surge zones with SLR and intensified storm surges [31]. SLR in the country is expected to have an incremental impact on a land area of about 22 km2, with a projected impact as a percentage of coastal total of 17.28% [30]. On wetlands, SLR will have an incremental impact of 4 km2 and a projected impact of 8.49% of coastal total [31], and may have critical, previously un-investigated implications for sea turtle nesting habitat on Bioko island [15].

Beach profiling datasets from Bioko's five southern nesting beaches estimate habitat loss with predicted increases in sea level by the years 2046-2065 and 2081-2100 indicates that an average of 62% of Bioko's current nesting habitat could be lost by 2046-2065 and 87% by 2081-2100 [15]. Due to SLR, the country's capital is scheduled to be moved from Malabo to Oyala – an unfinished city deep in the rainforest [32].

Others

No information

INTEGRATED COASTAL AREA MANAGEMENT

Identification of coastal management policies at national, subnational or local levels, including cities/metropolitan plans.

Identification of national/local pilots with the objective to establish or improve coastal management plans.

- Constitution of the Republic of Equatorial Guinea - Fundamental Law 2011
  The new text of the Fundamental Law of Equatorial Guinea was promulgated on 16 February 2012 and came into force on the same date.
- National Action Programme to Combat Deforestation and Land Degradation in Equatorial Guinea (PAN/LCD)
  It is a programmatic instrument of national scope covering the period 2016-2025.
- National Action Plan for Adapting to Climate Change (PANA) 2013*A national planning instrument whose main objective is to build capacity for resistance to climate change, recognising the great vulnerability of the country at several levels.*
- National Programme for Food Security (PNSA) of 1 July 2012
  The structure of the National Programme for Food Security (PNSA) has 4 main strategic directions and 7 sub-programmes.
- Organic Law n° 4/2012
  Law that regulates the Ombudsman, November 2012.
- Law n° 1/1999 - Law on the regime of Non-Governmental Organisations (NGOs) of 24 February 1999:
  The present Law establishes the regime of Non-Governmental Organisations (NGOs), which institutionalises NGOs as an expression of participation, solidarity and pluralism, promoting their development.
- Law n° 16/1995 - Law regulating small and medium-sized companies, 13 June 1995
  This Law, which regulates small and medium-sized companies, provides that the establishment of companies is free and the rights acquired by all naturalised are guaranteed to companies located in Equatorial Guinea.
- Environmental Law, 27 November 2003
  This law establishes the legal framework for environmental management, regulating the basic norms of conservation, protection and recovery of the environment, promoting the sustainable use of natural resources to achieve sustainable human development.
- Regulation n° 09/05-UEAC-143-CM-13 of 4 November 2004
  This regulation adopts the Common Regulation on the Control of the Consumption of Ozone-Depleting Substances in the Central African Economic and Monetary Community (CAEMC) zone.

Fisheries

- Law n° 10/2003 - Law regulating fishing activity in the Republic of Equatorial Guinea, 17 November 2003
  This Law consists of 61 articles, divided into 10 Chapters, 1 additional provision, 1 derogatory and 1 final. Articles 4 to 6 define provisions for fishing licenses.
- Decree n° 123/1987 - Regulation implementing the Fisheries Act of the Republic of Equatorial Guinea
  It dwells on issues such as fishing areas, National Fisheries Registry, information on resources; rules relating to mesh networks, artisanal fishery documents, fishing licenses, etc.
- Decree n° 130/2004 approving the Regulations for the Application of the Law regulating fishing activity in the Republic of Equatorial Guinea
  This regulation, which consists of 60 articles divided into 18 Chapters and 3 Annexes, establishes the application of the Law Regulating Fishing Activity in the Republic of Equatorial Guinea and regulates the following types of fishing: maritime fishing, continental fishing and aquaculture.

Forestry

- Law n° 1/1997 - Use and management of forests, 18 February 1997
  The Law consists of 6 titles, 110 articles, 4 transitional provisions, 1 derogatory and 1 final index establishing the legal, economic and administrative regime of the forestry subsector, extraction, use and management of forest resources, conservation of ecosystems, transport, industrial processing and marketing of forest products, economic and tax system, control, infractions and sanctions.
- Decree n° 56/1991 - Internal regulations of the special body of the Forest Nursery, 22 July 1991
  This Internal Regulation, which consists of 5 chapters, 41 articles, 2 additional provisions, 1 derogatory and 1 final index defines the Forest Nursery as the specialised body, organically dependent of the Ministry of Defense and functionally in charge of the service of monitoring and control of the forest heritage.
- Decree n° 55/1991 - Prohibits large-scale logging activities on Bioko Island (9 July 1991)
  This Decree prohibits large-scale logging and timber harvesting on Bioko island, as of 1 January 1992.

Legislation on land

- Law n° 4/2009 - Law on land ownership in Equatorial Guinea (18 May 2009)
  The present Law on the property regime of Equatorial Guinea stipulates that land shall be distinguished according to whether they belong to individuals and entities, or form part of the State's property.
- Act n° 1/1999 designating the median line as the maritime boundary of the Republic of Equatorial Guinea (6 March 1999)
  The Act designs the median line as the maritime boundary of the territorial sea and the exclusive economic zone in the northern maritime zone, off the island of Bioko and the coast of Rio Muni, and establishes the geodetic lines connecting the defining points.
- Law n° 15/1984 - Territorial sea and exclusive economic zone (12 November 1984)
  The law details (i) Territorial sea (ii); Exclusive economic zone. In this, the sovereignty of the Republic of Equatorial Guinea extends to all the national territory integrated according to the limits inherited from the colonial period (article 1). In the exclusive economic zone, fishing shall be reserved for nationals of Equatorial Guinea.
- Law n° 3/200719, 20 - Water and Coasts Regulatory Law in the Republic of Equatorial Guinea (23 July 2007)
  This Law regulates the following aspects of the public hydrological domain: use of water and the determination, protection, exploitation, use and police of the maritime-terrestrial public domain, as well as the exercise of the powers attributed to the State in matters related to these domains.

