

Climate Change Adaptation Plan

A priorities plan for the Sierra Leone Coastal Landscape Complex



Photos- top left to bottom right: Community nursery for mangrove restoration in Saamu in the Yawri Bay; cross-section of participants at a community education session in Kychom in the SRE; cross-section of paramount chiefs at a workshop in Port Loko for the establishment of a Coastal Chiefdoms Natural Resources Management Network (CCNRMN); and WABiCC team on a trip to communities in the SRE (Credit: Abu-Bakar S. Massaquoi)

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Plate 1 Temporal embankment in Kortimoh in the Scarcies region of Sierra Leone to buffer the effects of sea-level rise

II. EXECUTIVE SUMMARY

West Africa Biodiversity and Climate Change (WA BiCC), a 5-year program funded by USAID West Africa and implemented by Tetra Tech ARD, is seeking to improve biodiversity conservation and promote climate-resilient and low-emission development across West Africa. The program focuses on targeted geographical areas within the region, including the SLCLC, to improve governance and policy over critical natural and human systems. The program works through regional partners, Economic Community of West African States (ECOWAS), Mano River Union (MRU) and the Abidjan Convention, and with targeted national and sub-national institutions to: (i) Reduce Wildlife Trafficking; (ii) Increase Coastal Resilience; and (iii) Reduce Deforestation, Forest Degradation, and Biodiversity loss in selected coastal and forest landscapes across West Africa.

WABICC has supported the preparation of this Climate Change Adaptation Plan (CCAP) to contribute towards making coastal ecosystems and communities across the Sierra Leone Coastal Landscape Complex (SLCLC) more resilient to stresses and shocks from climate change impacts and effects. The CCAP is an important management document that could provide guidance for fostering a climate change adaptation agenda throughout Sierra Leone and the sub-region. It proposes a fundamental shift in the approach used by practitioners and climate change risk managers to protect and restore critical coastal ecosystems and bolster sustainable livelihoods in an integrated manner. Moreover, it expands the scope of priorities considered by the Integrated Coastal Zone Management Plan (ICZMP), specifically those pertinent to adaptation in the SLCLC, and facilitates the operationalisation of various regional plans like the Abidjan Convention, which recently adopted a protocol on Integrated Coastal Zone Management (ICZM).

The plan, therefore, epitomises the careful planning required to coordinate all the potential pressures and conflicts of interest from upstream to downstream of the coast and manage them fairly, responsibly and sustainably. For instance, the plan advocates for the use of conceptualized best practices and underscores the importance of relying upon previous and on-going efforts to create fair, equitable and lasting adaptation solutions in the landscape and coastal areas in the country in general. The anticipation, as such, is that this plan will foster a new culture of coastal resilience that requires practitioners and policy-makers to effectively mainstream climate change risks, vulnerabilities, and adaptation considerations into decision-making and field interventions.

While the activities highlighted in the plan may not be exhaustive, they have been scientifically identified through climate change vulnerability assessments, intervention options analysis, literature review and stakeholder consultations. The proposed adaptation measures straddle around prevailing climate observed and perceived risks in the SLCLC and target multiple actors at various levels, with implementation designed to draw upon the valuable perspectives and experiences of all those affected by climate change risks and anthropogenic impacts along the coast of Sierra Leone and beyond. These include local leaders and formal or informal institutions in various coastal communities that need to

be strong partners in designing and delivering climate change adaptation interventions.

The plan categorizes adaptation in the SLCLC into three focal areas (themes): ecological restoration and management of critical coastal ecosystems, livelihoods and sustainable development, and disaster risk reduction and early warning systems. The first theme, *ecological restoration and management of critical coastal ecosystem*, involves promoting healthy coastal ecosystems by facilitating mangrove restoration and management as an adaptation solution, mainstreaming adaptation considerations into coastal ecosystem conservation, encouraging and supporting joint planning and shared decision-making, and increasing access to information (and co-producing knowledge) on climate trends, impacts, risks, and adaptation opportunities. The second theme, *livelihoods and sustainable development*, entails promoting healthy and resilient communities by providing alternatives for sustainable livelihood support, supporting efforts to raise awareness, and increase training and skills formation. The last theme, *disaster risk reduction and early warning systems*, focuses on building resilience through appropriate infrastructure, supporting particularly vulnerable regions, and reducing hazards and risks.

These focal areas include both broad and targeted adaptation measures that meet the cross-cutting objectives of sustaining local stakeholder engagement, improving coastal governance through formalized collaboration and adaptive management, resources mobilization and building capacities to facilitate long-term planning, implementation, and monitoring of anticipated change. They also have broad implications for national adaptation efforts, because the three themes feature prominently either separately or together in all of the recent climate change adaptation plans and frameworks developed by agencies of government and the international community for Sierra Leone. Besides, they are operational areas in which the Government of Sierra Leone is building the levers, assets, and capabilities necessary to generate adaptation knowledge, products, and services (e.g., decision-making tools, future climate data). Consequently, the CCAP necessitates cost-effective action in situations where inaction would result in increased negative impacts, including associated costs or forgone opportunities. It established the need for priority-driven partnerships to integrate plans and actions among local and international partners and support a coherent, targeted response in the key domains of critical ecosystems restoration, livelihoods support, and disaster risk reduction.

III. LIST OF ACRONYMS

AbC	Abidjan Convention
ACM	Adaptive Collaborative Management
CA	Community Animators
CCAP	Climate Change Adaptation Plan
CCNRMN	Coastal Chiefdoms Natural Resources Management Network
CCVA	Climate Change Vulnerability Assessment
CEFCON	Climate Change, Environment, and Forestry Consortium
CES	Communication and Engagement Strategy
CMA	Community Management Associations
CSA	Climate-Smart Agriculture
CSACC	Civil Society Alliance on Climate Change
CSO	Civil Society Organisation
CSSL	Conservation Society of Sierra Leone
EJF	Environmental Justice Foundation
EPA	Environment Protection Agency
ENFORAC	Environmental Forum for Action
GoSL	Government of Sierra Leone
IASL	Island Aid Sierra Leone
ICZMP	Integrated Coastal Zone Management Plan
IFSS	Improved Fish Smoking Systems
IMBO	Institute of Marine Biology and Oceanography
MDA	Ministries, Departments, and Agencies
MFMR	Ministry of Fisheries and Marine Resources
MPA	Marine Protected Area
MRC	Mangrove Restoration Committee
MRU	Mano River Union
NAPA	National Adaptation Programme of Action
NBSAP	National Biodiversity Strategic Action Plan
NCCS	National Climate Change Secretariat
NPAA	National Protected Area Authority
SLCLC	Sierra Leone Coastal Landscape Complex
UNDP	United Nations Development Programme
USAID	United States Agency for International Development
VSLA	Village Savings and Loan Associations
WABICC	West Africa Biodiversity and Climate Change Program
WARD	Western Area Rural District
WARFP	Western Area Regional Fisheries Programme
YBCDO	Yawri Bay Community Development Organisation

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Plate 2 A degraded mangrove back area of Yeliboya community in the Scarcies region of Sierra Leone

V. OVERVIEW OF CCAP OBJECTIVES, SCOPE & METHODOLOGY

This CCAP is not an exhaustive attempt to define, support, or refute understandings and practices for climate change adaptation in Sierra Leone. Rather, it builds upon climate change vulnerability assessment and options analysis conducted by WA BiCC, as well as the Abidjan Convention Protocols on Sustainable Mangrove Management and Integrated Coastal Zone management, to facilitate climate change adaptation planning and interventions in the SLCLC. The plan is intended to serve as a guide, that will help practitioners and policy-makers to address the challenges of climate change and other risks. Hence, users may use the whole guide or specific sections, depending on the focus of their adaptation efforts, or where they are with planning and implementation.

The plan draws from a wide variety of published resources specific to climate change vulnerability, adaptation and resilience from other developing countries within the sub-region and beyond. Some text is drawn directly from these sources to minimize inaccuracies and possible misrepresentations, as well as to improve readability by providing appropriate source attributions. Similarly, information from these sources are synthesized to propose actions/measures that are specific to the context of roles and actions in the SLCLC, as well as the impacts and consequences of climate change. All of these considerations are supplemented by stakeholder opinions gained from consultation meetings with focal persons in key governmental and non-governmental organizations (such as EPA, UNDP, CSSL etc), traditional leaders, NGOs, local and district councils, and key MDAs. Additional grey literature was sourced through an intensive internet-based search on google, google scholar, and ScienceDirect, and documents from the author's Mendeley library.

Objectives and scope

The objective of this assignment was to: 1) review existing methods and tools for climate change adaptation in the SLCLC, and the coast of Sierra Leone more broadly; 2) explore past experiences and best practices to provide recommendations on the approaches and tools best suited to the SLCLC; and 3) propose additional measures for adaptation planning and define their appropriateness for SLCLC communities, and the coast of Sierra Leone generally. Explanations of what 'method', 'approach', and 'tool' mean in this context are provided in the footnote¹.

Therefore, whereas the geographical scope of the review is global, the methods, tools, and approaches applicable to the SLCLC are the ultimate focus. The tools and methods selected are based on experiences with various approaches within the SLCLC and coastal areas in Sierra Leone

¹ A method is a set or sequence of steps that should be followed in order to accomplish a specific task within a larger climate adaptation framework. Approach is a complete framework that prescribes an entire process for the assessment of vulnerability and adaptation and offers a broad strategic approach. For instance, the National Adaptation Programme of Action (NAPA) provides an overview of how adaptation in Sierra Leone should be approached, rather than a specific set of instructions.

A tool refers to the means or instrument by which a specific task is accomplished. Examples include decision-making tools like the CCVA, and options analysis undertaken by WABICC.

generally, coupled with an assessment of the applicability and potential uptake of additional approaches in the SLCLC by WABiCC. The plan is mainly for national and local government agencies responsible for adaptation to climate change in Sierra Leone, and thus, summarizes basic approaches common to multiple sectors but based on latest scientific knowledge and consideration of uncertainty, the possibility to scale-up interventions, and the value in increased adaptation visibility. Accordingly, the scope of the CCAP examines basic approaches that should be shared across multiple national sectors with the aim of achieving coherence, improving coordination, and enhancing cross-level learning. With possibilities for policy learning across regional landscapes, the CCAP can form the basis of integrating regional lessons and strategies (such as the Abidjan Convention Protocol on Integrated Coastal Zone Management) to achieve multiple policy outcomes, including: climate change adaptation planning and implementation; increased capacity to build climate resilience in coastal areas; and more opportunities to leverage for regional exchange, collaboration, and learning. Nonetheless, the recommendations made in this report should be interpreted with caution so as not to think that they may apply specifically beyond the scope of the SLCLC. Wherever necessary, the CCAP brings the focus down from regional to national, and in many instances to the level of the SLCLC to show that the document has an exclusive coastal focus and not meant for addressing marine, upstream, and transboundary issues related to the management of coastal landscapes in Sierra Leone.

Methodology

Literature review

One of the first sources of information for this work was an internet search. A search of grey literature, for instance, led both to project documents (reports, working papers, proposals, and plans), as well as online toolkits, compendia, and databases. The review also covered assessments undertaken by WABiCC to inform adaptation decision-making in the SLCLC, such as the CCVA and options analysis carried out between 2016 and 2017, which assessed vulnerability and identified options (and prioritisation among those options) for adaptation planning and support. Literature has also been drawn from feasibility assessments undertaken by WABiCC (on the applicability and potential uptake of IFSS, for example) to support planning for livelihood interventions across the SLCLC.

Altogether, these reviews look specifically at the landscape scale and also examine national and regional linkages. At the same time, the reviews are sensitive to gender considerations because men and women in the SLCLC are likely to perceive and experience climate change differently, meaning that they have different adaptation needs. Additionally, the review considered governance issues, specifically how adaptation planning processes incorporate and prioritize stakeholder engagement, political feasibility, and learning. It also examined issues of cross-level institutions (those that span from local and national), particularly how policy-making relates to the planning approaches, methods, and tools selected. Furthermore, the review paid keen attention to the social, environmental, and economic implications of selected approaches, to determine how sustainable a certain approach would be over time. Finally, the review entailed a stocktake to identify the major laws, policies, and

plans (most relevant discourses) for adaptation planning in Sierra Leone. In all cases, information that has been included is limited to what is easily accessible on the internet or already available on hand at WABiCC and partner organisations in the country.

Stakeholder engagement

Stakeholder engagement happened on two levels: policy and local. In the first instance, meeting requests were emailed to the list of partners and stakeholders below (table X), and follow-up calls made to confirm attendance. Those contacted were asked to propose both the meeting time and venue, as a way of ensuring their attendance and contribution. At the meeting, the consultant made a brief presentation on the purpose of the CCAP, which was followed by a discussion of questions that had been provided in advance to help focus the meeting. The questions included: 1) What challenges do you face in adapting to climate change in the coastal areas? 2) What opportunities for innovation and effective governance exist in your sector? 3) What sustainable adaptation solutions do you propose?

Overall, three themes featured repeatedly in the answers that were provided, including: sustaining local engagement by making climate change adaptation more inclusive and meaningful; sustaining adaptation financing by undertaking targeted investments that reflect the scope and magnitude of the adaptation challenge; and facilitating intersectoral and interdisciplinary collaboration to effectively institutionalize joint action. The broad purpose of the meetings was to understand the breadth of climate change adaptation challenges in the coastal areas of Sierra Leone and identify innovative measures and actions to address those identified specifically in the SLCLC. The meetings also served the purpose of informing partners and stakeholders about the CCAP, to seek their guidance and identify opportunities for synergy.

1	Joseph Kaindaneh	UNDP Sierra Leone	National Coordinator, GEF Early Warning Project
2	Tanzila Sankoh	UNDP Sierra Leone	Programme Specialist, Energy, Environment and NRM
3	Dr Sheku Kamara	Conservation Society of Sierra Leone (CSSL)	Executive Director
4	Papanie Bai-Sesay	Conservation Society of Sierra Leone (CSSL)	Biodiversity Officer
5	Joseph Rahall	Green Scenery	Executive Director
6	Paul Lamin	Environment Protection Agency (EPA)	Head, NRM Unit
7	Gabriel Kpaka	Sierra Leone Meteorological Agency (SLMA)	Deputy Director & UNFCCC focal person
8	Kate M. B. Garnett	National Protected Area Authority (NPAA)	Executive Director
9	Hadijatou Jallow	Environment Protection Agency (EPA)	Executive Chairperson
10	Sahr Kellie	Forestry Division	Deputy Director

11	Sheikh Sowa	Green Future	Director; former National Coordinator for PRCM/Wetlands International programme
12	John V. Rogers	Office of National Security (ONS)	Director, Disaster Management Department
13	Edward Bendu	Ministry of Lands, Country Planning and the Environment (MLCPE)	Director, Environment Department

Table 1: policy stakeholders contacted at pre-CCAP writing-up stage

Engagement at the local level involved a 3-day workshop (Nov. 21-23, 2017) in Port Loko, northern Sierra Leone to establish a Coastal Chiefdoms Natural Resources Management Network (CCNRMN). The network was originally named the Traditional Chiefs Network (TCN) following the inaugural meeting held in July of the same year, to emphasize the important role traditional leaders play in the management of coastal resources and activities that build the resilience of communities and ecosystems. The draft CCAP was presented to members of the network, mostly individuals from the 22 chiefdoms spanning the 5 regions of the SLCLC, who, in turn, provided insightful feedback. These insights enriched the draft further for the validation workshop that was held in April 2019.



Plate 3: break-out sessions at the CCNRMN workshop and a cross-section of participants

Data limitations

The methods and procedures used to gather information for preparing the CCAP identified a wide range of relevant approaches, methods, and tools for adaptation to climate change. Defining the scope of the assignment ensured that the work was finished in the set timeframe and included the most relevant details. Some of the information sourced (like the results of feasibility assessments carried out by WABICC) may only apply to the specific landscapes within the SLCLC, while others (like the ICZMP developed by EPA) have wider applicability. In addition, some of the plans reviewed offer no real-world experience to support the CCAP implementation process, while few are field-tested and offer landscape-level success stories. A key limitation of this work, therefore, is that whereas most of the information is based on information reflecting field-level experience, more work is required to validate the utility of some approaches as useful methods for the current purpose.