Hydrocarbon laws

- Law n° 8/2006 (November 2006)
  This Hydrocarbons Law provides the framework for the licensing and award of exploration and production rights and authorises the Minister of Mines, Industry and Energy to enter into contracts with oil companies.
- Decree Law n° 1/1986 and Decree Law n° 4/2004
  The taxation of petroleum exploration and production activities is covered by the general tax provisions in Decree Law n° 1/1986, as augmented by Decree Law n° 4/2004.
- Mining law n° 9/2006 of the Republic of Equatorial Guinea
  This Law governs mineral exploration and production activity. It stipulates that mineral resources are the property of the Government of the Republic of Equatorial Guinea.
- Law n° 1/1997 on land use classification
  Article 8 of the Act defines the role of the National Commission for Land Classification and Use (Comisión Nacional de Clasificación y Uso de las Tierras).

ADAPTATION

Adaptation measures under implementation or implemented in the last decade and its effects

Identification of national adaptation plan into force

Identification of specific actions undertaken during the last decade

- National Forest Action Programme (PNAF-GE). A policy paper for the forestry sector, developed in 2000 with FAO support
- National Action Plan for Adapting to Climate Change
- Final report of the goal setting process for land degradation neutrality in the Republic of Equatorial Guinea
- Project 2: National Forest Reforestation Plan.
- National REDD + Investment Plan (PNI-REDD +) January 2017-June 2018. Guides and supports the initiatives of the multiple parties and sectors involved in reducing deforestation and degradation in the country.
- Project 4: Preparatory support for the participation of Equatorial Guinea in the Fund Green (March 2018-March 2019).
- Final report on the goal setting process for forest degradation neutrality in the Republic of Equatorial Guinea, 2018.
- Capacity Building on REDD+, 2013-2017.
- National Action Programme to Combat Deforestation and Land Degradation in Equatorial Guinea (PAN/LCD), developed in 2005.
- Support Project for the Development of Value Chains in the Fisheries and Aquaculture Sector (PASPA) with the African Development Bank
- Support national fisheries and improve food security

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- National Action Plan for Adapting to Climate Change (PANA) 2013. http://unfccc.int/resource/docs/napa/gnq01.pdf
- National Programme for Food Security (PNSA) of 1 July 2012. http://www.fao.org/3/a-bl407s.pdf
- Organic Law n° 4/2012. http://extwprlegs1.fao.org/docs/pdf/eqg127477.pdf
- Law n° 1/1999 - Law on the regime of Non-Governmental Organisations (NGOs) of 24 February 1999. http://extwprlegs1.fao.org/docs/pdf/eqg143875.pdf
- Law n° 16/1995 - Law regulating small and medium-sized companies, 13 June 1995. http://extwprlegs1.fao.org/docs/pdf/eqg143875.pdf
- Environmental Law, 27 November 2003. https://bit.ly/373PvU8
- Regulation n° 09/05-UEAC-143-CM-13 of 4 November 2004. http://extwprlegs1.fao.org/docs/pdf/eqg102892.pdf
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Description of the coastal areas of the country

The coastal zone of Gabon, which has about 85% of the national population (estimated at 1,520,911 inhabitants[1] in 2003 and 2,119,275 in 2018[2]), is bathed by the Atlantic Ocean on 800 km, from the border with Equatorial Guinea in the north to its border with Congo in the south. Its continental shelf is of varying width and extends between 15 and 40 km north of Cape Lopez and approximately 80 km to the south. It covers an area of approximately 40,000 km^2 with an exclusive economic zone[3] of around 213,000 km^2, relatively equivalent to its territorial space [1]. The river system is dominated along the coast by the Ogooué River, which flows over 1200 km, in addition to the Noya, Mbeya, Ntsini, Komo and Nyanga rivers.

The geomorphology of the Gabonese coastline is characterised by a diversity of elements, including rocky beaches, sandy beaches, lagoons, estuaries and deltas. In the northwest are three main estuaries: Mouni, Mondah and Komo, along with a set of rocky and sandy areas on the lowlands and wetlands covered by mangroves. The Ogooué River forms a delta at its opening on the Atlantic Ocean towards the centre of the country. The coastal area also hosts a system of lagoons, the main ones being Fernan Vaz Nkomi, Ngove, Ndogo, Banio, Sette Cama, Mayumba and Gamba.

The dominant ecosystems are mangroves, coastal savannah and coastal forest. Gabon has between 395,000 and 400,000 ha of mangroves distributed between the Muni Estuary, Mondah Bay, Komo Estuary, Ogooué Delta and southern coastal lagoons. The fishery resource is composed of varied animal and plant species divided into groups [2] of demersal species of the continental shelf, deepwater demersal species, as well as small coastal pelagic and large offshore pelagic fish. The equatorial coastal climate is subdivided into two distinct transition zones, one of which in the northwest is characterised by heavy rainfall ranging from 2,000 to 3,800 mm per year, and the other in the southwest by annual rainfall ranging from 1,700 to 3,500 mm [3].

Oil, whose production exerts strong pressure on the coast, is the leading sector of the Gabonese economy given its weight in GDP. In 2014, it accounted for 39% of GDP, 85% of export earnings and 49% of budget revenue [1]. Maritime transport is the second largest economic force in the country thanks to the Port-Gentil and Owendo seaports, located in Port-Gentil and Libreville respectively. They

account for approximately 90% of the country's trade with the sub-region and rest of the world. While Port-Gentil acts as a gateway to trade, the Owendo port is more geared towards oil activities.

Coastal tourism contributes to more than 80% of the national tourism industry, influenced by the presence of marine animals such as sea turtles, dolphins, whales and orcas found in Gabonese waters. Of the thirteen national parks present in the country, four (Akanda, Pongara, Loango and Mayumba) are located along the coast.