VI. ROADMAP TO THIS PLAN

This plan is divided into three parts: part one- introduction to the SLCLC: part two- climate change and the coast of Sierra Leone; and part three- proposed actions for adapting to climate change in the SLCLC. Part one introduces the plan, its purpose, intended audience, methodology and structure. It also describes the SLCLC, highlighting both biophysical and socio-economic characteristics, and past and current institutional arrangements. It, therefore, sets the context for adaptation planning. Part two provides a brief overview of the climate change in Sierra Leone, and a general overview of the value of the coast and how it may be affected by climate change; Part three proposes the measures to consider in bringing the plan to life, including key goals and actions that could help address the adverse impacts of climate change in the SLCLC, as well as logical frameworks to help in delineating, tracking, evaluating, and communicating adaptation outputs and outcomes.



Plate 4 Stumps showing previous location of houses in Sasiyeck community in the Scarcies region of the SLCLC



Plate 5 Mangrove wood transported in boats on the Great Scarcies in the SLCLC

PART I: INTRODUCTION TO THE SLCLC

1.1 INTRODUCTION

This plan synthesizes knowledge on known and potential climate change effects on coastal ecosystems within the SLCLC. It outlines policy and management responses, culled mainly from the extant literature, to foster adaptation to climate change in coastal communities. The CCAP will provide needed tools for adaptation by prioritizing data and decision-support activities based principally on the needs for ecosystem conservation and sustainable livelihoods in the region. More specifically, the CCAP will generate applied science to inform mangrove conservation and livelihood support actions in the SLCLC, which are efforts seeking to address landscape-level vulnerability to climate change and other resource use issues.

Vulnerability in this context refers to “the degree to which a system- natural or human- is susceptible to, or unable to cope with, adverse effects of climate change, including climate variability and

extremes” (USAID 2009). It is a function of the character, magnitude, and rate of climate variation to which a system is exposed, its sensitivity, and its adaptive capacity. Whereas exposure to climate variation is more a function of geography, sensitivity is the extent to which a given community or ecosystem is affected by climatic shocks and stresses. *Adaptive capacity* on the other hand, reflects an ecosystem or community’s capacity to manage, and thus, reduce vulnerability. These three factors can be used to demonstrate the degree to which the SLCLC is vulnerable to climate impacts and consequences. For instance, landscapes in the region are considered highly vulnerable to the increased frequency and severity of coastal erosion, flooding, and storm surges, which severely impact social wellbeing, livelihood security, water resources, and major socio-economic sectors such as fishing, tourism, human settlements, fresh water supply, and agriculture. These impacts are already being felt in coastal communities, where the stress on livelihoods is implicated in low fishing and farm outputs, food security, increased health risks from lack of potable water, and mangrove ecosystem degradation.

Therefore, this plan attempts to provide a response by firstly, improving local understanding of the impacts of climate change in the SLCLC, and then, proposing strategies needed to alleviate and or reduce current stresses and potential impacts. The strategies proposed in this plan will help the SCLCC to become greener, healthier and more resilient to the effects of climate change. Similarly, this CCAP will shape the ability of decision-makers to make informed planning and policy decisions and to take appropriate actions to remedy potential impacts and consequences. This will be achieved by pointing to and helping to overcome barriers to building resilience in the affected communities, including the inadequacy of institutional and implementation capacities, limited awareness and availability of relevant data, and inadequate financial and technical resources for livelihood support, mangrove conservation, and community development. Essentially, this plan will help guide policy-makers and practitioners in their current and future climate change adaptation planning, implementation, and evaluation efforts.

I.2 PHYSICAL CHARACTERISTICS OF THE SLCLC

I.2.1 Geography

Sierra Leone is located on the west coast of Africa, between the 7th and 10th parallels north of the equator. The coastline of Sierra Leone stretches for about 506 km from North East where it is bordered by Guinea and Liberia to the South East. The SLCLC, located on the Atlantic edge of Sierra Leone is made up of five distinct administrative regions that stretch from the north to the southern parts of Sierra Leone. These regions include: Scarcies River Estuary (SRE), Sierra Leone River Estuary (SLRE), Yawri Bay, Sherbro-Bonthe River Estuaries (B-SRE), and the Western Area (see figure I.1). The SRE is found in Kambia District in the north of Sierra Leone and is formed by the Great and Little Scarcies which merge before emptying into the Atlantic Ocean. SLRE on the other hand is found in the Port Loko District in the north of Sierra Leone and is formed by the Bankasoka and

Rokel rivers that border Port Loko District and the Western Area (Seilhart and Gbondo 2011). It is important to note that the SLRE is host to historically important localities such as Tombo, Tasso, Bunce Island, and Queen Elizabeth II Quay (the largest natural harbour in West Africa) (EPA 2015a). The Yawri Bay is in Moyamba District in the southern province along three rivers- Ribbi, Bumpe, and Kagboro creek. Bonthe-SRE is also located in in the southern province in Bonthe District and primarily stretches along the Sherbro River. The last region, Western Area, is found in the west of the country along the borders of Port Loko and the Western Area Rural District (WARD).

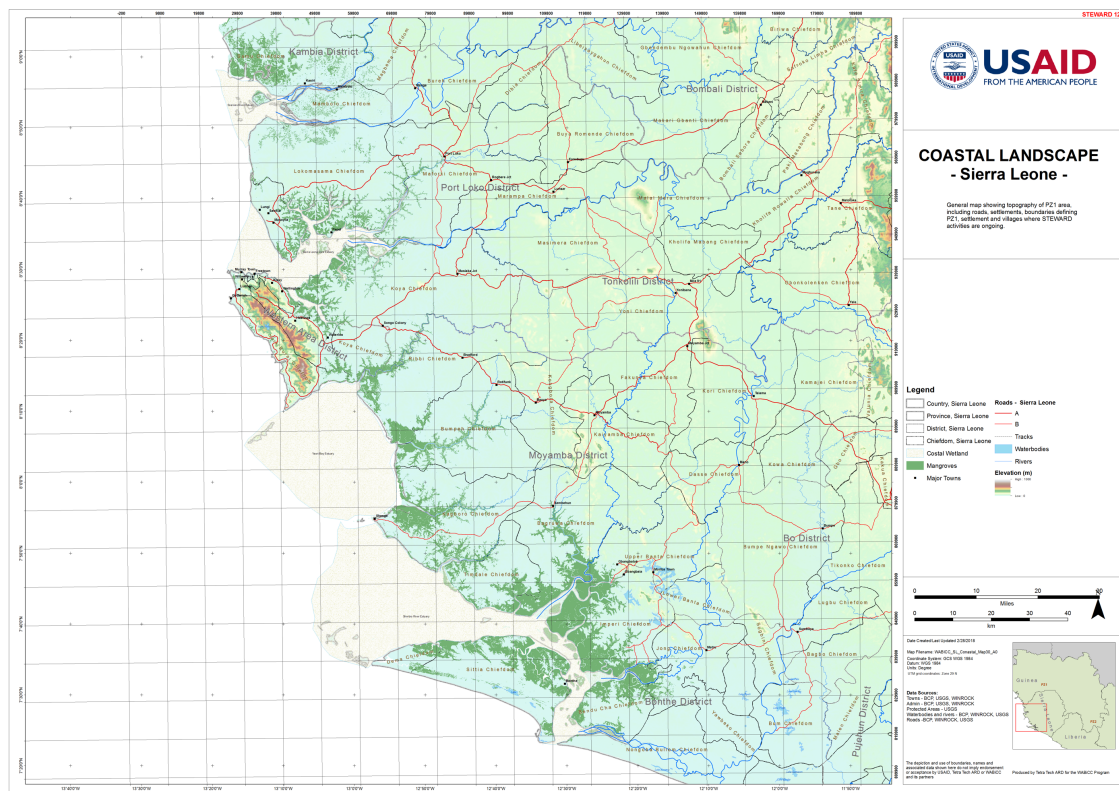


Figure 1 Regions of the Sierra Leone Coastal Landscape Complex

The entire coastline of Sierra Leone stretches for 506km. This coastline is characterized by sandy beaches, cliffs, lagoons, estuaries, mudflats, creeks, bays, and mangrove swamps. There are about 105200 ha of mangrove stands along this coastline, spread across the five regions as follows: Scarcies River Estuary (13,007ha), Sierra Leone River Estuary (34,234 ha), Yawri Bay (24,505 ha), Bonthe-Sherbro River Estuary (99,854 ha) and Western Area (7,189 ha). These mangroves occupy 47% of the coastline. Three of the four regions of the SLCLC are proposed Marine Protected Areas (MPAs), only the SLRE is an MPA and a designated Ramsar site.

1.2.2 Geology and geomorphology

Although a limited variety of minerals is found and extracted from the SLCLC, there are reports of the occurrence of diamonds, gold, iron ore, platinum, copper, cobalt, zircon, and manganese (see

table 2). Mining is chiefly in the hands of foreign companies (such as Zircon Mining), though exact estimates of the value of these coarse aggregates is not readily available. Fine aggregates like sand are extracted and used for construction purposes, though data on the quantity extracted is not available. Granite rock is also mined along the banks of coastal streams as a source of concrete material for the construction of roads and for export by foreign companies (EPA 2015a).

The coastal swamps where mangroves are typically found consist of alternating banks of silt, sand, gravel and clay. Silt is mostly found in the northwest, while the south has large areas of coarse sand. The Scarcies River Estuary for example, is characterized by partly compacted, cohesive silts and clays. The clay in this area has high salt-fixing capacity, providing a base for the development of potentially acid sulphate soils because of the marine influence. This soil type supports swamp rice production, which is mostly cultivated in areas previously forested by mangroves. Furthermore, clay is extracted near beaches by local residents for brick and ceramic making, leading to a significant change in the land cover and increasing coastal erosion. Furthermore, hard rocks are mined along the banks of coastal streams for the construction of homes and roads, and for export by foreign companies (EPA 2015a).

Location	Mineral	Quantity (indicative value in metric tons)
Konakridee	Sand and gravel	80,000
Tisana	Rutile	2,300,000
Shenge	Ilmenite	1,800,000
Sulima point	Zircon	230,000
Pujehun district	Monazite	2,500

Table 2 Location and quantity of some minerals sourced from the coastal zones (source Johnson & Johnson 2012)

Regarding geomorphology, the SLCLC is characterized by shelves, water column systems, structural systems and coastal landforms. Weathering of these geomorphologic features is caused mainly by increasing temperature and moisture, producing materials that find their way into rivers and the ocean. Surface waters in the SLCLC demonstrate variant temperatures because of the diluting effect of river discharge and increased precipitation. The western and southern parts of Sherbro Island show this kind of effect, creating a marked distinction in the salinity of shallow water and seawater areas. These features are mostly observable in the dry season, when there is less precipitation and river discharge.

Likewise, the SLCLC is characterized by canyons and shelf breaks, sea mounts, large gulfs, offshore banks, shoals and islands, and upwellings. Canyons mostly serve as sediment traps and are composed largely of rocks. Sea mounts are not characteristic of waters in this area and make up about 0.04% of seamounts world over. Large gulfs are also atypical of the coastal and marine features in the SLCLC, though offshore banks, shoals and islands can be found.

I.2.3 Hydrology

Hydrological features of the SLCLC include lagoons, rivers, estuaries which all end up into the Atlantic Ocean. These water bodies include the bays and estuaries of the Rokel, Great and Little Scarcies, Sherbro, Jong, Moa, Sewa, and Mano. The SLRE comprises major rivers such as Rokel and Bunce, and the Port Loko Creek, while the SRE contains rivers such as the Great (also known as Kobuter River) and Little Scarcies (also known as Kabba River). In the Yawri Bay, there are rivers such as Ribi, Kukuli, and Kagboro. The B-SRE shelters abroad waterway that is about 60km long, into which the Bagru, Jong, and Kittam rivers discharge. Together, these estuaries support diverse biodiversity which support local livelihoods. These water bodies contain large amounts of nutrients because of their nearness to terrestrial sources of sediments and surface run-offs from rains. In these waters, diverse florae and faunae also thrive because of the shallowness of the water and nutrients. Additional benefits of water bodies in this area include providing a means of transportation, and a source of recreation and food.

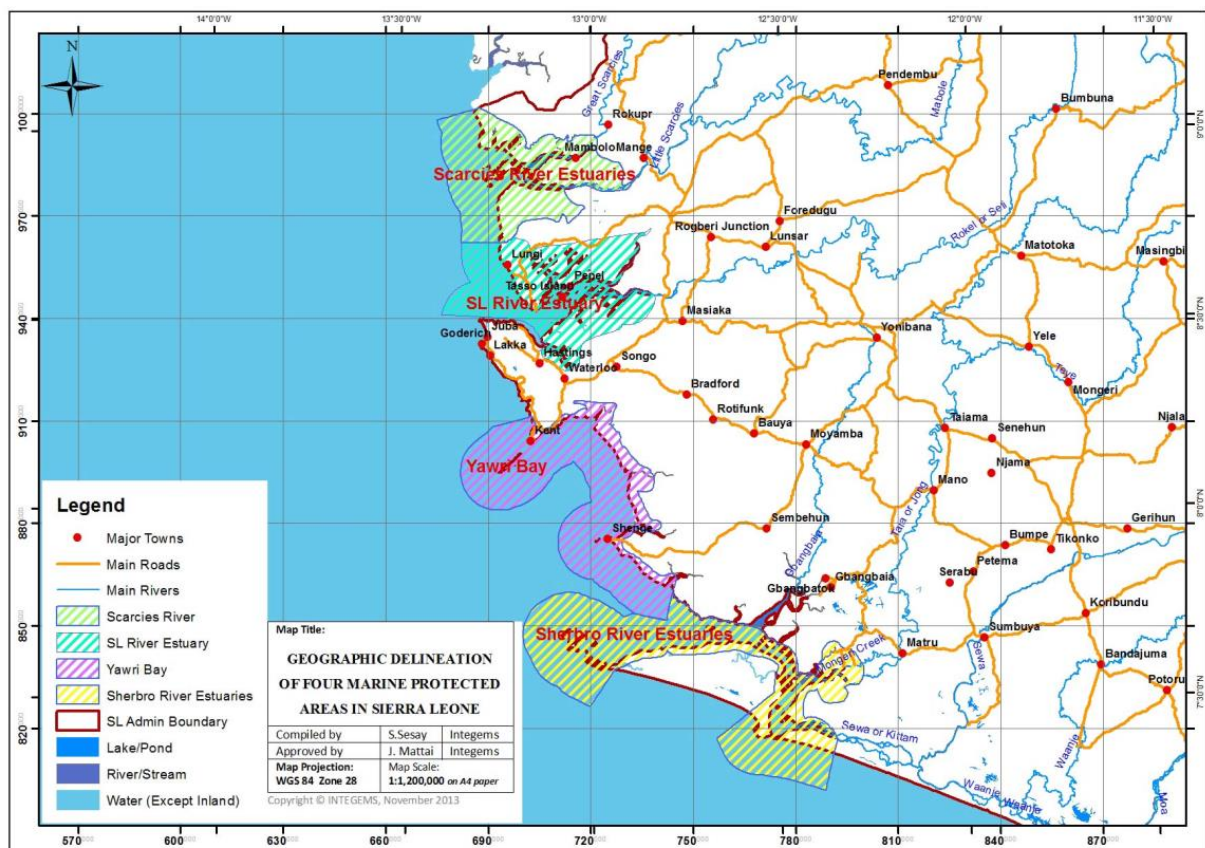


Figure 2 Estuaries in the SLCLC (Source: EPA 2015a Pp.9)

I.2.4 Biological diversity

The SLCLC is a large ecological complex of great environmental and biological importance. Common in this coastal scape are mangroves, fish and other marine species, with occasional spotting of

terrestrial and marine mammals. There are six mangrove species in the SLCLC, including *Avicennia germinans*, *Rhizophora harissonii*, *Rhizophora mangle*, *Rhizophora racemosa*, *Laguncularia racemosa*, and *Anisophyllia laurina*, but three are commonly reported by the local communities, including black, white, and red mangroves. In addition, different forms and sizes of biodiversity such as crabs, oysters, and abnormally-sized shrimp and lobsters are also found in the coastal waters of the SLCLC. Critically endangered species of wintering birds, such as Ringed and Kentish Plover, Sanderlings, and Curlew Sandpipers have also been reported to occur in this landscape. About twenty-three species of these threatened bird species have been identified and recorded along the Sierra Leonean coastline. The 350km stretch of beaches is dominated by mangroves and fine-grained sand and provide a feeding and nesting ground for turtles and birds. The mangrove ecosystem also provides feeding grounds for terrestrial mammals such as monkeys and aquatic mammals such as the West African Manatee, and a nesting and feeding ground for various species of turtles, fish and shrimps. Molluscs (bernaclles, mussels, oysters, periwinkles, limpets, and gastropods), algae, and coralline sponges can also be found on rocky shores in this area.

I.3 SOCIO-CULTURAL AND ECONOMIC CHARACTERISTICS

I.3.1 Demography

The SLCLC is home to approximately 2.2 million people. The average age of inhabitants across the SLCLC is 22, while the sex ratio measured as number of males per 100 females are as follows: 90.27 for the Scarcies, 87.35 for Sherbro, 70.86 for the SLRE, and 94.84 for the Yawri Bay (USAID 2017a). The statistics compares with the 2004 national census data, which places the sex ratio at 94 and the 2015 census that places same at 96 for males. Most regions of the SLCLC have slightly lower numbers of female-headed households and slightly higher number of male-headed households than the national average of 74.6 percent. The four regions are characterized by very low levels of literacy, with female residents being the most education-deprived. Movements between and across the different regions are associated with inter-marriages and the search for jobs and trade. The majority of residents speak more than one language; the most common being Themne and Krio. Other languages spoken in the SLCLC include Limba, Loko, Sherbro, Mende, and Maninka.

I.3.2 Social groupings and economic activities

Social groups found in the SLCLC include religious groups, cultural groups, and fishermen associations. Some groups are labour-related, like groups made up of fishermen, miners, farmers etc. Social groupings generally provide a means to making a living or gaining socio-cultural and political identity in the communities. Fishing is the major livelihood activity in all SLCLC regions, though smallholder rice cultivation can also be found. Tombo, Shenge, and Yeliboya supply most of the fish consumed in Freetown, which has increased in intensity due to the development of small artisanal

fishing projects by UNDP, Africare, and other agencies. Other economic activities include salt production, which uses large quantities of mangrove wood. Fish processing, especially smoking using traditional methods, also uses large quantities of mangrove wood brought into the communities by boats. Whereas fishing is the mainstay of the coastal economy, providing a source of income and livelihoods for both fishers, fish processors, and fish traders, it has also given rise to a booming secondary economy of boat building, wood cutting, fish transportation, basket weaving, selling fishing gears, and petty trading. It is believed that around 40,000 artisanal fishers and their families operate more than 12000 fishing boats that create up to 50,000 jobs in the fisheries sector (EJF 2009).

I.4 GOVERNANCE AND ADAPTATION ACTIONS

I.4.1 Laws, policies and plans

There is one National Climate Change Strategy & Action Plan or legislation that specifically targets climate change adaptation in Sierra Leone. However, most of the country's policy response to climate change are centered around internationally motivated directives from United Nations Framework Convention on Climate Change (UNFCCC), such as the National Adaptation Programmes of Action (NAPAs), National Communications etc. All of the other various country-wide laws, policies, and plans exist, but they focus more on the management of natural resources with very scant consideration of climate change. The following laws include elements that seek to govern access and use of mangrove resources in the SLCLC:

Laws

- 1) Draft Wetland Conservation Act (2015) formulated by the NPAA, which focuses on improving the sustainable management of priority wetland ecosystems by restoring, maintaining and enhancing the ecological processes essential for their effective functioning.
- 2) Fisheries Act (2007), which seeks to manage, develop and conserve all fisheries and marine resources. It seeks, among other things, to enhance the sustainable use of fisheries resources; increase co-management through committed, informed and involved stakeholders; diversity and increase international trade of fish and fishery; deliver cost-effective and efficient management tools; and promote sustainable aquaculture development.
- 3) Fisheries Development and Management Act (1994) and its subsidiary regulations of 1995 and 2010, which, together, seek to restrict harmful fishing practices and protect breeding zones.
- 4) Merchant Shipping Act (2009), which provides for the registration and licensing of ships, including steps to ensure maritime safety, pollution control, and environmental control.
- 5) Sierra Leone Maritime Administration Act (2000), which seeks to improve standards of performance, practice, and safety in the shipping industry, including the coastal and inland water transport system, and the maritime environment.
- 6) Draft Conservation and Wildlife Policy and Act, 2011, which sets out five principles for wildlife management (sustainable management, rights-based governance, economic and social

benefits, integrated wildlife conservation and culturally-sensitive, knowledge-based conservation) and recommends action in five areas (species management, conservation areas, research and monitoring, education and awareness, and capacity building).

- 7) Draft Forestry Policy and Act, 2011, which is set-out according to similar guiding principles as the draft Conservation and Wildlife Policy and establishes a set of policy objectives around forestry land management, forest-based industry and practices, ecosystem conservation, education and awareness, research and monitoring, and capacity building.
- 8) Sierra Leone Meteorological Agency Act (2017), which establishes the Sierra Leone Meteorological Agency (previously known as Meteorological Department) with the authority to advise government on all aspects of meteorology, climatology, climate change, and related issues, including: developing policy; undertaking relevant research; issuing weather information and forecasts; promoting the use of meteorology in agriculture, food monitoring and environmental monitoring; serving as the focal agency for all climate change matters etc.

Policies

- 1) The National Environmental Policy (1994) seeks to ensure sound environmental and natural resources management throughout Sierra Leone. The key objectives are to encourage and facilitate local participation in environmental governance practices; secure an environment that is adequate for the health and wellbeing of communities and ecosystems; and foster learning and knowledge exchange through public education campaigns and programmes.
- 2) Regional Development Authorities policy (2007), which, like the Local Government Act (2004), provides for the use of local-level institutional arrangements to ensure equitable and balanced national sustainable development planning and effective natural resources management. The policy has a direct bearing on streamlining and strengthening the roles and functions of community-based structures in coastal zone development and management.
- 3) National Land Policy (approved by cabinet in November 2015) is part of efforts to reform land policies in the country to incorporate good practices related to gender equality and land registration.

Plans

- 1) National Adaptation Programme of Action (2007), which documents information and resources used in the identification and prioritization of strategies for climate change adaptation in the country. The Sierra Leone NAPA recommends climate adaptation projects under the following themes: establishment of early warning systems to facilitate effective climate awareness and education; development of an integrated natural resources and environmental management programme; promotion of renewable energy systems; management and protection of forest reserves and catchment areas including wetlands; improvement of energy efficiency and conservation to reduce deforestation for fuelwood and charcoal; development of an integrated coastal zone management plan; development and

enactment of appropriate policies and laws; delineation and restoration of degraded vulnerable coastal habitats and ecosystems

- 2) Nationally Determined Contributions (2017), which includes prioritized activities such as: a comprehensive assessment of vulnerability and GHG contributions; management of rangelands; restoration of degraded areas using soil and water conservation approaches; management of coastal areas and fisheries; promotion of early warning and observation systems; improvement of local adaptive capabilities through safety nets and insurance schemes; and integration of disaster management, land tenure, extractives, tourism, and health matters into climate change actions and legislations.
- 3) National Biodiversity and Strategic Action Plan (2007 and 2014), which seeks to protect marine and coastal biodiversity by strengthening technical research, developing and applying landscapes, establish Marine Protected Areas (MPAs), foster broad stakeholder participation, facilitate learning and knowledge exchange, and promote positive attitudes through communications and education.
- 4) Integrated Coastal Zone Management Plan (2015), which seeks to harmonize existing plans for the management of the coastal zone and formalize collaboration between and among concerned sectors. The ICZMP lays out four pathways for improving coastal ecosystems management in Sierra Leone, including: increase knowledge generation and conversion into effective management actions; adopt an adaptive collaborative management approach for design and delivery of coastal management institutions and interventions; follow thorough procedures to manage for results, thus improving monitoring, ownership, and accountability.
- 5) National Climate Change Strategy and Action Plan includes mechanisms and frameworks for climate adaptation and resilience-building at the national, district and community levels. The plan was supported by UNDP and validated in 2015.
- 6) National Adaptation Plan (NAP) framework (2019) sets objectives for and outlines the principles, approaches, and structure of the NAP process. It identifies medium and long-term priorities for adaptation, including ensuring that the NAP is aligned with existing policies, plans, and strategies.

I.4.2 Institutional arrangements

The coordination of climate change activities is the responsibility of the National Climate Change Secretariat (NCCS) under the Office of the President. This secretariat is now reported to be housed with the Environment Protection Agency (EPA-SL), where the National Adaptation Planning focal point is also based. Paradoxically, the National Focal Point for the UNFCCC is housed within the Sierra Leone Meteorological Agency (SLMA). Regardless, it is the Office of National Security and Disaster Management Department (DMD) that should oversee adaptation and resilience-building after major disasters in the country. There is an informal climate change coordination committee that meets irregularly in Freetown to discuss climate change issues under the leadership of EPA-SL. This committee represents in different ministerial departments and agencies. However, it is not clear how this entity is ensuring that climate change is mainstreamed into different sectors of the economy.

Besides the coordinating agencies, there are a plethora of institutions involved in the management of coastal resources in the SLCLC that influence directly or indirectly the management of climate change in Sierra Leone. These institutions include central government departments, devolved government institutions such as councils and chiefdoms. In addition, these institutions are complemented by a plethora of local to national level organizations established by development agencies and Non-Governmental Organizations (NGOs). Below is a summary outline of some of the MDAs that are directly intervening in the SLCLC:

- 1) Ministry of Fisheries and Marine Resources (MFMR), which is responsible for developing and managing fisheries and marine resources across the country. In this regard, MFMR also leads in establishing Community Management Associations (CMA) and getting them to work; undertaking coastal livelihood support interventions; and providing technical advice for the establishment and running of Marine Protected Areas (MPAs) which also involves formulating and enforcing laws and policies as applicable.
- 2) Ministry of Agriculture, Forestry, and Food Security (MAFFS), which hosts the Forestry Division and the National Protected Area Authority (NPAA), is responsible for conserving degraded areas along the coast, especially protected areas like the Yawri Bay. NPAA recently developed a Wetlands Conservation Act (2015) that seeks to facilitate the sustainable management of priority wetland ecosystems across the country.
- 3) Local Councils (including District Councils in various Coastal Districts) take care of licensing of boats, as well as legalizing community by-laws using procedures set out in the Local Government Act (2004). MFMR have devolved the functions of managing/licensing artisanal fisheries to local councils, which is similar to what MAFFS have done for forest governance.
- 4) Traditional authorities (such as Chiefs, Headmen etc) who are the major custodians of land in the coastal areas and have a mandate to make and enforce by-laws that ensure effective governance of common property resources. Management practices closely follow provisions in the Local Government Act (2004) and the Chieftaincy Act (2009).
- 5) Non-Governmental Organisations like Conservation Society of Sierra Leone (CSSL) and International NGOs like the Environmental Justice Foundation (EJF) have been active in the SLCLC in the past decade. CSSL's wetlands conservation project, and EJF's maritime administration initiative have been presented in more detail in the last chapter.
- 6) Research institutions like the Department of Aquaculture and Fisheries Management at Njala University, and the Institute of Marine Biology and Oceanography (IMBO) at Fourah Bay College, have contributed to much of the technical research that has been done on processes and practices in the SLCLC and beyond.
- 7) The Disaster Management Department (DMD) of the Office of National Security (ONS) led the development of a Disaster Management Policy, Strategy and Action plan, which were approved by the National Security Council in November 2015. DMD has also established a centralized Disaster Inventory database and conducted trainings to increase staff capacity for efficient collection, processing and dissemination of disaster-related data.
- 8) Ministry of Water Resources (MWR), which recently implemented a project on building adaptive capacity to catalyze active public and private sector participation to manage

the exposure and sensitivity of water supply services to climate change.

- 9) Ministry of Energy (MoE), which started a project on energy efficient production and utilization of charcoal through innovative technologies and private sector involvement in 2014. Among other deliverables, the project sought to reduce greenhouse gas emissions in rural households and industrial sectors of Sierra Leone through sustainable biomass resource production and utilization, and promotion of sustainable biomass energy technologies using market-based approaches.
- 10) Sierra Leone Meteorological Department (SLMD) which secured support from the UK Meteorological Office in 2013 for the implementation of a project on strengthening climate information and early warning systems for climate resilient development and adaptation to climate change (CIEWS). One of the key outputs in Sierra Leone is to re-establish a functional network of meteorological and hydrological infrastructure in order to better understand and predict climatic changes and provide early warning information to relevant sectors such as transport and agriculture.

All of these organizations strive to promote the sustainable management of coastal resources in the SLCLC. However, this plethora of institutions do not have clearly devolved roles and responsibilities, which has led to increased conflicts between institutions and undermined natural resource management efforts. For instance, there are challenges associated with placing wetland conservation under the Ministry of Agriculture, Forestry, and Food Security (MAFFS), instead of under the Ministry of Fisheries and Marine Resources (MFMR), which is responsible for managing fish and other living resources in the coastal and estuarine habitats. Other issues include centralized management, weak policies, and inappropriate institutions. Many agencies are understaffed to carry out their delegated tasks, which is partly because the government lacks a sustainable funding strategy for projects designed for and delivered in coastal areas. In this regard, the establishment of an institutional platform for policy and project coordination could be helpful. One such effort is the Coastal Chiefdoms Natural Resources Management Network (CCNRMN), which WABiCC has intends to use as a direct link between local community and the central government actors involved in coastal ecosystem management.



Plate 6 Degraded and regularly flooded shoreline of Sasiyeck community in the Scarcies region of the SLCLC

PART 2: CLIMATE CHANGE AND THE COAST OF SIERRA LEONE

2.1 VALUE OF THE SIERRA LEONE COAST

The coastline is of immense ecological and economic significance to Sierra Leone's economy. This coastline is epitomized by a variety of coastal habitats, from which various stakeholders rely and depend on for socio-economic and developmental needs. It is estimated that 47% of Sierra Leone's coastline is covered with mangroves. Mangrove in this coastal landscape stand out as special ecosystems that play essential functions in the management of climate change. With respect to building resilience to climate change, they provide protection to coastal communities and shorelines against erosion and strong winds. In addition, they reduce the impact of flooding by acting as surface sponges that favor water infiltration. In supporting other ecosystems and biodiversity, they serve as fish nurseries and provide detritus to other nearby marine ecosystems. At the same time, mangroves provide services to society, such as fire wood, construction wood and a variety of non-timber forest

products, that form the basis of livelihood strategies followed by many fishing communities and non-fishing coastal communities. Fisheries represent around 10% of Sierra Leone's gross domestic product and directly employ over 40,000 fishermen with a total of 500,000 of people employed either directly or indirectly in the fisheries-related sector (fish processing, marketing, trading and transporting, boat building, wood cutting, basket weaving, and so on). Fish are also the most affordable and widely available protein source and constitute 80% of animal protein consumed in the country. Fisheries contribute significantly to poverty reduction and food security in Sierra Leone.

By its very nature, this coastline has led to the development of an enabling environment for primary industries such as tourism, transportation, agriculture, mining, boat building and repairs, fishing (and related preservation and commercialization activities), construction etc. In the case of Sierra Leone and the SLCLC specifically, data on the coastal economy and the broader value of the coast are limited. More research is needed to quantify the non-market value of coastal wetlands, including the total value of ecosystem services that they provide.

These coastal resources and values are increasingly undermined by the ever-changing environmental conditions. For instance, in recent decades, intense and frequent flash floods and storms, with four major floods affecting up to 220,000 people in the last 15 years, have had significant effects in coastal sierra Leone (World Bank 2017). This outcome has implications to the development goals of the country. For instance, the World Health Organization (WHO) attributes regular outbreaks of cholera, diarrhoea and dysentery to these changing conditions, making similar attributions for other West African countries. Still, further research is needed to quantify the trends and impacts of climate change on the coast of Sierra Leone.