COASTAL VULNERABILITY – PRELIMINARY ASSESSMENT

Floods

The Gabonese coasts have long been exposed to important human influence. Given the melting of North Pole glaciers due to global warming and the intense urbanisation of shorelines, in addition to the lack of a rigorous land development plan and blockage of water and sewer outlets, Gabon is subject to recurrent floods of rare violence.

Already, the observation [4] of a trend in sea level rise of 2.62 mm per year (measured in 2011) implies a projected increase of flood scenarios of the order of 10-14% along the Gabonese coast by 2050. An average of 2 to 8 flood events per year are forecasted, compared to the scenarios observed in 2011 in this case. Additionally, the report [5] on the disaster risk profile in Gabon highlights that current floods affect on average 0.33% of the total population of the country, with a hot spot in the coastal region of Ogooué-Maritime.

Droughts

The phenomenon of droughts is much less recurrent in Gabon than at the regional level.

Erosion

According to [6] SNALG (2011), wave heights will increase by around 4% in 2050 compared to current heights. Added to the sea level, it is projected that by 2050, beaches would have retreated by about 4.5 m. Nevertheless, according to this report,

1 Final Communiqué of the Council of Ministers, following the Order of the Constitutional Court proclaiming the results of the General Population and Housing Census (RPGH) of 2003.

2 World Bank, 2019. Estimated Population data for Gabon in 2018. https://data.worldbank.org/country/gabon

3 The information provided for the area of the EEZ, the extent of the facade and the area of the continental shelf comes from the Strategic Plan for the Sustainable Development of Fisheries and Aquaculture (PSPA).

issues of coastal erosion related to hydrodynamics (currents, swells, waves, tidal waves) are mainly observed on exposed coastal segments, which undergo significant degradation.

Also, the destruction of the mangrove, establishment of important infrastructures on the coast, uncontrolled and anarchic exploitation of the sand on the beaches and coastal belts (Libreville, Port-Gentil, southern coast) all favour the aggravation of the phenomenon of coastal erosion and encroachment of the sea on the land while causing an imbalance in the sedimentary dynamics of the beaches.

Salinity intrusion

The drop in freshwater levels during the dry season leads to an increase in saltwater. In Port-Gentil (province of Ogooué-Maritime), an intrusion of saltwater in the conduits of the energy and water company of Gabon can be seen. However, a robust experimental analysis should validate these observations.

Wetland change and loss, dry land loss

Coastal erosion and flooding are the two major hazards causing damage, with considerable wetland losses and destruction of coastal infrastructure in Gabon. Their amplification is attributed to the strong human influence on the sensitive areas of the coast.

Marine pollution, water quality change

Although the coastal zone of Port-Gentil is more polluted [4], its condition generally gives an overview of all Gabonese coastal waters. The absence of urban wastewater drainage network contributes to the discharge of waste in the sea. Indeed, most of the pollution on the Gabonese coast is anthropogenic: heavy metals, plastic, chemicals (oil spills related to oil and marine activities), etc. It should be noted that in 2016, Gabon[4] produced an amount of waste equivalent to 403,931 tons per year, and it is projected to increase to 578,036 tons per year by 2030 and 924,679 tons per year by 2050. Wetlands threatened by pollution and by anthropogenic activities include the Lower Ogoué Ramsar sites.

Reduction of marine stocks

The depletion of certain fish species (Captain, Sardine, etc.) and the disruption of certain species' migration have been observed in Gabonese waters. The lack of technical and material means, however, impede precise quantification.

Urban sprawl and coastal/maritime infrastructure development

The strong human influence on sensitive areas of the Gabonese coast amplifies the losses of lands, as well as the destruction of the ecosystems. Added to the continuous development of coastal infrastructures, about 80% of the Gabonese population lives in a coastal zone and this population keeps growing. However, the absence of a sustainable urban planning method defined and framed by law is worthy of note [6]. In addition to the phenomenon of coastal pollution, rapid and often unplanned urbanisation is causing a negative transformation of coastal landscapes that once offered protection against erosion and floods.

Sea level rise

The melting of continental glaciers as a result of global warming is the main contributor to sea-level rise, with intensified flooding and many coastal areas in Gabon becoming risk areas [6]. Subsequently, the observation of a trend in sea level rise of 2.62 mm per year (measured in 2011) implies a potential increase in the average sea level of about 10.2 cm by 2050 in Gabon. Hot spots to consider in this dynamic include Mandji Island and the province of Ogooué-Maritime (Port-Gentil), where some observations reveal increased sea level.

Others

There is the possibility that 3 more storms per year would occur by 2050 on the Gabonese coastline, with up to 7 more days in terms of annual storm duration [6].

INTEGRATED COASTAL AREA MANAGEMENT

Identification of coastal management policies at national, subnational or local levels, including cities/metropolitan plans.

National policies

- Emerging Gabon Strategic Plan (EGSP, 2009, 2012) serving as a driving force for emergence by 2035.
- National Action Plan for the Sustainable Management of Marine and Coastal Environmental Resources (December 2010).
- Gabon's National Emergency Plan (Chapter II, Section I of Decree n° 653 of 21 May 2003 on the preparation and control of pollution by oil and other harmful substances).
- National Environmental Action Plan (PNAE, 2000).
- National Adaptation Strategy of the Gabonese Coast against Climate Change.
- National Strategy and Action Plan on Biological Diversity (SNPADB), which identifies the strategic directions to follow over 25 years.
- Blue Gabon
- Green Gabon (Operational Plan) - Vision 2025
- Integrated Maritime Strategy of Gabon

Regional and sub-regional policies

- Regional Strategic Action Plan for the Environment and Biodiversity Resources of the Congo Basin Ecosystems.
- African Union's "Agenda 2063: The Africa We Want".
- African Union's "Africa's Integrated Maritime Strategy".
- Africa's Blue Economy: A policy handbook.
- Cross-Border Diagnostic Analysis Document and Strategic Action Programme of the GCM-CG.
- Convergence Plan/Sub-Regional Action Plan to Combat Desertification for Central Africa (PASR-AC -2000, 2005) - Developed and implemented by COMIFAC.
- Blue Fund and Climate Commission initiatives for the Congo Basin.
- Central Africa Regional Strategy for Risk Prevention, Disaster Management and Climate Change Adaptation (2016).
- African Strategy on Climate Change (2015).