2.1.1 Trends and variability of climate variables in Sierra Leone

Sierra Leone is having a tropical climate that is strongly influenced by the West African Monsoon. The rainfall season begins in May and ends in October, peaking between July and September. Generally, the West African Monsoon causes exceptionally high rainfalls on the West African coast in the wet season. In the coast of Sierra Leone, for example, monthly rainfall can exceed 1000mm, but decrease significantly to about 300mm in the far west. The timing and intensity of the West African Monsoon determine changes in the precipitation pattern, as well as the intensity and frequency of storms and winds. These interactions, as well as the local topography, lead to annual rainfall amounts, especially in the SLCLC, that are among the highest in Africa. On the other hand, temperatures in Sierra Leone show a statistically significant trend of approximately 0.14 degrees Celsius per decade. Temperatures are lowest at the peak of the wet season (about 22 to 25 degrees Celsius) and high during the rest of the year (around 25 to 27 degrees Celsius) (Ref. NAPA report). Despite these claims, much of the available information on the general climate of Sierra Leone needs to be substantiated by more localized, data and information. The available data on climate trends, risks and impacts mostly lack the granularity and accuracy needed for effective decision-making. Besides, there is a general lack of access to relevant, in-situ information about climate change and related conditions of environmental change, because of a weak climate research and communication infrastructure.

2.1.2 Future climate trends

Recent projections show that the mean annual temperature may increase by 1.0 to 2.6°C by the 2060s (McSweetney et al 2010). The average number of hot nights per year increased by 38 between 1960 and 2003 (McSweetney et al 2010) and a substantial increase in the frequency of “hot” days and nights is anticipated in the future. In addition, long-term projections suggest an overall increase in temperature between 1.5 and 4 degrees Celsius and potential increase in rainfall. This projection shows that more rainfall will progressively be recorded in the latter half of the year (McSweetney et al 2010). However, the mean annual rainfall over Sierra Leone has decreased since 1960, but it is difficult to term this as climate change because of the variable nature of rainfall in this region. Considering the lack of capacity to adapt and respond to these changing circumstances, the country is more vulnerable to the adverse effects of climate change. For instance, Sierra Leone is the 3rd most vulnerable to the effects of climate change in the world (Maplecroft 2013). This vulnerability mostly due to the fact that the country has one of the lowest adaptive capabilities globally.

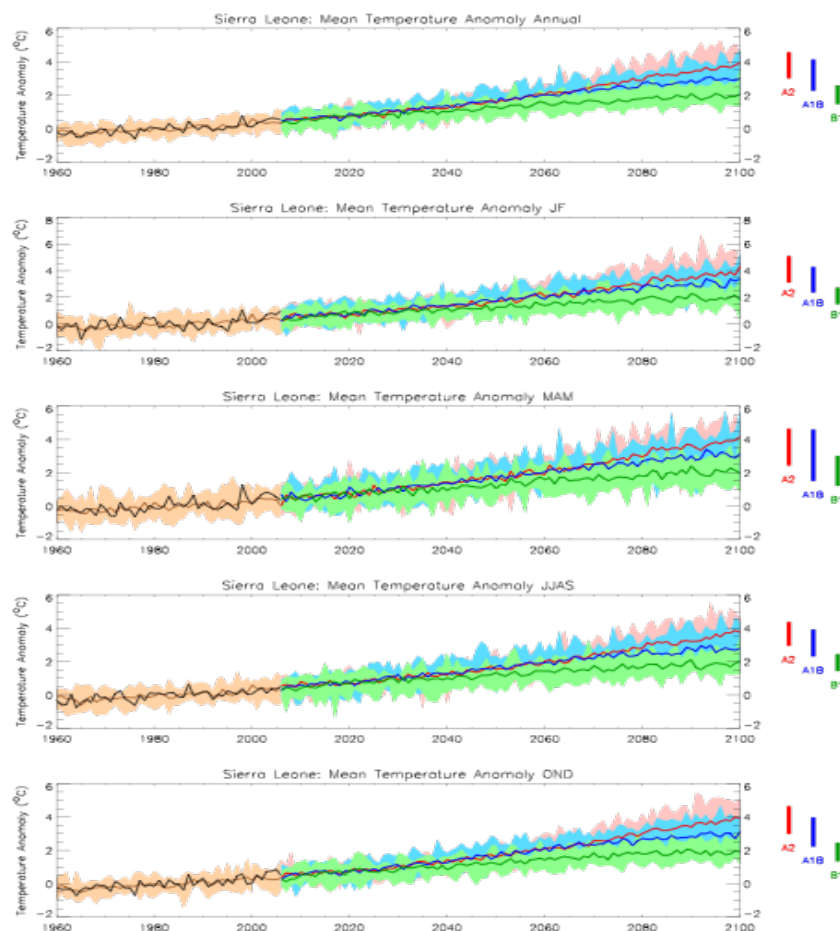


Figure 3 Trends in annual and seasonal mean temperature for the recent past and projected future. All values shown are anomalies, relative to the 1970-1999 mean climate. Black curves show the mean of observed data from 1960 to 2006, Brown curves show the median (solid line) and range (shading) of model simulations of recent climate across an ensemble of 15 models. Coloured lines from 2006 onwards show the median (solid line) and range (shading) of the ensemble projections of climate under three emissions scenarios. Coloured bars on the right-hand side of the projections summarise the range of mean 2090-2100 climates

simulated by the 15 models for each emissions scenario (Source: McSweetney et al. 2010).

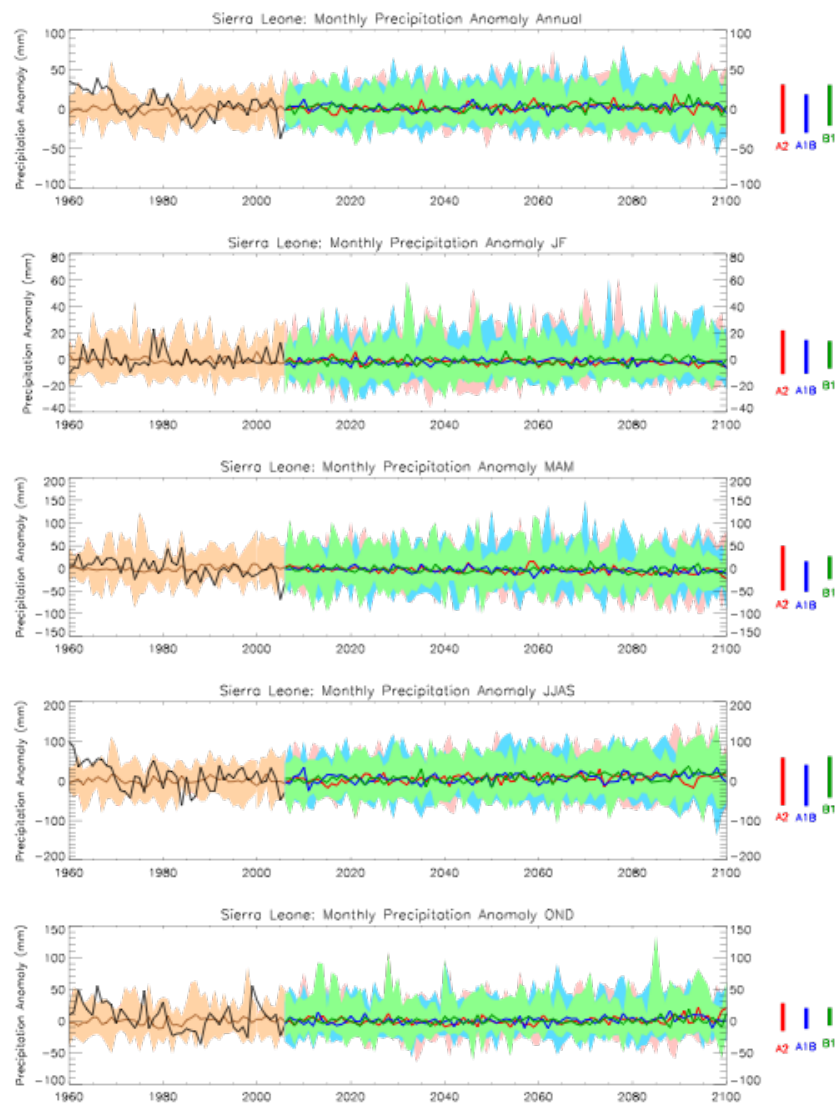


Figure 4 Trends in monthly precipitation for the recent past and projected future (Source: McSweetney et al. 2010)

Increasing air temperature

Except for ocean acidification, all of the climate change phenomena discussed in this section are attributable to increasing air temperature. Increasing temperatures will also mean more droughts and wildfires, which threaten human and other populations and weaken infrastructure and its capacity to provide the necessary services. Moreover, increasing air temperature may affect coastal ecosystems by killing native species (if they cannot withstand the increasing temperature), and engender disruptions in the food web, thus stressing the critical ecosystems and economies that rely upon them. Furthermore, increasing air temperatures will cause water scarcity and pose significant challenges to areas where runoff, streams, and lakes are critical sources of water. The significance of

these events can be drawn from current projections for temperature, which indicate that hotter days will occur on 23 to 63% of days by the 2060s and 37 to 84% of days by the 2090s (McSweetney et al 2010).

Changing precipitation patterns

Precipitation patterns will vary across the different regions of the coast of Sierra Leone; simply, there will be too much or less rainfall in some areas in a specific season or throughout the year. In either case, water quality will be adversely affected. Heavy rains that increase surface run-off may pollute coastal waters with nitrogen, phosphorous and sediments, and sometimes, toxic contaminants that could affect dissolved oxygen levels. At the same time, low rainfall will diminish water supplies, increase the salinity gradient of freshwater and significantly stress coastal ecosystems. More rainfall will also cause flooding and erosion that could engender considerable loss of and damage to lives and property, and harm ecosystems along the coasts and throughout watersheds. Existing flood and water management structures that were not designed with climate change in mind will be negatively affected. Generally, although more rainfall (whether less frequent but more intense) is likelier in the context of the coast of Sierra Leone, the lack of regular rainfall combined with higher temperatures that could cause severe droughts, should also be considered. Drought conditions will further compound the challenge with drinking water in coastal communities, which will further stress human and ecosystem health and cause fires that have the potential of destroying built and natural environments. Current projections for rainfall help put these consequences into perspective. For instance, weak changes in rainfall amounts are expected to occur for the 2020 to 2049 period, with a potential increase in rainfall of about 30% for coastal regions (McSweetney et al. 2010). Under these conditions, climate-induced events (like flash floods, storms and subsidence) could become more frequent, putting further stress on the natural resources on which coastal populations largely depend.

Intense and frequent storms

Coastal storms have become frequent and more intense, especially in the wet season. Storms cause significant damage to the built and natural environment through flooding, erosion, and high winds. Consequences of these storms may include injuries and loss of life, as well as damage to and destruction of coastal property and infrastructure. In the last 15 years, intense and frequent storms, as well as flash floods, have affected more than 220,000 people along the coast of Freetown (World Bank 2017). Storms have also accounted for the majority of disaster losses in coastal areas, leading to economic impacts and consequences that could be exacerbated by climate change. In addition to the physical damage caused by flooding and high winds, storm water runoff also introduces pollutants and toxic substances to ecosystems, which further stresses coastal habitats. It should also be noted that while some coastal areas might be resilient to these circumstances, they may succumb under the influence of cumulative impacts, such as multiple storms and rising sea levels, which will lead to diminished or loss of productivity, damage to and loss of protective features (such as wetlands), and leave coastal communities more vulnerable to future storms. The Sierra Leone NAPA (GoSL 2007) observed that the pre-monsoon period which runs from April to June, is now marked by stronger

winds and more frequent storms, causing greater damage to lives and property. Changes to the characteristics of the seasons have been linked to climate change and underlying factors like turbocharged urbanization, which has led to a removal of the protective forest cover to deliver housing projects.

Rising sea levels

Sea level rise is largely associated with the thermal expansion of the oceans and the melting of glaciers and polar ice sheets resulting from a warming atmosphere (Karl et al. 2009). Atmospheric and oceanic circulation, which will be altered by climate change, will also affect relative sea levels- which is the sea level measured against land elevation at a given particular location. Because of the variability of these processes, relative sea level rise and its impacts and consequences, will vary across locations on the coast of Sierra Leone. Rising sea levels have caused significant damage to coastal property at Lakka and Konakridee, thus threatening human health and coastal ecosystems that become sediment-starved. Such conditions will also inundate coastal wetlands and other low-lying lands and intensify erosion and flooding as new areas become exposed to storm surges, waves, currents and tides. Furthermore, as rising sea levels cause changes to coastal ecosystems, these ecosystems will, in turn, impact the biological, ecological, and physical services they provide. Human populations will also be affected by the reduced quantity and quality of freshwater, as saltwater inundates estuaries and rivers; water tables will rise; and affected lands and infrastructure will introduce more nonpoint source pollutants and toxic materials into the rising seas. Put differently, any rise in current sea levels will mean land and ecosystem loss, causing a loss of associated cultural resources especially if local populations are forced to relocate.

Increasing water temperature

Increasing air temperatures are leading to warmer conditions in both marine and fresh water systems. In addition to their role in sea level rise, increases in water temperature, and associated changes to coastal currents that moderate ocean temperatures and increased stratification, will impact the quality of marine and coastal waters and their biological resources. This will, in turn, affect species distribution and biological productivity and connectivity. Warming seas will likely be accompanied by increased occurrences of pathogens and disease, harmful algal blooms, and invasive species. Under these conditions, coastal ecosystems will be significantly weakened or entirely lost, causing profound consequences where fisheries and coastal communities depend on a vulnerable resource for sustenance and livelihoods.

Ocean acidification

As the chemistry of the oceans change because of warming temperatures and rising sea levels, the accumulation of Carbon (IV) Oxide in the atmosphere also changes. Ocean acidification may result from an increase in Carbon (IV) Oxide absorption by ocean water and the corresponding decrease in

pH. As sea water becomes more acidic, less calcium carbonate is available for species that need it to build their shells and skeletons. This poses significant risks to the marine food web and associated coastal communities. In this regard, a grim situation has recently been presented for the coast of Sierra Leone where water quality is thought to be deteriorating due to an increase in land-based activities. A decline in water quality in some coastal areas is thought to be having an adverse effect on shore waters, estuaries, lagoons, creeks and the adjacent seas. Sea-borne pollution and coastal erosion is also closely linked with declining fish stocks, as well as the alteration and degradation of critical habitats. Increases in coastal populations and industrial development are also connected to these changing seawater conditions, as beaches and adjacent seas are constantly littered by debris items. These circumstances are expected to persist and worsen for the foreseeable future because of climate change impacts and consequences.

2.2 IMPACTS OF CLIMATE CHANGE & OTHER RISKS ON THE COAST

Sierra Leone faces multiple risks from climate change that threaten key economic sectors such as agriculture, fisheries and transport (World Bank 2017). These risks are anticipated to increase because of the potential for wider environmental degradation driven by an economy that strongly depends on natural resources, coupled with high rates of poverty and unemployment. This high dependency on natural resources has increased the probability for environmental degradation, hence leaving Sierra Leone vulnerable to climate change impacts. The coast of Sierra Leone is already subject to an array of social and environmental stressors that have led in habitat degradation, loss and conversion. Key stressors driving this change include un-planned coastal development, overexploitation, lack of appropriate legislation or poor enforcement of legislation. According to the Intergovernmental Panel on Climate Change (IPCC), climate change is “any change in climate over time, whether due to natural variability or as result of human activity”. Climate change will synergize with these none climatic stressors and exacerbate the effects of climate change on ecosystems and humanity (IPCC 2007). The consequences of this synergy will be more severe for coastal communities, economies, and ecosystems such as the SLCLC. For the coast of Sierra Leone, some of the observed climate change phenomena include: increasing air temperature, changing precipitation patterns, intense and frequent storms, rising sea levels, increasing water temperature, ocean acidification, declining coastal wetlands, and declining river levels.

Table 3 provides a summary of how climate change may affect (and in some cases, is already affecting) coastal communities in Sierra Leone. It presents a general overview of the issues with national-level observations and projections and offers a starting point for discussions. Specifically, the table points to the key climate change phenomena and their associated impacts and consequences that may be included, although possibly in a restricted way, within measures for climate change adaptation, which are addressed further in this guide. Brief descriptions of the potential impacts and consequences of the various conditions succeed the table. The general nature of this plan, and the paucity of data on trends, impacts and consequences, do not allow for an in-depth coverage of how the different

conditions may vary in different settings along the coast. At the same time, whereas the narrative is mostly presented in the future sense, it should be noted that some of these impacts and consequences are already being felt. Likewise, it is important to note that these stressors will not occur in isolation. The possibility of interaction with other stressors and socio-economic factors, as well as the possibility of cumulative secondary impacts should not be overlooked because a combination of climate change phenomena and human activities that have adverse effects will lead to worse impacts and consequences than those engendered by individual factors and conditions. Therefore, it is critical to manage not only climate change effects but also human activities, including mining, infrastructure development, urban development, forests and wildlife, farmlands, rangelands, tourism, fisheries, and water resources.

Climate change impact	Associated potential impacts	Associated potential consequences	Observed changes	Projected changes
Increasing air temperature	Drought, wildfire, changes in timing of ecological events, invasive species	Illnesses, injuries, and loss of life; loss/degradation/alteration/migration of coastal ecosystems and the goods and services they provide; decline in quantity and quality of freshwater; destruction and damage to coastal property and infrastructure; economic losses	Mean annual temperature has increased by 0.8°C since 1960, an average rate of 0.18 °C per decade.	The mean annual temperature may increase by 1.0 to 2.6°C by the 2060s.
Changing precipitation patterns	<p><i>Increasing precipitation</i> Flooding, erosion, nonpoint source pollution, introduction of toxics, salinity shifts</p> <p><i>Decreasing precipitation</i> Drought, wildfire, nonpoint source pollution, salinity shifts</p>	Illnesses, injuries, and loss of life; destruction and damage to coastal property and infrastructure; loss/degradation/alteration of coastal ecosystems and the goods and services they provide; decline in quality of freshwater; economic losses	Mean annual rainfall over has decreased since 1960. The rainfall record is punctuated by wetter and drier periods; the 60s and late 70s were particularly wet, whilst the early 70s and 80s were very dry. Rainfalls in 2005 and 2006 were very low (McSweeney et al 2010). ^{[1][SEP]}	Rainfall is projected to change by -27 to +29% by the 2090s, and -19 to +33% in OND (McSweeney et al 2010). ^{[1][SEP]}
Intense and frequent storms	Flooding, high wind, high waves, erosion, salinity shifts, nonpoint source pollution, introduction of toxics	Injuries and loss of life, destruction and damage to coastal property and infrastructure, loss/degradation/alteration of coastal and marine ecosystems and the goods and services they provide, decline in quality of freshwater, economic losses		
Rising sea levels	Coastal inundation, erosion, storm surge flooding, rising water tables, saltwater intrusion, nonpoint source pollution, introduction of toxics	Injuries and loss of life, destruction and damage to coastal property and infrastructure, loss/degradation/alteration of coastal and marine ecosystems and the goods and services they provide, decline in quantity and quality of freshwater, economic losses, loss of beach		

		access, loss of cultural resources, population displacement/ migration		
Increasing water temperature	Coral bleaching, pathogens and disease, harmful algal blooms, invasive species, shift in species range, changes in timing of ecological events	Loss/degradation/ alteration/migration of coastal and marine ecosystems and the goods and services they provide, decreased water quality, economic losses		
Ocean acidification	Dissolution of calcium carbonate in marine shell-forming organisms	Loss/degradation/ alteration/migration of coastal and marine ecosystems and the goods and services they provide, economic losses		
Declining community assets	Drought, wildfire, flooding, erosion, nonpoint source pollution, introduction of toxics, salinity shifts	Illnesses, injuries, and loss of life, loss/degradation/alteration/ migration of coastal ecosystems and the goods and services they provide, decline in quantity and quality of freshwater, destruction and damage to coastal property and infrastructure, economic losses, navigational challenges, reduced access to waterfront facilities, public trust conflicts, sea level rise, increasing population leading to habitat conversion and biodiversity loss due to lack of appropriate climate change adaptation policies, spread of communicable diseases like cholera, typhoid etc.		
Declining coastal wetlands	Storm surge flooding, erosion, nonpoint source pollution, coastal inundation	Loss/degradation/ alteration/migration of coastal and marine ecosystems and the goods and services they provide, destruction and damage to coastal property and infrastructure		

Table 3 Current and potential climate change impacts and consequences in coastal areas in Sierra Leone

2.3 EXTENT OF CLIMATE CHANGE VULNERABILITY IN THE SLCLC

It is increasingly unequivocal, based on recent studies (USAID 2017a, b), that the Sierra Leone coast is vulnerable to the risks posed by climate change. Climate risks in the SLCLC are commonly epitomized by events such as recurrent floods, strong winds, heat waves, intense and frequent storms, and landslides, which are likely to be exacerbated in the coming years. The Notre Dame Global Adaptation Index ranked Sierra Leone 158 out of 182 countries in terms of vulnerability to climate change. With 13% of its area and more than 35% of the population at risk, the mortality from multiple, climate-induced hazards (World Bank 2017). The SLCLC is particularly vulnerable to climate change because of the extent of mangrove forest loss, exposure of coastal populace to the effects of sea-level rise and winds, and high poverty levels (see figure 5).

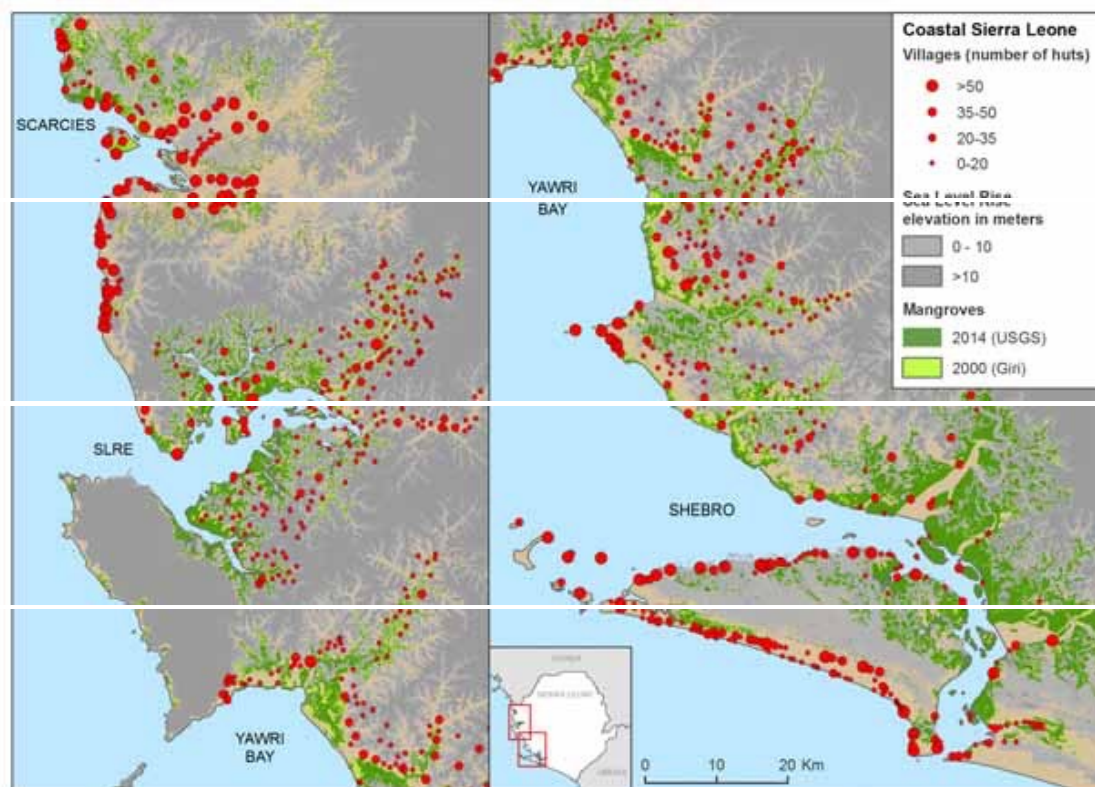


Figure 5 Mangrove extent as of 2014 (dark green) and 2000 (light green), along with mangrove settlement size and location information. Sources: The year 2000 mangrove layer is from Giri et al. (2013), and the 2014 mangrove layer is from unpublished data provided by Gray Tappan, USGS Eros Data Center. Note that both the 2013 and 2000 layers used Landsat imagery, but that the methods differed, and hence the mangrove layers are not directly comparable.

Mangrove deforestation which exposes both coastal ecosystems to climate change vulnerabilities is driven by the excessive exploitation of wood for fish smoking, energy poverty in urban areas like Freetown, construction, land reclamation for urban development and clearing for rice farm development (see plate 7). Heavy winds have often caused fires (from smoke houses and cook stoves) which spread across densely built villages and causing damage to property and lives. This means that improper rural, as well as urban town planning might also be a driver of climate change

vulnerability. Strong storms and heavy winds also destroy houses and capsize passenger boats, causing significant loss of lives and property. Floods also leads to salt water intrusion, salinization, and loss of productive land and crops, hence impacting the livelihood strategies of coastal communities that thrive in these risk prone areas. These conditions have persisted due to a combination of a lack of adaptive capacity, exposure of communities and ecosystems that is leading to increase sensitivity of these systems to the effects of climate change. Regardless of the general vulnerabilities, areas of the landscape suffer from differentiated effects. For instance, communities such as seaport in the Yawri Bay and Sasiyeck in the SRE are more vulnerable than others. Consequently, in planning for adaptation, it is important to take into consideration localized specifics including how social and economic factors and conditions may distinctly affect local conditions because of the complexity of the phenomenon of climate change.



Plate 7 Major drivers of mangrove deforestation in the SLCLC (rice cultivation and fish smoking)

2.3.1 Climate change impacts on community assets and coastal resources

The climate change has led to various impacts to coastal community assets and resources (human, financial, natural, physical, social, and cultural). Flooding, intense storms, high winds and wildfires affect coastal communities and ecosystems in different ways, as described in the foregoing sections (see table 4). Flooding, for instance, has had a huge toll on human environments in Sierra Leone in the last 5 years. A recent mudslide at Regent area below Mount Sugar Loaf (the highest peak in the north of the Western Area Peninsula) on August 14, 2017, caused flooding in various parts of Freetown, affecting about 6000 people, 1,141 of which have been declared dead or missing. The total economic value of the effects of the landslide and floods is estimated at about SLL 237.37 billion (USD 31.65 million) according to the 2017 World Bank Loss and Damage Assessment Report. These impacts are the result of a blend of climate variability and unsustainable land use practices (such as building on steep slopes). The risks can be avoided or at least reduced through improved land use practices.



Plate 8 Communities flooded, and houses destroyed (and buried) by the recent Mount Sugar Loaf landslide in Freetown

Sector	Impacts of climate change threats	Impacts of human threats
Mangrove ecosystem	Inundation, asphyxiation or possible migration of mangroves as a result of sea level rise	A considerable fraction of the mangroves of Sierra Leone has been lost as a result of habitat destruction for development in the SLRE, agricultural expansion in the Scarcies and Bonthe-Sherbro regions. Cutting of mangroves for construction and fuel wood use across all four coastal landscapes is an important threat. The spread of sargassum spp, and reported sand mining of riverbeds and beaches in the SLRE
Fisheries	Loss or shifts in critical fish habitat locations due to increasing temperatures.	Over harvesting of fisheries and destructive fishing practices (such as bottom trawling in shallow inshore areas, use of small-size nets fishing, beach seining).
Agriculture	Storms, erosion, and heavy precipitation inundates and erodes beaches, destroys crops and compromises water quality for farming. Poor germination of planted seeds due to extreme late rains and high temperatures.	Persistent use of fertilizers by rice farmers might be polluting fresh water sources and enabling nutrient runoff. In some enclosed water bodies, nutrient enhancement could lead to eutrophication. Flooding of rice fields could lead to total loss of transplanted rice either by herbivorous fish eating the rice or the rice rot due to prolonged submergence under water.
Freshwater resources	Saltwater intrusion reported in the SLRE and Yawri Bay regions is causing the salinization of fresh waters, salinizing farming lands and soil.	This would affect drinking water sources and cause crop failure particularly in estuarine areas
Human Settlements	Coastal and riverine flooding is forcing the temporal relocation of population to higher areas in these coastal landscapes. Inundation of houses, destruction of property and overtopping of local flood defense mechanisms	Sea level rise, increasing population will lead to habitat conversion and biodiversity loss due to lack of appropriate climate change adaptation policies. This could also lead to the spread of communicable diseases like cholera, typhoid etc.
Human Health	Community members reported heat stress and discomfort due to extremely high temperatures. Destruction of	Pollution and water contamination could lead to seafood poisoning and less earnings from fish as fish cannot be exported to more lucrative markets in Europe and the United States.

	houses, capsizing of boats and high sea accidents due to storms.	
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Table 4 Local community assets exposed or affected by climate threats (adapted from USAID options analysis report)

2.3.2 Declining coastal wetlands

The climate change impacts and consequences described above, will also negatively affect coastal wetlands. Whereas mangrove ecosystems are critical to building coastal resilience on the coast of Sierra Leone, they have been converted and severely degraded in various areas. Mangroves are primarily under pressure from rice cultivation, fish smoking, construction, and salt production (USAID 2017). While they provide an environment for various life forms, and help in trapping sediment, thereby assisting in strengthening the protection of low-lying inland areas, mangrove forests are expected to significantly decline in the coming years due to current anthropogenic pressures. For instance, the pace of coastal development will increase coastal erosion, deforest mangrove forests, and increase the extraction of sand, clay, and other materials that make up existing sediment. Coastal erosion is already a significant challenge in some coastal areas in Sierra Leone (like Konakridee, Lakka, Hamilton and Plantain Island) where the coastline is shifting by about 4 to 6 metres a year (EPA 2015b). With increased storm surges, flash floods, and high winds in coastal communities, these conditions will be exacerbated by pollution, landslides, coastal erosion, deforestation, biodiversity loss, and invasive species which will further stress coastal wetlands and diminish the goods and services they provide.

2.4 ADAPTATION CHALLENGES AND OPPORTUNITIES IN THE SLCLC

The nature and extent of climate change vulnerability combined with unsustainable land use systems presented in the previous section lays the foundation for this adaptation plan. It provides an understanding of what could happen as the current climate changes, and what areas, or specific assets (people, infrastructure, and natural resources), deserve more attention because of their relative vulnerability to different stresses and shocks. This section and the previous parts point to specific challenges and opportunities for adaptation in the SLCLC. Challenges such as lack of technical capacity, which relate to the ability of local and national governments, communities, and NGOs to prepare for, respond to, and recover from the impacts of climate change, have been highlighted in various synthesis reports (e.g., EPA 2015a; USAID 2017b). Similarly, there is a lack of tools and resources to support the capabilities needed to address climate change and other risks, including regulatory and planning capabilities (such as coastal management regulations, disaster preparedness plans, infrastructure guidelines etc), and administrative and governance capabilities (such as trained staff and the availability of relevant equipment). There is also a challenge with fiscal capabilities (funding and other financial incentives); and infrastructure (flood and erosion control structures, water management structures etc). Funding is the biggest challenge to designing and delivering

effective and long-term coastal adaptation projects in Sierra Leone, thus requiring creativity and networking to mobilize resources and action at multiple levels and scales.

Despite these challenges, current efforts to improve capacity in relevant MDAs can help mobilize collaborative action, and better mainstream climate change in existing tools and resources. Efforts are also being made by various governmental (such as WARFP) and non-governmental structures (such as financial support from development partners, including the USAID-funded project WA BiCC) to increase the adaptive capacity of natural systems and socio-economic systems, including mangrove ecosystems, which can help coastal communities adjust to the impacts and consequences of climate change. These efforts also seek to change coastal attitudes (perceptions) and behaviours (activities) and facilitate shared decision-making and mutual accountability. Using this understanding of where capacity needs to be built or enhanced, and drawing upon vulnerability information compiled in this plan- especially how coastal assets are projected to change in the future and what that might mean in the context of climate change, the next section will identify where adaptation efforts should be focused, and what resources are needed to maximize impact.



Plate 9 Preserved part of mangrove forest in Moable in the Scarries region of the SLCLC

PART 3: ACTIONS FOR CLIMATE CHANGE ADAPTATION IN THE SLCLC

3.1 VISION AND GUIDING PRINCIPLES

3.1.1 Vision

The Government of Sierra Leone and the international community have been working to address climate change impacts, especially floods, for the last decade and a half in Sierra Leone. These interventions have been geared towards disaster risk reduction through the department of disasters risk reduction and humanitarian efforts (cholera break out) after such disasters. However, as climate change risks increase, additional efforts will be required to address current and prospective vulnerabilities. A drive in this direction is anticipated to enhance sustainable development to enable the country to attain its 2030 development vision. This part of the plan presents a framework of

proposed adaptation actions with examples of ongoing efforts focusing primarily on where to begin and what to consider.