Identification of national/local pilots with the objective to establish or improve coastal management plans

- Blue Gabon programme, which aims at better management of the coastal zone and its resources to make the maritime sector participate more significantly in the economic and social development of the country.
- National Council of the Sea, under the office of the President of the Republic, is the inter-administration support unit for the design and coordination of Gabon's national sea policy.
- Establishment of marine protected areas.
- Creation of national marine parks.

National legislation

- Environmental Code: Law n° 16/93 of 26 August 1993 on the protection and improvement of the environment.
- Environmental Code: Law n° 007/2014 of 1st August 2014 on the protection of the environment in the Gabonese Republic.
- Mining Code established by Law n° 5/2000 of 12 October 2000.
- Fisheries Code established by Law n° 015/2005 of 8 October 2005 on the Code of Fisheries and Aquaculture in the Gabonese Republic.
- Forest Code established by Law n° 16/2001 of 31 December 2001.
- Decree n° 653 of 21 May 2003 on the preparation and the fight against pollution by oil and other harmful substances.
- Decree n° 542 of 15 July 2005 regulating the discharge of certain products into surface water, groundwater and marine waters (resulting from the Environmental Code).

- Decree n° 539 of 15 July 2005 regulating environmental impact assessments adopted in application of the provisions of Article 67 of the Environment Code.
- Decree n° 543 of 15 July 2005 laying down the legal regime for classified installations.
- Decree n° 541 of 15 July 2005 regulating the disposal of waste.
- Decree n° 0312/PR/MRIC establishing and organising the National Council of the Sea.
- The law n° 1/82 of 22 July 1982 known as Orientation Law on Waters and Forests.
- Law n° 002/2014 of 1 August 2014 on the orientation of sustainable development in the Gabonese Republic.
- Ordinance n° 6/2002 of 22 August 2002 amending certain provisions of Law n° 16/2001 of 31 December 2001.

Sub-regional and international agreements

- United Nations Convention on the Law of the Sea.
- United Nations Convention to Combat Desertification (February 1998).
- Convention on the Conservation of Migratory Species of Wild Animals.
- United Nations Convention on Biological Diversity (May 1997).
- Ramsar Convention on Wetlands (April 1987).
- Washington Convention on International Trade in Endangered Species of Wild Fauna and Flora (July 1987).
- International Convention on Oil Pollution Preparedness, Response and Co-operation.
- MARPOL 73/78 Convention for the Prevention of Pollution from Ships.
- Basel and Bamako Convention on the Ban to Import to Africa and the Control of Transboundary Movement and Management of Hazardous Wastes within Africa.
- United Nations Framework Convention on Climate Change (April 1997).
- Abidjan Convention for the Co-operation in the Protection and Development of the Marine and Coastal Environment of the West and Central African Region (Gabon is Member State of the additional protocol on Integrated Coastal Zone Management).
- Kyoto Protocol.
- International Convention on Oil Pollution Preparedness, Response and Cooperation (1990).
- African Convention on the Conservation of Nature and Natural Resources, negotiated under the auspices of the African Union, adopted in Algiers in 1968 and ratified by Gabon in July 1987.
- Treaty of COMIFAC.
- Statute of CEFDHAC.

Proposed adaptation measures

- Coordinate communication and information management activities in order to put in place a common communication strategy and establish a resource centre.
- Support and coordinate resource mobilisation efforts.
- Monitor the implementation of Integrated Coastal Zone Management.
- Establish a coastal observatory (Gabonese and sub-regional).
- Implement environmental knowledge related to a coastal information system.
- Limit human pressure on Gabonese coastal areas.
- Adapt to natural phenomena through appropriate adjustments.
- Integrate coastal planning tools.
- Update observed and measurable data and effects.

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- National Strategy and Action Plan on Biological Diversity (NSAPD), which identifies the strategic directions to follow over 25 years. http://extwprlegs1.fao.org/docs/pdf/Ga164989.pdf
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- African Union's "Agenda 2063: The Africa We Want". https://www.un.org/en/africa/osaa/pdf/au/agenda2063.pdf
- African Union's "Africa's Integrated Maritime Strategy". https://www.au.int/web/sites/default/files/documents/30930-doc-2050_aim_strategy_fr_0.pdf
- Africa's Blue Economy: A policy handbook. https://repository.uneca.org/bitstream/handle/10855/23014/b11560836.pdf?sequence=1&isAllowed=y
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São Tomé and Príncipe

Description of the coastal areas of the country

São Tomé and Príncipe (STP) has a 209 km coastline around a land area. The country consists of an archipelago with two main islands: São Tomé island – 50 km long and 30 km wide with 180,000 [1] inhabitants – and Príncipe island – about 30 km long and 6 km wide with 7,500 [1] inhabitants [2] – as well as several rocky islets, including Rôlas south of São Tomé and Caroço, Pedras and Tinhosas south of Príncipe [3].

In the south and west of both islands, high volcanic mountains fall precipitously to the sea, although neither island has witnessed any volcanic activity in recent centuries [3], but the coastal zone within which the environment is under stress from soil degradation and coastal erosion [2].

The mountains descend gradually to small plains in the northeast. São Tomé Peak, the highest point on the main island, rises to 6,640 feet (2,024 metres) above sea level, and Príncipe Peak on the smaller island reaches 3,110 feet (948 metres) [4]. These mountainous areas are deeply dissected by stream erosion, and spectacular isolated volcanic plugs stand out as landmarks. Swift and rocky streams rush down to the coast in every direction [4].

In the coastal areas, the mean annual temperature is high, in the low 80s°F (upper 20s°C); the average relative humidity is also high, about 80%. Average temperatures decline sharply with elevation, and night temperatures fall below 50°F (10°C) at about 2,300 feet (700 metres). Above 3,300 feet (1,000 metres), fine misty rain falls almost continuously and the nights are cold, although frost and snow are unknown [4].