This plan is a living document and should be reviewed and updated to accommodate new risks and interventions as data on vulnerabilities become available. The primary vision of this CCAP is to identify and implement measures to conserve and make the best use of the coastal resources of Sierra Leone and contribute to the Sustainable Development Goals for the benefits of present and future generations through an ecosystem-based approach to climate change adaptation in the coast of Sierra Leone, as part of efforts to foster climate resilience in the country and hopefully with replication in West Africa. The ultimate outcome is to have coastal landscapes in Sierra Leone that are organized and furnished with the tools to plan for and adapt to the impacts of climate change. This broad vision may change over time based on new research findings, improved vulnerability assessments, observed climate change phenomena, and implementation lessons and best practices.

3.1.2 Guiding principles

The intervention actions proposed by this plan is guided by the following principles:

- 1) Recognize that coastal landscapes are vital assets for sustainable development that are threatened by climate change and there is a need for adaptation;
- 2) Build effective partnerships: to successfully address the key challenges related to adaptation to climate change, all relevant institutions will be required to jointly adopt realistic solutions and share responsibilities to cooperatively carry out management practices that contribute to the reduction of vulnerability of people to climate change.
- 3) Adaptation actions should prevent, stop and reverse the loss and degradation of coastal landscapes and they need to be nested, nesting local, sub-national, and national actions and decisions, and leading to clear immediate, intermediate, and end results;
- 4) Adaptation actions should reflect the needs and strategies conceived for addressing vulnerability in the context of coastal communities. That is, adaptation actions must be commensurate with the realities of time, funding, personnel, and institutional capacity;
- 5) Adaptation actions must bolster the effective and efficient delivery of multiple roles at multiple levels, as well as create credible commitment towards joint-problem solving;
- 6) Adaptation actions must reflect opportunities for mainstreaming climate change considerations into existing policies and procedures;
- 7) Adaptation actions should be underpinned by the best available evidence to ensure measurability and scalability;
- 8) Adaptation actions should link social, ecological, economic, technological, and political interests to promote adaptive collaborative management; and
- 9) Adaptation actions must be gender-neutral, ensuring equal focus on men's and women's vulnerability, resource use patterns, and roles in decision-making.
- 10) Adaptation actions should be in line with key principles of Integrated Coastal Zone Management, which requires to adopt and implement seven interrelated themes including

regional, national, and local scales of ICZM, human/social dimensions, physical and biological aspects, and key closely linked topics ranging from biodiversity conservation to hazards and risk management, the impact of climate change, and the application of remote sensing and geospatial technologies.

3.2 IDENTIFICATION AND PRIORITIZATION OF ADAPTATION ACTIONS

The priority adaptation actions proposed in this plan are based on perceived and assessed vulnerabilities presented in section two of this plan. To build ownership of the priority actions by relevant institutions, it is critical to review and reinforce authority and accountability for the coordination of all planning, development, resource management and activities in the coastal zone, and for implementation of the integrated coastal zone management plan adopted by Sierra Leone. The integrated management plan should be completed for all sectors of the coast, through additional planning for other contingencies, such as sea-level rise, recognition of most sensitive areas, tropical storms, and the need for restoration of degraded environments; The authors of this plan present actions as prioritized by stakeholders during the CCVA, options analysis and consultation process. The proposed actions typically focus on coastal ecosystems and communities. The proposed actions vary based on the following number of factors: type and magnitude of projected climate change impacts and consequences, vulnerabilities and urgency of implementation in the short-term, compatibility with best practices of other related countries and low cost, no regrets options

To prioritize adaptation actions for the SLCLC, a mix of win-win, no-regrets, low-regrets, and flexible options were identified (see box 1). The CCVA confirmed that many of the impacts and consequences of climate change are not new, and some actions to address them already exist, though they are mostly implemented outside the context of climate change. The options analysis on the other hand noted that current actions are likely insufficient for addressing the scale of the potential changes, thus proposing a mix of existing, reconfigured and new actions to meet the challenges of climate change. Consequently, the adaptation measures described thoroughly in the next section, are measures that can be modified to meet multiple purposes with shared resources. Since addressing climate change challenges require a strong partnership between institutions at all levels, this proposed action plan is not just for WA BiCC's interventions. It is intended to be shared with all stakeholders, so that they can adapt it to their needs and use it as they wish, including government institutions, communities and socio-economic groups, NGOs, private sector, and development partners. Coordination and collaboration between institutions and communities is, however, crucial, to capitalize on individual efforts and address conflicts that could be hard and costly to overcome in the future.

Box 1 Choosing climate change adaptation options

Win-win options: Cost-effective adaptation measures that minimize climate risks or exploit opportunities but also have other social, environmental, or economic benefits. In this context, win-win options are often associated with those measures or activities that address climate impacts but which also contribute to climate change mitigation or meet other social and environmental objectives.

No-regrets options: Cost-effective adaptation measures that are worthwhile (i.e., they bring net socioeconomic benefits) whatever the extent of future climate change. These types of measures include those which are justified (cost-effective) under current climate conditions (including those addressing its variability and extremes) and are also consistent with addressing risks associated with projected climate changes.

Low-regrets options: Adaptation measures where the associated costs are relatively low and where the benefits, although mainly met under projected future climate change, may be relatively large.

Flexible options: Measures which are designed with the capacity to be modified at a future date as climate changes.

3.3 PROPOSED ADAPTATION ACTIONS

Based on the recommendations of the options analysis, expert opinion (consultations) and literature review, interventions to reduce climate change vulnerabilities in the SLCLC were identified and categorized into three broad groups: 1) ecological restoration and management; 2) coastal livelihoods and sustainable development; and 3) disaster risk reduction and early warning systems. Overall, 13 adaptation measures have been proposed. The list is limited to measures that key stakeholders may have a significant role in. The measures are categorized into three broad groups based on the different sectors assessed and scope of this plan. In many cases, the adaptation measures will serve multiple purposes and could fit into multiple into the three categories, but more involve activities such as capacity building, information sharing, mainstreaming etc. Whereas some measures can be implemented at the community level, there are measures and activities that need to be implemented at the national level such as within government structures (e.g., EPA, NPAA etc) Moreover, many of the measures included in this plan will be implemented at the local level, but technical assistance from national and international community will be vital to secure the required level of local commitment. Furthermore, not all measures will be systematically implemented across all of the four regions. Some may be appropriate in one region of the SLCLC but not in another. Suitability will depend on circumstances specific to each region as highlighted in the CCVA, which may require additional research and further stakeholder engagement.

3.3.1 Coastal ecosystems restoration and management

A healthy coastal ecosystem is needed to maintain the ecosystem services that benefit human health, and communities as a whole, including buffering communities from climate change impacts like more frequent and severe flooding. Ecological restoration and management encompass a number of measures to conserve (or preserve) and restore ecosystems. Although many of the measures discussed in the next two categories (i.e. livelihoods and sustainable development, and disaster risk reduction and early warning systems) can also play a role in ecosystem management (and vice-versa), the measures featured in this category are primarily focused on managing for ecological structure, function and diversity. In general, they include activities that create and accommodate new natural areas, reorient management of existing ecosystems, and restore degraded ecosystems. Adaptation measures for ecological restoration and management are described as follows (see table 8):

Impact identification and assessment

It is likely that when climate change vulnerability assessments are done, coastal managers don't get as much information as they would like. And, even if they do, circumstances will change, science and interests will evolve, and more information will become available. Adaptation actions in the SLCLC will continue to depend on new and better information about climate change, as well as the needs, strengths and weaknesses of intervening organizations. Adaptation interventions that incorporate research, monitoring, and mapping, and adjusting will result in coastal landscapes that are better prepared to adapt to a changing climate. For the purpose of this plan, impact identification and assessment will include: 1) regular monitoring to keep informed about changes in the climate, adaptation tools, and success stories. This will require sourcing information needed to make adequate and appropriate climate adaptation decisions, such as time series of historical annual temperature (average, minimum, and maximum) at the national scale; time series of historical annual rainfall at the local and national scales, with assessments of the amplitude of inter-annual variability, potentially decadal variability and long-term trends, including: seasonal cycle of temperature, analysis of climate extremes, and analysis of other meteorological variables important to coastal regions, such as prevailing winds, changes in wind speed, surge, or storm events; 2) collecting physical and socio-economic data to better understand coastal vulnerabilities, which will require the provision of services (data, tools, and products) to carry out land use change mapping, including (a) mapping coastal exposure to climate change, including sea level rise, floods, landslides, and erosion; (b) biodiversity assessments; and (c) urban infrastructure threats; and 3) coordinating research initiatives to support other assessment measures and support the design and delivery of other adaptation actions.

Multi-stakeholder forum for coastal adaptation

A multi-stakeholder forum will bring together the national government, academia, and other stakeholders to deliver information services needed by a wide array of coastal adaptation decision-

makers. The forum will primarily seek to enhance open and equitable access to a variety of information, and provide a platform for ongoing dialogue among various stakeholders, and hence leverage existing capacities, bridge information and knowledge gaps, and enhance the delivery of adaptation interventions by facilitating engagement between and among climate information producers, providers, and users. The Coastal Chiefdoms Natural Resources Management Network (CCNRMN) that is being proposed by WA BiCC as a mechanism for promoting synergy and increasing the involvement of stakeholders within the coastal landscape, could be used to serve this purpose. Where the CCNRMN is fully utilized to serve its intended purpose, the result would be a coordinated mechanism for delivering locally relevant, accessible, and actionable climate change information and knowledge management services.

Given the purpose of the multi-stakeholder fora, lessons could be learnt from efforts driven by WABiCC over the last 5 years to ensure a degree of self-management among coastal communities so that they can actively engage in mangrove restoration and protection activities. Consequently, at the level below members of the CCNRMN, Community Animators (CA) should be supported to help with mobilising coastal communities and ensure the full participation of members of any Mangrove Restoration Committees (MRC) formed. A sample community engagement plan (see table 6) developed by WABiCC (and sourced from the Mangrove Restoration Plan) provides adequate direction on the likely tiers of participation at the local level, focusing on roles and responsibilities, potential results, and nature of support implementers could give to the process.

Stakeholder unit	Role in restoration process	Support by implementers	Key output	Expected outcome
Traditional leaders	Serve as primary traditional resource governance institution, including directing benefit-sharing and local involvement.	Trainings in leadership and networking and supporting community mobilization	Functional CCNRMN	Traditional leaders are fully engaged in mangrove conservation, restoration and management
Community Animators	Serve as liaison between communities and implementing agency	Monthly stipend and trainings in community animation and awareness-raising	Support designated communities in mangrove restoration and conservation work, and provide regular progress reports to implementing agency	A network of chiefdom or district-level monitoring and surveillance groups established. Community Animators evolve into Mobile Adaptation Experts
Mangrove Restoration Committees – Comprising men, women, youths, traditional leaders etc	Direct overall management of the resource, as well as community livelihood activities	Trainings, nursery tools and livelihood support	Functional MRCs established and equipped Mangrove nurseries established Livelihood support options rolled out	Adequate seedlings (produced) and wildings (collected) for the restoration of degraded sites across the SLCLC

Table 5 Model framework for community engagement in the SLCLC

Ecosystem restoration, and management

Ecosystem restoration, creation, and enhancement (see box 2) will involve a suite of conservation, management, and restoration activities. It is unlikely that coastal ecosystems can be effectively managed to address climate change through a single measure. As such, traditional actions, adapted to consider climate change, combined with best management practices that reduce prevailing stressors, and a plan that identifies and prioritizes related activities, will be useful in helping coastal ecosystems to adapt to climate change. The broad goal is to work together to define, develop and agree on shared management responsibilities, as well as costs and benefits regarding the sustainable use of mangrove forest resources.

Box 2 Ecosystems Restoration, Creation and Enhancement

Activities designed to restore, create, or enhance coastal and marine ecosystems entail the manipulation of the physical, chemical, or biological characteristics of a site. The focus is on maintaining and enhancing connectivity and preserving ecosystem functionality and services, rather than re-creating a specific species composition.

Restoration, creation, and enhancement consist of a wide-range of activities and are essential in recovering or replacing ecosystems that have been degraded or destroyed (Interagency Workgroup on Wetland Restoration 2003). Definitions of the three aspects of this approach are provided as follows:

Restoration: Returning a degraded wetland or former wetland to a pre-existing condition or as close to that condition as is possible.

Creation: Converting a non-wetland (either dry land or unvegetated water) to a wetland.

Enhancement: Increasing one or more of the functions performed by an existing wetland beyond what currently or previously existed in the wetland.

In this regard, the key areas of focus will include: 1) sustainable management of mangroves to provide tangible community benefits like protection against storms, floods and strong winds, and a sustained fisheries base; 2) create or strengthen management groups or sub-groups that will support a zoning process, including areas of healthy mangroves that just need the maintenance of the positive conditions, areas that are suitable for restoration; 3) map coastal ecosystems resources and wise use areas; 4) identify boundaries and conflicting issues; 5) develop a restoration and management plan for MPAs; 6) plant mangrove trees to restore coastal areas that have been partially or completely degraded; 7) decentralize the management of MPAs through Adaptive Co-Management (ACM)²; 8) undertake technical research, trainings and community

² ACM is a blend of collaborative management (or co-management CM that focuses on participation or shared decision-making) and adaptive management (AM that focuses on knowledge co-production or joint learning). ACM is different from CM and AM because it establishes both vertical and horizontal relationships to facilitate participation and learning and requires multiple iterations over significant periods of time. Besides, ACM works across multiple scales and levels, encompassing all stakeholders and strongly emphasizes building the capacity of all those involved (Berkes 2007). In the scope of this plan, ACM can be distinguished along three themes: “a horizontal theme”, which relates to relationships between stakeholders at the same level (such as between communities and community-based organizations); “a vertical theme”, which is concerned with relationships between stakeholders at different levels (such as government agencies and local communities); and “a progressive (or iterative) theme”, which underscores the

education; and 9) facilitate agri-silviculture practices.



Plate 10 (left) Mangrove nursery in Kychom in the Scarcies region of the SLCLC



Plate 11 (right) Mangrove nursery in Kortimoh in the Scarcies region of the SLCLC

In terms of mangrove restoration planning, efforts to implement this plan could scale-up work done by WABICC to prepare and implement a Mangrove Restoration Plan (MRP) between 2017 and 2019. The action plan was a response to concerns raised in the Climate Change Vulnerability Analysis (CCVA) undertaken by WA BiCC to address the incessant degradation of mangrove ecosystems in the SLCLC for fish smoking and rice cultivation. Its primary purpose was to guide the process of collecting data to characterize the geophysical and hydrological characteristics of proposed planting sites; the engagement and education of communities; the development of local capacity; and the restoration of 117.36 hectares of mangrove across the SLCLC (see table 6). Preliminary work to characterise the geophysical and hydrological conditions in 24 sites identified and classified by communities as degraded have been undertaken, though the non-availability of site-specific data warrants further research into the suitability of certain sites for mangrove restoration.

Region of the SLCLC	Community	No. of hectares to restore	Seedlings needed for restoration
Scarcies	Sasiyeck	8.62	35,000
	Yeliboya	10.85	48,500
	Mahela	1.99	9,045
	Moable	1.85	9,000
	Kychom A	1.1	8,408
	Kortimoh I	10.81	49,131
	Makompa	0	0
SLRE	Rogberay Mamamki	3.75	25,000
	Kafunka	6.45	32,906
	Mange Koya		3,000
	Deep Eye Water	7.24	32,905
Yawri Bay	Tombo	3.21	14,589

importance of learning to the construction and maintenance of these relationships (Colfer & Prabhu 2008).

	Tissana	1.05	4,772
	Madina	0	11,500
	Shenge	2.66	10,000
	Katta I	7.34	26,000
	Samu	22.75	103,398
	Shengbull	6.87	31,224
	Mosam	1.02	4,636
	Mopala I	12.45	50,000
BSRE	Hangy site I	1.86	8,370
	Njayeihun	0	0
	York Island I	1.12	5,000
	Momaya I	0.37	1,682
	Bonthe I	3.46	15,725
	Gbongboma I	0.55	2,400
	TOTAL	117.36	500,256

Table 6 Data for the establishment of mangrove nurseries in the SLCLC (source: Mangrove Restoration Plan)

Awareness-raising and community learning

Awareness raising and community learning are distinct but related activities, and both are vitally important for effective ecological restoration and management. Provision of information to all stakeholders (anyone who will be affected by climate change in the SLCLC) will help in engaging these stakeholders in planning adaptation efforts and gaining support for actual implementation. It also forms the basis of community learning because they should be informed about adaptation activities so that they can communicate the benefits of mangrove conservation and ways to protect coastal ecosystem resources. For the purpose of implementing this plan, a community outreach and education strategy will need to be developed by WABiCC, or key national and international partners to identify goals and actions to ensure that coastal communities are reached in an effective manner. The development and operationalization of a strategy will involve segmenting communities in the SLCLC to find the best way to share information and exchange knowledge, including to craft appropriate messages, decide on channels for effective dissemination, and evaluate learning.