Coastal ecosystems in STP are fundamentally comprised of beaches, rocky coastlines, estuaries and marshland, where different species abound. Critically endangered species include sea turtles and reptiles that spawn on the coast and the endemic bat Tartarides thomensis present in the savannahs of the Praia das Conchas and Lagoa Azul, on the northern coast of São Tomé. This winged mammal belongs to the order Chiroptera [5]. There are likewise threatened endemic species of insects, such as Lepidoptera, Graphium leonidas thomasius and Oelides bocagii [5].

Along coastal areas, the fauna is made up mostly of birds inhabiting small islets and coastal areas away from human settlements, typically on the Tinhosa and Sete Pedras islets [5]. The main species nesting in colonies are Phaeton lepturus (Coconzucu), Sula leucogaster, Sula dactylatra, Anous stólidus, Anous minutus, Sterna fuscata, Sterna anaethetus and Oceanodroma castro (band-rumped storm-petrel). In the savannahs of northern São Tomé, there is a distinct group of birds comprised of quails (Coturnix delegorguei) and African crake (Crecopsis egregia) [5].

On the transitional coastal areas, 5 species of sea turtles are frequently encountered, coming to nest on the coast. These are Lepidochelys olivacea (Tatô), Chelonias mydas (Ambó), Eretmochelys imbricata (Sada), Dermochelys coriacea (Ambulância) and the carreta-carreta [5]. Spawning takes place from October to February, with greater frequency during November, December and January. Considering their conservation status, all five are endangered [5].

The coast is endowed with excellent conditions for tropical agriculture. The growing season is long, volcanic soils are fertile and there is no lack of water. Consequently, the economy remains dependent on plantation agriculture, especially cacao (grown for its seeds, cocoa beans). About two-fifths of the total land area is under cultivation, with cacao trees covering a little less than two-thirds of the cultivated land; coconut palms cover most of the remainder [4].

Fishing resources are limited by the narrow continental shelf. The domestic demand for fish exceeds supply by the local artisan fishermen, and trawlers from European Union countries pay small license fees for the right to fish in the country's national waters. The deep-sea tuna resources of the Gulf of Guinea and shellfish in coastal waters represent the best hopes for fishery exports [4].

Where coastal fishing is concerned, there are 5 zones, throughout which the concentration of fish is highly important [5]:

- North of Neves: a zone with large and small pelagic species;
- Region of Micoló and Ribeira Afonso: small coastal pelagic;
- South of São Tomé, between Porto Alegre and Ribeira Afonso: demersal and coastal pelagic;
- Around Príncipe island: demersal, large pelagic and a zone with great potential for small pelagic species (sardines), not yet exploited;
- Beyond 25 nautic miles: large pelagic

The village of Ribeira Afonso counts about 2,000 inhabitants. At the sea-side (east), the village is delimited by a pocket beach approximately 30 m wide [3]. The beach width, when compared with historical maps, seems not to have remarkably changed in time. This would suggest a beach in a sustainable condition [3]. It is mainly characterised by alluvial deposits with volcanic origins. Sediment is predominantly gravel on the southern side with a D50 of about 80 mm. The rest of the beach is characterised by sand with a diameter of approximately 0.5 mm in the middle and 0.35 mm in the north [3].

COASTAL VULNERABILITY – PRELIMINARY ASSESSMENT

Floods

In São Tomé and Príncipe, the major natural hazard affecting the islands and associated coastal communities is coastal flooding as a result of extreme storm surge and waves, river flooding, flash flooding and overland flow from intense rainfall, high winds and beach loss [6]. Coastal communities experience flooding as many as 10 times each year and mudslides yearly, destroying homes and sources of livelihoods [7]. All these are exacerbated by climate change.

Incidences of floods affect more than 200 people each year, about 0.11% of the total population. The highest concentration of potentially affected people is on the main and most populated island – São Tomé – a trend confirmed in climate predictions [8]. This leaves the local economy highly vulnerable to flooding. On an annual average, flood-affected areas represent about 0.80% of national Gross Domestic Product (GDP), which corresponds to about 2.8 million USD a year, with the island of São Tomé experiencing the highest losses [8].

The value of direct economic losses in terms of Average Annual Loss/Probable Maximum Loss (AAL/PML) amounts to almost 2.1 million USD, which represents about 0.14% of the total exposure value in the present climate [8]. Most losses occur in the service sector, followed by the housing sector. In relative terms, the most affected sectors are transport and agriculture [8]. Although the average annual loss is about 2.1 million USD, the probability of a 5 million USD loss due to flooding is on average once every 10 years, meaning that they can occur frequently. The probability of disaster losses of about 15 million USD is on average once every 150 years [8].

The sectors most affected by very frequent events are service and agriculture (less than once every 10 years). The trend changes when considering less frequent events where the housing and production sectors become more impacted, together with services [8]. Losses related to frequency are likely to increase sharply in future climate conditions, and future losses may be catastrophic, given the high level of uncertainty in future climate scenarios [8].

Droughts

Compared to current conditions (1951-2000), the probability of droughts (precipitation - evapotranspiration deficiency) is expected to decrease in the future climate (2050-2100) [8]. Already in the current climate, an average of 23,000 people (12% of 2016 population) are affected annually by droughts [8]. Projections based on the future climate indicate that this number would not change for São Tomé due to the decrease in drought conditions on the island but decline slightly on Príncipe [8].

In the current climate, the average annual percentage of GDP affected by drought is about 13% of the total GDP, equalling about 47 million USD per year of damage caused by droughts [8]. Under future climate conditions, the amount of GDP affected by drought could reach 600 million USD if it includes socio-economic projections [8]. Under current climatic conditions, affected livestock (i.e. animals living in drought-affected areas) make up 14%. In future climate conditions, and if the current number of animals is maintained, this number should decrease slightly [8].

In both the present and future climate, physical crop losses are dominated by four crops: banana, coconut, palm oil and taro, alongside the production of cocoa and fruit [8]. In future climate conditions, losses in agricultural production due to droughts should decrease for all six crops [8]. Under current climate conditions, taro production shows the highest relative loss, reaching 2.7% of average total production [8].

In the current climate, direct economic losses recorded in the agricultural production of São Tomé (more than 0.5 million USD) are higher than the losses recorded on the island of Príncipe (between 0.1 and 0.2 million USD) [8]. In future climatic conditions, agricultural losses are expected to decrease in both islands [8].

Erosion

The coastline of STP is already weakened by unsustainable sand extraction practices [1]. Stronger and increasingly unpredictable spring tides, combined with extensive sand mining, have led to high rates of coastline erosion (about 0.2-1.2 m a year), which exacerbates the threat to the coastal infrastructures [1]. Some erosion most likely due to the storm is visible on the upper part of the beach profile of the Ribeira Afonso village, where a sea wall and rudimentary revetment with rocks have been built [3].

The effect of short-term erosion might become even more important in the future, leading to a possible coastal retreat of more than 20 m by 2050, for a storm with a return period of 50 years [3]. Storm surge levels might also increase in the future, reaching values close to 1.5 m by 2050 [3].

Salinity intrusion

No information

Wetland change and loss, dry land loss

Human activities are taking a toll on the unique biodiversity of the islands and are likely to become more pressing soon as the human population keeps growing. Habitat loss, overexploitation and introduced species threaten the biodiversity of São Tomé and Príncipe. This is translated into the felling of coconut trees and others for the extraction of building materials, fuel and coal; also, into accelerated urban development on account of the tourist industry and other economic development plans in the country [5]. Still, the rugged terrain has allowed native forests to remain standing in about one-quarter of the country [5].

STP's fast-growing economy and human population have had a significant effect on the native forests. As land has become scarce, people have turned to the forest to sustain their livelihoods. At the same time, the government has licensed large areas of forest to commercial interests. In the past few years, it has handed 5% of the country to oil palm production and 5% to commercial cocoa producers [9].

On both islands, the remaining areas of primary forest need immediate protection and suitable boundaries have been designated under the Zona Ecológica plan. Except for an important area around Lagoa Amélia, primary forest is not under immediate threat, although a variety of pressures are likely to increase [10].

Marine pollution, water quality change

Considering the heavy rain in the country and fragile coastal ecosystems, the most serious issues related to the marine and coastal environment are due to the huge quantities of sediments carried by rivers, which contribute to the degradation of the aquatic environment [6].

Negative impact on coastal and marine biodiversity is due to the presence of solid and liquid chemical waste, increased water temperature, and coastal erosion and estuary erosion caused by increases in population density [5].

The Rio Provaz basin is the main source of water for domestic and industrial use in the town of Neves, the capital of the Lembá district. Over the past few years, the basin has been affected by several natural disasters, exacerbated by changes in land use and climate change. There has been an increase in land conversion from tropical rain forest to agriculture and charcoal production – practices that pose a major threat to the water resources of the Provaz and which may compromise water supply in the future [11].

Deficient water quality in STP has been caused by "inadequate and degraded systems, vandalism and lack of awareness, lack of government support and insufficient investment, and deficient management of water resources." Rainwater damage and waste accumulation contribute to the spread of parasitic and infectious diseases in urban areas. About 75% of the population does not have a proper excrement removal system [12].

Reduction of marine stocks

According to the National Biodiversity Strategy Action Plan (NBSAP), major environmental issues include deforestation for construction and charcoal; coastal erosion caused by sand mining for construction; desertification; unregulated construction and tourism development along the coastline due to the lack of town and country planning; land-based pollution from human sources (pesticides and sewage) in rivers; capture of endangered species (e.g. turtles); and marine pollution from ships and illegal dumping at sea.

Fish stock is generally on the decline, resulting from the illegal use of fishing nets with extremely tight meshes in the territorial waters of STP. These nets capture growing specimens, such as the black sea bream (Pomadasys rogeri) of the family Haemulidae, which São Toméans have taken to calling "disaster". Young fish of the species measure from 2 to 5 cm in length, while adult fish grow to a length of 20 to 25 cm, weighing 400-800 g. The young weigh under 30 g [13].

Among vertebrates, there are 18 threatened endemic species and many more are likely to be listed soon, as new species are still being described and evaluated. Four bird species are listed as critically endangered: the Dwarf Olive Ibis (Bostrychia bocagei), the São Tomé fiscal (Lanius newtoni), the São Tomé Grosbeak (Neospiza concolor), and the Príncipe Thrush (Turdus xanthorhynchus). Restricted to the best-preserved forest areas, these birds have historically been little studied. The grosbeak, for instance, had not been recorded for over 100 years and was even considered extinct until its rediscovery in 1991 [14].

Urban sprawl and coastal/maritime infrastructure development

Coastal communities have been growing rapidly without proper spatial planning, occupying areas at high risk of natural hazards and the adverse consequences of climate change [15].

The urban/rural divide is often a driving force for inequality. As countries urbanise, many people move towards the cities and leave rural areas behind. In STP, the population and economic activities are mainly located along the attractive coastlines [1]. Most of the national infrastructure is located in low-lying areas along the shoreline – port, airport, oil reservoirs, hotels – therefore, a large part of the national road network (National Roads 1 and 2) is located along the coast [1]. This implies

that infrastructures are directly exposed to the elevation of the sea level, which, in addition to increased consequences of coastal flooding, exacerbates coastal erosion [1].

Consequently, most people leaving STP's rural areas often have trouble keeping up with the shift and fall into a pattern of poverty.

Sea level rise

Sea level rise in the country is expected to have an incremental impact on a land area of about 2 km2, with a projected impact as a percentage of coastal total of 29.10% [16]. The IPPC scenario (SREF A1F1 as shown in the IPCC 4th assessment report) suggests a global sea-level rise between 0.26 to 0.59 m, between the present (1980–1999) and the end of this century (2090–2099) [3].