In this regard, lessons could be learnt from work done by WABiCC across the SLCLC to organise regular public education campaigns ranging from training workshops, community meetings, nature clubs, to film screening events. The Community Education Strategy developed for this purpose could be scaled-up to meet needs identified for community education across the five landscapes. Proposed activities can build upon those outlined in the following modified framework (table 7), which was used by WABiCC to address community knowledge gaps that increasingly posed risks to and significantly undermined the success of restoration and management interventions. The understanding is that by learning about mangroves and their use, coastal communities would contribute more positively towards restoration activities and change behaviours that could degrade such efforts.

Community education tool/approach	Target groups	Support required	Key outputs	Expected outcome
Training workshops	CCNRMN, MRCs, Nature clubs and communities	Designated agency to lead the development of training manual, provide refreshment and support transportation costs	By-laws for resource use and conservation	Sustainable resource use and access Increased awareness of climate risks and impacts and steps taken to try adaptation solutions using mangrove conservation interventions
Community meetings	MRCs	Designated agency to support costs for training in mangrove activities, ranging from nursery establishment, planting, to management approaches	Increased local knowledge capabilities Increased involvement in mangrove conservation activities due to enhanced access to quality information and formation of new skills.	Improvements in local capacities to constructively engage in resource management processes, including in contributing to the design and delivery of climate change adaptation processes
Field guides	Local actors, MDA practitioners	Designated agency to document steps followed throughout conservation work and tailor it to the information needs of local actors and MDA practitioners	Field guide/handbook for practitioners	Increased capacity on environmental issues for communities
Nature clubs	Pupils in primary and secondary schools	Designated agency to support the cost of producing learning materials and refreshment	Functional School Nature Clubs Peer-to-peer communication and advocacy	Significant improvement in local attitudes, preferences and actions as a result of behaviour change campaigns organized by SNCs
Film screening events	Designated coastal communities	Designated agency to source video material for screening events	Copies of video material distributed Positive shifts in local resource management knowledge, attitudes, and practices	Knowledge created on the impacts of climate change, adaptation solutions using mangrove conservation practices, and broader implications of sustainable resource use for disaster management and livelihoods improvement.

Table 7 Model framework for community education and learning in the SLCLC

Skills training and capacity development

Trainings in soap making, tailoring, charcoal burning, and bee keeping will incentivize community participation in mangrove restoration and management activities. Trainings for policy stakeholders

(e.g., MDAs) in adaptation processes such as formulating, reviewing, and implementing climate change policies and plans, and in monitoring and disseminating results, will improve policy understanding of climate change and facilitate the design and delivery of ecological restoration and management activities. Generally, successful coastal adaptation will depend on the ability of coastal managers to translate new knowledge into sustained and targeted adaptation actions. Therefore, activities seeking to achieve mangrove restoration and management should also seek to build sufficient technical capacity to drive long-term involvement and action. Technical capacity development requires not only training but also availability of funding. Therefore, implementation of this Action Plan should focus on actions and solutions that maintain, restore and enhance the ecological and socio-economic conditions of coastal landscapes; that provide products and services contributing to the current and future needs for the diversification of the economy; and that are in line with the national priorities of Sierra Leone. The successful implementation of the Action Plan will therefore support and contribute to the implementation of other existing and planned policies/strategies and legal frameworks, including those on water management, land use planning, poverty eradication, agriculture, fishery, biodiversity conservation, industry, tourism development, energy supply, housing and urban development, and employment.

Policy mainstreaming and influencing

This CCAP should be perceived as a pilot plan that can be replicated by national institutions in Sierra Leone but also at regional level through the implementation of the policies of WA BiCC's regional institutional partners (see section 3.4.2). The adoption and future implementation of this plan is a way to initiate the implementation of the Abidjan Protocols on Integrated Coastal Zone Management and on the Sustainable Management of Mangroves. Likewise, this Action Plan should contribute to the National Adaptation Plan process so as to promote the integration of coastal issues into all national adaptation strategies, plans, and projects. Effective policy mainstreaming and influencing will be achieved through the development of guidelines, tools and best management practices (see table 4 for examples of activities), which will complement current efforts to increase access to relevant knowledge and develop the capacity to act. The process should consider three key actions (USAID 2009, p.59): 1) creating enabling policy, finance and legal frameworks by prioritizing adaptation in national planning and budgeting; harmonizing sectoral policies; creating national coordination committees; and providing relevant financial and technical assistance; 2) capturing local experience to build a sense of ownership and strengthen local voice in planning and policy-making for coastal adaptation to climate change; 3) public education through awareness-raising and education campaigns that help convey information about the impacts of climate change and drive consensus on adaptation decisions and actions.

Adaptation measure	Rationale	Activities/success indicators
Impact identification and measurement	Technical research on various relevant topics, such as the impact of climate change on fisheries, long-term projection of climate change impacts and consequences for mangrove forests etc, should be undertaken to improve local and policy understanding of issues for ecological restoration and management. Research will also examine the feasibility and cost-effectiveness (benefit-cost analysis) of potential adaptation measures/actions.	<ul style="list-style-type: none"> • Monitoring of academic and public news media to keep informed about changes in climate change science and adaptation tools, technologies, and success stories • Collection of physical and socioeconomic data to better understand vulnerabilities • Documentation of events and impacts associated with climate variability and change • Projection of climate and non-climate changes (e.g., population growth, loss/gain of open space, etc.) • Coordination of research initiatives and partnerships with governmental and non-governmental organizations
Multi-stakeholder forum for coastal adaptation	Traditional leaders and local government structures have a critical role to play in coastal ecosystem management. WA BiCC's experiences from the recent CCVA and options analysis indicate that these landscapes are inhabited by people who are loyal to their leaders. For this reason, a multi-stakeholder forum will need to be formed to provide a platform for climate information sharing, knowledge exchange, policy advocacy, and quality assurance.	<ul style="list-style-type: none"> • Formation of a Coastal Chiefdoms Natural Resources Management Network (CCNRMN) • Support the development, validation and enforcement of by-laws on mangrove wood harvesting, fishing and sand mining, at local and regional levels to promote mangrove conservation and adaptation to climate change. • Convene an annual roundtable event for coastal stakeholders and key climate change agencies to discuss achievements, challenges, action plans.
Ecosystem restoration, creation and enhancement	<i>Rehabilitation and management of mangroves</i> Mangrove rehabilitation and management will need to involve planting, which is identified in the options analysis as one of the most effective strategies for building resilience. The precise location of sites is yet unknown but there is considerable scientific understanding of mangrove rehabilitation and management.	<ul style="list-style-type: none"> • Mapping and quantification of depleted or degraded mangrove areas • Training of community members on mangrove ecosystem rehabilitation techniques • Participatory research with communities to understand the: autecology of the mangrove species at the site, hydrology patterns and identify original drivers of change (what caused mangrove degradation and when). • Design a Mangrove Restoration Plan (MRP) • Identification of appropriate mangrove species • Establishment of community nurseries • Planting • Monitoring of plantations
	<i>Development of management plans for MPAs</i>	<ul style="list-style-type: none"> • Community participatory land use mapping

	<p>All four coastal landscapes are at various stages of MPA designation, but none of them has a functional management plan. It is, therefore, essential to work with NPAA and Ministry of Fisheries and Marine Resources (MFMR) to identify and map out different areas such as protection and community use zones. These MPAs and their effective management will provide refuges for biodiversity (fisheries), guarantee livelihood source for communities and the national economy and ensure the sustainability of resilient climate mangrove. Climate resilient mangroves are those that have a good sediment supply and high species diversity, as both of these factors enhance resilience</p>	<ul style="list-style-type: none"> • Community stakeholder's analysis to identify direct and indirect users • Determination of mangrove forest and other coastal ecosystems uses and distribution in the MPAs • Participatory framing of Forest Management Actions (completed through options analysis) based on conservation, DRR and livelihood development priorities. • Development/strengthening of by-laws that support mangrove and fisheries conservation • Delineation of gender roles and interests in coastal resources use and management • Organization of sensitization and decision-making meetings to agree upon levels of mangrove forests use and harvest. • Establishment or strengthening of management institutions through a series of community meetings to agree and set up MPA management rules and institutions • Organization of community resource user groups at village level • Development of skills required for management and monitoring • Participatory zoning of MPAs into different management/use areas e.g. planting, protection based or established and verified criteria • Development of a participatory monitoring and evaluation plan • Writing of the MPA management plan • Formulation and signing of MPA Management Agreement between government and communities through a series of consultative meetings
	<p><i>Decentralization of the adaptive co-management of MPAs</i></p> <p>The MFMR has already Established Principles of Co-management of MPAs. It is important to review these principles in collaboration with the local communities as this will reduce government operational costs. Generally, the approach will lead to improved management of coastal resources as it will empower local communities to employ customary authority to restrict resource use and enforce laws based on local rules.</p>	<ul style="list-style-type: none"> • Reviewing and updating of Principles of Co-management of MPAs to include aspects of resilience to climate change • Facilitation and promotion of the creation or strengthening of coastal/mangrove management CBOs • Development of capacities of community management groups • Promotion of participatory ecosystem resources assessment, mapping, and land use mapping • Identification and improvement of sustainable management techniques
	<p><i>Monitoring and evaluation</i></p>	<ul style="list-style-type: none"> • Strengthening or formation of community management groups

	Monitoring and evaluation procedures should be established at the local level, in collaboration with community members, to ensure capacity building, ownership, and sustainability.	<ul style="list-style-type: none"> • Involvement of group members in resource inventories and research • Training in participatory monitoring of implemented activities • Support of local groups through livelihood improvement and diversification
Awareness raising and community learning	Mangroves and other coastal ecosystems are marginalized in national and regional political agenda. This political position is the result of lack of understanding of the role coastal ecosystems can play in national economic development and climate change management. This situation is exacerbated by the acute lack of information and research interest in the management of mangrove resources. Moreover, local communities in these landscapes have indicated that their actions are contributing to exacerbating climate change impacts. This means that aiming to bring about changes in behavior and attitudes of community members might contribute to mangrove conservation. This will ensure that a greater percentage of the community members are better informed about the value of mangroves and other coastal ecosystems, as well as understand the connectivity between ecosystems well-being and their livelihood strategies.	<ul style="list-style-type: none"> • Training of relevant national institutions such as NPAA, EPA, MAFFS and MFMR staff on climate change adaptation and mangrove conservation • Education of local community leaders and community members with the aim of influencing behavior change. • Establishment of knowledge sharing platforms such as: a coastal landscape chief's roundtable, policy briefs, quarterly newsletter, symposia and seminars, and regional and national learning events and documents
Skills training and capacity development	At the moment, policies to manage mangroves in Sierra Leone are encapsulated within wider natural resources management frameworks. As such, their enforcement is weak and ineffective. For this reason, mangrove-specific management policies and legislation about climate change management will need to be developed.	
Policy mainstreaming and influencing	There is a multitude of government institutions with unclear management mandates for coastal ecosystems management. It is critical to map and delineate the roles and responsibilities of all government institutions involved in the management of coastal ecosystems and mangroves in Sierra Leone. This mapping will guarantee the sustainability	<ul style="list-style-type: none"> • Identification and review of existing policies and legislation • Proposition of text for legislative and policy reforms to the relevant government department with information from research • Disaggregation, strengthening and harmonization of regulations that promote the sustainable harvest of mangrove resources in Sierra Leone

	of mangrove ecosystems and ensure resilience to the effects of climate change.	<ul style="list-style-type: none"> • Institutionalization of economic incentives by governments and the private sector to promote mangrove conservation e.g. Blue carbon schemes, eco-tourism • Operationalization of existing ICZM by identifying and implementing actions already elaborated in the scope of work of this plan
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Table 8 Climate change adaptation measures activities for ecological restoration and management (adapted from WA BiCC options analysis)

3.3.2 Coastal livelihoods and sustainable development

Many of the measures discussed in the first category (ecological restoration and management) can also play a role in livelihoods and sustainable development (and vice versa). For instance, achieving livelihood resilience and community development will require coastal managers to have the knowledge and skills they need to act in the best way possible. At the same time, livelihood and sustainable development initiatives can be sustained by incorporating climate change adaptation considerations into all forms and levels of decision-making and action. Thus, mainstreaming is also key in this context, because coastal livelihoods and sustainable development interventions should capture local experience to build ownership, as well as include awareness-raising and education campaigns that help convey useful information about climate change and build capacity for adaptation actions.



Livelihood issues in the SLCLC: Plate 12 Fishing as the main economic/livelihood activity in the SLCLC (women processing fish in Sasiyeck); Plate 13 Drinking water as a key livelihood challenge in the SLCLC (containers for sale in Yeliboya community)

The measures featured in this category are primarily focused on: 1) creating sustainable livelihood alternatives for people adversely affected by coastal climate change impacts; 2) supporting research so that livelihood work is guided by the best available science; 3) promoting knowledge exchange and the development of practical tools for implementing livelihood interventions; and 4) developing education, training, leadership, and networking capabilities (see table 9). Generally, they include activities that support livelihood and sustainable development options that ensure healthy, biologically diverse, and resilient coastal ecosystems. The activities will form an integral part of ecological restoration and management, so that a holistic and collaborative approach is taken to maintain productive and resilient coastal ecosystems and communities. Put differently, livelihood and sustainable development measures will bolster actions taken to conserve, manage, and restore mangrove and other coastal ecosystems, while simultaneously addressing social, economic and cultural pressures that increase vulnerability to climate change in coastal areas.