In relative terms, this means that these values are quite important and their effect on the communities living close to the sea is comparable to those of a surge with a return period of more than 100 years [3]. Although a stretch of coastline appears to be in long-term morphological equilibrium for the present condition, the effect of sea-level rise might lead to a coastal retreat of almost 20 m by the year 2100 when the most drastic IPCC scenarios are considered [3].

Others

No information

INTEGRATED COASTAL AREA MANAGEMENT

Identification of coastal management policies at national, subnational or local levels, including cities/ metropolitan plans.

Identification of national/local pilots with the objective to establish or improve coastal management plans.

- Law n° 8/2019 approving the Major Options Plan for the Economic Year of 2019.
- Decree n° 27/2018 approving the National Environmental Sanitation Policy (PNSA).
- São Tomé and Príncipe Intended Nationally Determined Contribution (INDC), September 2015.
- National Biodiversity Strategy and Action Plan 2015-2020 (NBSAP II).
- Order n° 12/2012 approving the Participatory Strategy for Water and Sanitation of São Tomé and Príncipe until 2030.
- Programme National de Sécurité Alimentaire et Nutritionnelle (PNSAN).
- Second National Poverty Reduction Strategy II (2012-2016)
- National Adaptation Programmes of Action on Climate Change (NAPA), 2006.
- National Strategy for the Adaptation to Climate Change.
- Decree-Law n° 32/78 on the expropriation of some agricultural properties.
- Decree-Law n° 19/75 establishing the 'Roça Monte Forte' as an agricultural public firm.
- Decree n° 52/2013 approving the Ministry of Agriculture, Fisheries and Rural Development.
- Decree n° 3/2012 creating the Supply Centre for Agricultural, Livestock and Fisheries Inputs (CAIMAP).
- Decree n° 73/95 amending Medium-Agricultural Farms extension.
- Government Resolution n° 1/85 on short-term food supply.
- Decree-Law n° 24/75 establishing certain private farms as agricultural public firms.
- Environmental Law n° 10/1999.
- Decree-Law n° 64/2009 approving the National Plan for the implementation of the Stockholm Convention on Persistent Organic Pollutants (POPs).
- Decree-Law n° 14/2003 regulating waste derived from packaging.
- Decree n° 10 /2012 approving the Statute of the National Institute of Meteorology (INM).
- Decree n° 9/2008 on the National Strategy against Poverty.
- Decree n° 32/05 instituting the Observatory for Poverty Reduction.
- Decree n° 36/99 regulating solid waste disposal.
- Fisheries Law n° 9/2001.

- Council Regulation (EC) n° 894/2007 on the conclusion of a Fisheries Partnership Agreement between the Democratic Republic of São Tomé and Príncipe and the European Community.
- Council Decision 2006/83/EC on the signing on behalf of the European Community and provisional application of the Agreement in the form of an Exchange of Letters extending the Protocol setting out, for the period from 1 June 2005 to 31 May 2006, the fishing opportunities and financial contribution provided for in the Agreement between the European Economic Community and the Government of the Democratic Republic of São Tomé and Príncipe on fishing off the coast of São Tomé and Príncipe.
- Council Regulation (EC) n° 428/2000 on the conclusion of the Protocol setting out for the period 1 June 1999 to 31 May 2002 the fishing opportunities and the financial contribution provided for in the Agreement between the European Economic Community and the Government of the Democratic Republic of São Tomé e Príncipe of fishing off the coast of São Tomé e Príncipe.
- Decree n° 28/2012 establishing the General Regulation on Fishing Activities and Fisheries Resources.
- Joint Decision n° 23/2018 approving the new Tax table of the Maritime and Port Institute of São Tomé and Príncipe.
- Decree n° 518/73 regulating Sport Fishing within the Overseas Provinces.
- Order n° 462/71 regulating fishing co-operatives.
- Forestry Law n° 5/2001.
- Decree-Law n° 21/2009 establishing licensing requirements for forest wood imports.
- Decree n° 48.198 establishing the Statute of Overseas Services for Agriculture and Forests.
- Law n° 5/2007 approving the Regulation on Property Transfer Tax (SISA).
- Law n° 8/2003 on crimes against property.
- Act n° 3/91 concerning public land.
- Decree-Law n° 34/88 on the detachment of dependencies on some companies.
- Decree-Law n° 32/88 establishing the State lands use.
- Decree-Law n° 32/87 on State's withdrawal from the management of production units.
- Act n° 6/73 approving the Overseas Land Act.
- Decree n° 12/2005 on the Land Management Plan.
- Decree n° 10-C/2000 on land concession contracts.
- Decree n° 35/99 establishing the requirements to be satisfied for coastal sand extraction.
- Decree n° 30/92 approving the Regulation on the distribution of agricultural lands.
- Decree n° 8/92 creating the National Commission for Land Distribution.
- Decision n° 8/92 regulating contractual rescinding procedures.
- Decree-Law n° 51/91 regulating the distribution of State agricultural lands.
- Dispatch n° 29 instituting the Unit for the Coordination and Technical Assistance.
- Decree n° 23/88 implementing the Decree-Law n° 32/87.
- Decree n° 47.486 regulating the ownership of lands occupied by non-owners.
- Law n° 13/2007 establishing the Basic Law on Maritime Safety and Prevention of Marine Pollution.
- Decree-Law n° 4/2018 creating the National Maritime Authority.
- Decree-Law n° 3/2018 approving the Maritime Authority System (SAM).
- Decree-Law n° 4/2010 establishing legal measures and competent authorities for the implementation of the International Code of Vessels and Harbours' protection.
- Decree-Law n° 57/2009 organising the Exclusive Economic Zone in blocks for oil exploitation.
- Decree-Law n° 30/2009 approving the General Regulation for vessels' safety and registration.
- Decree-Law n° 32/2007 creating the Maritime and Harbour Institute of São Tomé and Príncipe (IMAP-STP).
- Water Resources Framework Law n° 07/2018.

- Decree-Law n° 01/2016 approving the Hunting Regulation.
- Law n° 4/2003 on Cultural and Natural Heritage.
- Law n° 11/99 on Flora and Fauna conservation and protected areas.
- Decree-Law n° 8/2014 approving the Regulation on the Capture and Marketing of Sea Turtles and their products.
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- Law n° 6/2006 on the "Obô de São Tomé" Natural Park.
- Law n° 7/2006 on the "Obô do Príncipe" Natural Park.

ADAPTATION

Adaptation measures under implementation or implemented in the last decade and its effects

Identification of national adaptation plan into force

Identification of specific actions undertaken during the last decade

- Adaptation to climate change project (2011) was designed as an integral part of the country's National Adaptation to Climate Change Programme, which prioritised three major areas:
  - Land-based adaptation in vulnerable areas
  - Coastal adaptation for vulnerable communities
  - Strengthened adaptation capacity.
- Strengthening the adaptive capacity of most vulnerable São Toméan's livestock-keeping households (2010) was another project aimed at improving the resilience of the livestock systems in support of the productivity of stockbreeding.
  - The African Development Bank has a goal to diversify rural infrastructure to keep up with São Tomé and Príncipe's growing agriculture strategy with the Infrastructure Rehabilitation for Food Security project [17].
  - STP's government is seeking international investors for the creation of a deep-water port 1. The government hopes that with the emergence of the deep-water port, São Tomé and Príncipe will become an international shipping point connecting Central Africa with the United States, Asia and Europe.

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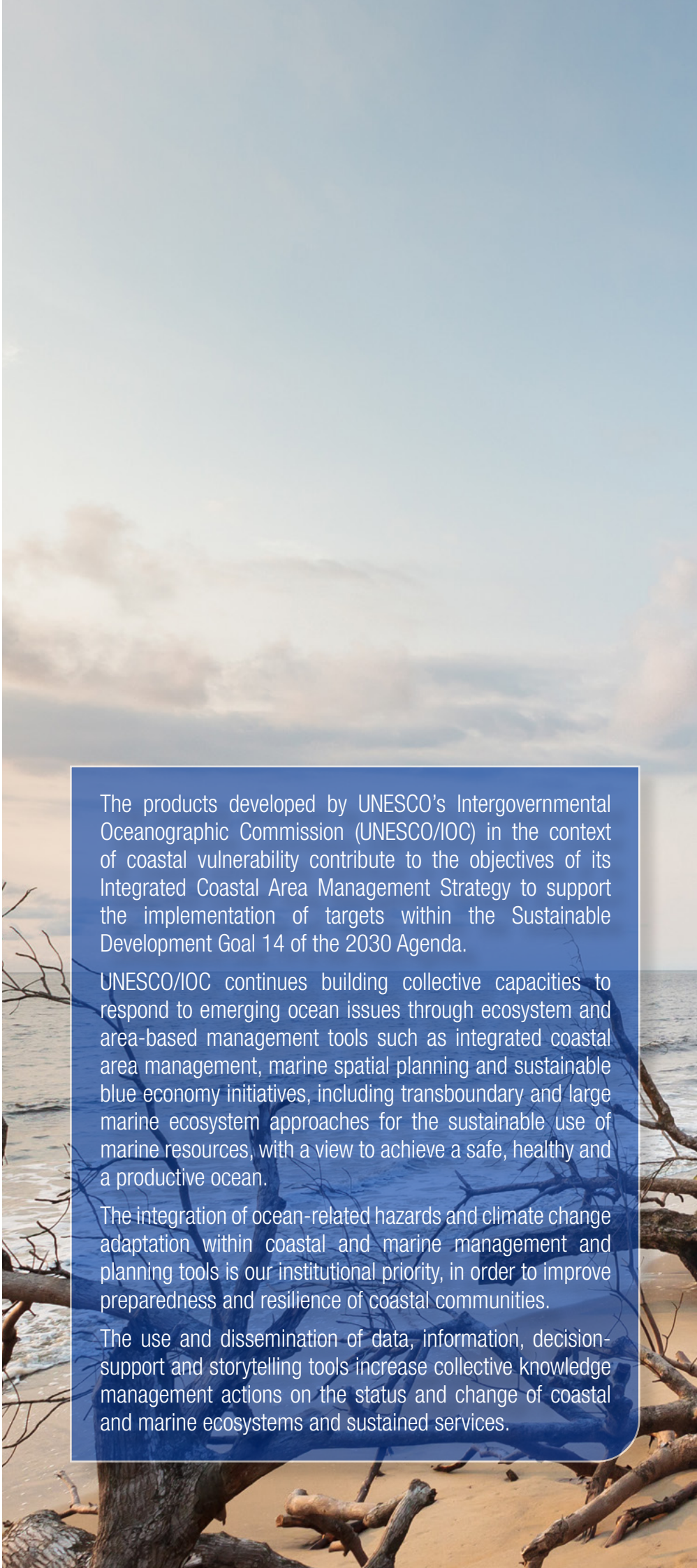

The products developed by UNESCO's Intergovernmental Oceanographic Commission (UNESCO/IOC) in the context of coastal vulnerability contribute to the objectives of its Integrated Coastal Area Management Strategy to support the implementation of targets within the Sustainable Development Goal 14 of the 2030 Agenda.

UNESCO/IOC continues building collective capacities to respond to emerging ocean issues through ecosystem and area-based management tools such as integrated coastal area management, marine spatial planning and sustainable blue economy initiatives, including transboundary and large marine ecosystem approaches for the sustainable use of marine resources, with a view to achieve a safe, healthy and a productive ocean.

The integration of ocean-related hazards and climate change adaptation within coastal and marine management and planning tools is our institutional priority, in order to improve preparedness and resilience of coastal communities.

The use and dissemination of data, information, decision-support and storytelling tools increase collective knowledge management actions on the status and change of coastal and marine ecosystems and sustained services.

Government Offices of Sweden

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Sustainable Development Goals

14 LIFE BELOW WATER