Adaptation measures	Rationale	Activities/success indicators
Diversify and strengthen coastal livelihoods	<p><i>Climate-Smart Agriculture (CSA)</i></p> <p>CSA implementation requires site-specific assessments to identify agricultural production techniques and practices that are appropriate to coastal conditions. Besides, although a rapid uptake of CSA practices has been documented in other areas, there are concerns that applying it to achieve climate and livelihood resilience in coastal areas may be challenging, partly because of a lack of experience. For instance, little empirical evidence has been put forth so far to systematically evaluate the outcomes of CSA practices. More common are case studies and anecdotes on CSA performance, which do not provide sufficient detail to assertively associate outcomes with interventions. The paucity of evidence especially for coastal areas in Africa is not surprising because of the novelty of the concept and the separate documentation of its main achievements and shortcomings in disparate literatures ranging from agricultural to social sciences.</p>	<ul style="list-style-type: none"> • Feasibility study to gather information on community perceptions of CSA techniques • Formation of community management group, including the development of by-laws • Development of CSA implementation strategy • Development or strengthening of farmer groups of cooperatives • Development and dissemination of success stories • Monitoring and evaluation of activities
	<p><i>Agri-silviculture</i></p> <p>Un-managed and unsustainable harvesting of mangrove wood for various uses is driving the depletion and loss of mangrove forests. This is exacerbated by the government's agricultural policy to valorize coastal swamps through rice planting. The CCVA indicated that Bonthe-Sherbro and Scarcity regions are the most exposed to the effects of climate change, and the main drivers of this exposure are rice farm expansion and cutting of mangrove wood.</p>	<ul style="list-style-type: none"> • Promotion of agri-sylvicultural practices and sustainable rice cultivation in other landscapes • Development of sustainable mangrove wood harvesting practices in consultation with local communities, NPAA, local councils, and mangrove wood harvesters
	<p><i>Sustainable fisheries management</i></p> <p>One of the major drivers of mangrove loss across the landscapes is the harvesting of mangrove wood to smoke fish. By promoting sustainable fisheries, it will be possible to reduce fishing effort, improve revenues sustain fishing stocks and reduce pressure on mangrove resources</p>	<ul style="list-style-type: none"> • Fisheries governance through awareness raising and law enforcement to regulate fishing practices • Regulation of types of fishing e.g. size and maturity of catch, educate fishers on the importance of sustainable fishing, • Introduction of improved methods for fishing and salt-harvesting that are less damaging to the mangroves; Support value added schemes.
	<p><i>Improved Fish Smoking Systems (IFSS)</i></p>	<ul style="list-style-type: none"> • Awareness raising on the socio-economic and ecological importance of improved technologies

	<p>Mangrove wood is extensively used for fish smoking and making of salt. These activities are very energy consuming because of very low fuelwood economy. One approach to alleviating excessive fuelwood consumption is to reduce fuelwood demand by introducing more fuel-efficient cook stoves, fish smoke systems, and solar energy systems. Improved fish smoking and introduced solar systems have great promise to avoid mangrove deforestation and promote climate change mitigation and adaptation. In the context of this project, WA BiCC will be able to support such initiatives on a case by case basis. Such considerations will be done on a needs basis, and the willingness of the community to support mangroves and coastal ecosystems n conservation activities.</p>	<ul style="list-style-type: none"> • Partnership agreement on funding and development of improved technology (guarantee community support and contribution) • Feasibility study to gather information on community perceptions of improved technologies and local availability of construction materials • Formation of community management group, including the development of partnership and use rules • Construction and management of improved technology and monitoring of use
	<p><i>Drinking water and village development</i></p> <p>All over the regions, there is an acute lack of portable drinking water. Some of these communities' purchase water from nearby towns and there is always the associated risk of contamination during the transportation of this water. Moreover, rising sea levels means that there is now the risk of salt water intrusion into existing water wells. These and other initiatives will contribute to developing coastal communities.</p>	<ul style="list-style-type: none"> • Provision of rainwater collection kits and storage tanks, and water treatment materials- e.g., chlorine tablets for killing pathogens in stored water etc • Construction of village water wells • Scholarships and incentives for village cleaning days and rehabilitation of drainage ways
	<p><i>Village Savings and Loan Associations (VSLAs)</i></p> <p>All communities have expressed the need for loans and micro-credit facilities. In the context of improving resilience to climate change, it will, therefore, be essential to offer these services within the framework of existing livelihood activities carried out by various community members. VSLAs are self-sustaining financial self-help groups. While it could be used to generate savings, communities often have limited skills and access to new markets and enterprises to sustain them. Implementers of this plan will oversee VSLA development and establish a direct connection between VSLAs and service users, building on experiences from other African countries. amounts of money at low-interest rates Government and other development</p>	<ul style="list-style-type: none"> • Awareness raising on the criteria for selecting VSLA members • Partnership agreement on funding mechanisms and development entrepreneur activities (guarantee community support for conservation and DRR activities) • Establishment of community VSLAs, including operating rules and regulations for partnership, and use resources and community trust fund. • Feasibility studies to establish local needs and enterprise opportunities focusing on existing livelihood activities

		<ul style="list-style-type: none"> • Establishment of relevant market network systems and develop a platform linking and providing necessary training to community members to satisfy end users' needs • Working with existing identified Micro-credit entities to promote coastal resilience actions in their lending schemes to communities as part of their Corporate Social Responsibility (CSR)
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Table 9 Climate change adaptation measures and activities for livelihoods and sustainable development (adapted from WA BiCC options analysis)

Knowing that it is unlikely that livelihood and sustainable development can effectively contribute to coastal adaptation through a single measure, a variety of traditional activities, adjusted to consider climate change, along with improved technology and technical options that reduce prevailing pressures on mangrove and other coastal resources, will be considered. The options analysis (USAID 2017b) considers the following livelihood and sustainable development measures to be pivotal in helping coastal communities adapt to climate change:

- 1) Village Savings and Loan Associations (VSLAs), to address the lack of access to financial credit and financial resources, which has been noted to have the potential of increasing vulnerabilities to climate change impacts and consequences. Sustainable, smallholder financing might be critical to improving resilience amongst vulnerable coastal communities, because it provides communities with savings, credit, and insurance services that build financial strength and adaptive capacity over the long-term;
- 2) Climate-Smart Agriculture (CSA), to operationalize sustainable agricultural development within the explicit parameters of climate change adaptation. CSA could address climate hazards while improving food security; deliver multiple benefits including food security, livelihood resilience, and coastal adaptation; and provide context-specific solutions in both space and time. The approach will improve and diversify livelihood support options, build resilience to climate change, and enhance mangrove conservation;
- 3) Improved Fish Smoking Systems (IFSS), to improve energy efficiency, reduce mangrove forest destruction (for fish smoking), and deliver health benefits for men, women and children;
- 4) Sustainable coastal fisheries, to improve fisheries governance by facilitating sustainable fishing practices and driving regulatory change;
- 5) Water supply, to address the acute lack of portable drinking water, given the risk of salt water intrusion because of rising sea levels caused by climate change.

Like other priorities specified for adaptation planning in this plan, cues can be taken from livelihood interventions supported by WABICC in various parts of the SLCLC, including, mainly, CSA and IFSS. This would essentially scale-up livelihood strategies deployed by the programme, and thus, expand and enrich support options to make local livelihoods efficient and sustainable. Concerning CSA, results of the feasibility assessment undertaken by WABICC could help implementers of the CCAP to determine current practices and delineate steps to improve productivity, income generation, and climate adaptation in vulnerable communities. Moreover, the study and consequent activities implemented could form the basis of a long-term support for salt production, vegetable farming, and other CSA activities by guiding implementers through establishing enabling structures for participation and learning and mobilizing needed financing. Likewise, long-term, best practices and lessons compiled on the basis of implementation in the SLCLC will guide replication and upscaling efforts and help trigger the adoption of new practices for the sustainable intensification of agriculture and diversification of local livelihoods.

Similarly, the study undertaken on the feasibility of IFSS in the SLCLC could help implementers of this plan understand the Knowledge, Attitudes, and Practices (KAP) relating to mangrove wood clearing in various communities, as well as the effectiveness of the breadth of livelihood interventions and regulatory mechanisms used to address risks engendered by such activities. The IFSS feasibility study will also deepen insights into the degree by which the artisanal fisheries sector in the SLCLC lacks efficient and effective processing techniques and technologies, and adequately inform decision-making on ways to improve current conditions and capacities. For instance, the delivery of an IFSS could drive a non-farm coastal economy, promote social services that will yield social services for the coastal poor, and move communities towards a system of resource efficiency where less natural resources would be required to meet the same livelihood and social protection needs and priorities.



Plate 14: Current fish smoking systems in the SLCLC (showing top and side sections)

3.3.3 Disaster risk reduction and early warning systems

Many of the measures discussed in the other categories can also play a role in disaster risk reduction and early warning systems (and vice versa). For instance, research and capacity development are required to improve policy understanding of climate risks and hazards and facilitate the design and delivery of effective adaptation solutions. Additionally, mainstreaming considerations could include procedures and processes to follow in reducing coastal disasters and improving early warning systems. Thus, like the previously discussed adaptation categories, effective disaster management will depend on the availability of relevant data, as well as the capacity at various levels to adequately interpret and utilize (including mainstream) such data. In this regard, the measures featured in this category are primarily focused on strengthening traditional and natural infrastructure and bolstering early warning systems. Generally, the activities include establishing or strengthening observation, monitoring and surveillance networks, establishing adaptation learning centres, developing best

management practices and guidelines for making and implementing infrastructure development decisions, and sourcing sustainable financing to enhance coastal adaptation through infrastructure development (see table 10).



Plate 15 (left) Coping strategy: Oyster shells used to stabilize the ground in Moable

Plate 16 (right) Coping strategy: Sand bags used to protect homes against flooding in Yeliboya

Climate change observation, monitoring and surveillance network

Observation, monitoring and surveillance networks will need to be established or strengthened at various levels of action to ensure thorough measurements of climate activities, as well as the development of tools and methodologies for translating such knowledge into useful information resources to help decision-makers improve coastal adaptation planning. Chiefdom and District Surveillance Groups could be formed, so a network of local observers and monitors will work together to document and share observations on climate trends, impacts, and consequences using a blend of local knowledge and scientific methodologies and tools. Generally, an observation, monitoring and surveillance network will help in raising awareness about disaster risks and management actions at specific levels, and provide the feedback needed to effectively plan, implement and evaluate disaster risk reduction and early warning initiatives. Overall, the network will: 1) build collaborative partnerships with other existing local networks such as the CCNRMN, Community Science Groups (formed by EJJ), youth and women's groups etc; 2) strengthen the coordinated monitoring of climate change-related health impacts to allow for consistency in the collection and analysis of data about climate change impacts on human wellbeing and communities; 3) establish robust and long-term mangrove ecosystem health surveillance, monitoring and analysis to develop insights into their current state and map future risks and vulnerabilities; and 4) facilitate and formalize collaboration among government MDAs and coastal communities to ensure the joint monitoring of climate change impacts on food safety and security and economic stability, and provide early warnings to improve adaptation decision-making.

Network of climate adaptation learning centres

Through climate adaptation learning centres based primarily at the universities, coastal managers (policy-makers, practitioners and researchers alike) will increase access to locally relevant information, tools, and expertise. The centres will help decision-makers develop innovative responses to climate change impacts and consequences by working with various stakeholders to tailor climate information to the needs of local actors, and thus, increase access to climate data, best practices, and tools. Generally, the learning centre will: 1) develop and disseminate locally-relevant information; 2) provide support and guidance to climate secretariats in various government MDAs; 3) undertake local awareness-raising and capacity building activities; 4) lead on climate adaptation research and analysis, focusing on developing methodologies and tools (including indicators) for assessing vulnerabilities and adaptive responses to hazards; and evaluating, comparing and documenting the benefits and costs of different disaster risk reduction approaches; and 5) provide targeted knowledge services in areas such as disaster management, biodiversity conservation, climate-resilient development, policy mainstreaming, and climate education.

Guidelines and best practices for infrastructure development

Coastal managers will need to collaborate in developing a common toolkit that would help decision-makers and practitioners in managing infrastructure-related climate risks. The toolkit will include best practices and guidelines for mainstreaming coastal climate change adaptation considerations into local infrastructure development decisions and actions. It will state where, when, and how such mainstreaming can be done, and provide guidance on dealing with climate change adaptation concerns for all phases of infrastructure development, including planning, delivery and maintenance.

Policies and plans to guide coastal infrastructure decision-making

Policies and plans related to financing coastal infrastructure development will need to be revised, or developed to that future infrastructure decisions and actions consider and maximize co-benefits (such as for health, livelihoods, biodiversity etc). Revising or developing policies and plans to guide infrastructure development decisions will encourage innovation, improve coastal safety, allow for long-range savings, and ultimately make communities more resilient. New policies and development plans will also stress the need for climate vulnerability or risk assessments in infrastructure development activities, as well as interventions that specifically address any post-risk assessment findings. For these objectives, sufficient political will is needed to overcome institutional inertia, and cushion effects that could result from sweeping revisions to existing policies and development plans.

Prioritize natural infrastructure

Natural (soft) infrastructure provides a viable and cost-effective approach to fostering coastal resilience to climate change. Therefore, new or revised policies and development plans should

promote increased use of soft engineering methods as an effective alternative to traditional, hard infrastructure development approaches. Coastal managers can achieve this by requiring infrastructure project developers and implementers to consider whether a natural approach will address an infrastructure need before all other options. When natural infrastructure is prioritized to the extent of either replacing traditional, hard infrastructure, or being implemented alongside it, the affected coastal system will benefit from increased protection, prolonged life, and serve multiple purposes.

Fund or incentivize disaster risk reduction and early warning systems

To fully leverage disaster risk reduction and early warning initiatives (and experiences), dedicated or top-up funding, or financial incentives to help with additional disaster management planning and implementation costs will need to be provided. Top-up funding will address the additional upfront costs that accompany resilience building. The necessary funding will need to be mobilized by taking one or more of the following steps: 1) engaging with NGOs and INGOs that already have climate change adaptation options in their community development projects; 2) identifying and tapping into complementary disaster risk reduction and early warning programmes implemented by government MDAs, such as fisheries projects, coastal zone management initiatives, and livelihood projects; 3) mainstreaming disaster preparedness and early warning into coastal development plans, thus using local development funds managed by councils to build resilience; 4) seeking out donor agencies that offer national-level disaster management and climate adaptation funding; and 5) exploring the utility of environmental performance bonds such as user fees, tourism fees etc.

Adaptation measures	Rationale	Activities
Climate change observation, monitoring and surveillance network	<p>Given the paucity of evidence on climate change trends, impacts and consequences in Sierra Leone, it is necessary to undertake research into climate risks and the state of resiliency in the SLCLC. Findings could provide a broad understanding about resilience and provide data for setting priorities for future investments and action. New information will also help in tracking progress made with coastal adaptation, which would form the basis for a sustained effort to engage and communicate with stakeholders broadly. The studies could propose a methodological approach (including measurement indicators) for framing and undertaking sectoral assessments to track progress and inform adaptation decision-making.</p>	<ul style="list-style-type: none"> • Building of collaborative partnerships with other existing local networks such as the CCNRMN, Community Science Groups (formed by EJJ), youth and women's groups etc • Strengthening the coordinated monitoring of climate change-related health impacts to allow for consistency in the collection and analysis of data about climate change impacts on human wellbeing and communities • Establishment of robust and long-term mangrove ecosystem health surveillance, monitoring and analysis to develop insights into their current state and map future risks and vulnerabilities; • Facilitation and formalization of collaboration among government MDAs and coastal communities to ensure the joint monitoring of climate change impacts on food safety and security and economic stability, and provide early warnings to improve adaptation decision-making • Liaison with the office of National Security's (ONS) Disaster management Department, and established District Disaster Risk Reduction Committees to ensure a multi-stakeholder approach and create local ownership of DRR • Mapping of key institutions promoting climate change response strategies in Sierra Leone, and identification and review of national climate change response policies/legislations (if any) • Collaboration with the national meteorological service to update and publish existing weather information. • Convening of at least two intergovernmental consultation meetings with practitioners of disaster risk reduction, climate change adaptation and coastal ecosystems development ecosystems to promote information exchange between experts and draft policies/legislation. • Engagement with FAO Sierra Leone to collaborate on the "early signs project" and assess how this could be piloted in coastal communities in the farming, fishing, and fresh water sectors

		<ul style="list-style-type: none"> • Sensitization of communities living in the coastal landscapes, particularly the slums and eroded areas (Sea fronts in Bonthe, Scarcies, degraded mangrove areas and Sand mining areas). • Improvement of knowledge and understanding of local communities and traditional authorities on climate change adaptation and its relations to their lifestyles and survival strategies and the urgent need to respond to the risks posed by climate change • Possible media of transmission: local radio stations, leaflets, village competitions, use of popular comedian shows, government officials, churches, and mosques) • Improvement of the capacity of local community members to monitor local weather conditions by training and providing community groups with basic equipment to collect and record climate data. • Training of community-based champions, local teachers, resources use leaders and community Management Associations (CMAs) on disaster risk response strategies and disaster management preparedness
Network of climate adaptation learning centres	<p>The WA BiCC options analysis indicated skills training as one way to address social and economic vulnerabilities in the SLCLC. In addition to skills training for local communities (in soap making, tailoring, charcoal burning, and bee keeping), the analysis also emphasized capacity development for MDA stakeholders like NPAA, EPA etc with the aim of improving policy understanding of climate change and facilitating the effective design and delivery of adaptation actions. Effective adaptation to climate change in the SLCLC will require practitioners and researchers alike to have the knowledge and skills they need to act in the best way possible, which learning centres will readily provide. When properly implemented these actions will lead to informed decisions and adaptive planning. This kind of practical information sharing and experiences will enable and motivate decision-makers to easily identify where natural and smart development solutions can be</p>	<ul style="list-style-type: none"> • Provision of support and guidance to climate secretariats in various government MDAs • Leading on climate adaptation research and analysis, focusing on the development of methodologies and tools (including indicators) for assessing vulnerabilities and adaptive responses; and evaluating, comparing and documenting the benefits and costs of different adaptation strategies • Provision of targeted knowledge services in areas such as disaster management, biodiversity conservation, climate-resilient development, policy mainstreaming, and climate education. • Research into effective experiences on DRR practices and lessons from other developing countries. • Dissemination of effective field experiences and DRR practices

	used to manage risks against traditional options to risk reduction such as building concrete walls.	<ul style="list-style-type: none"> • Facilitation of exchange visits for community members and key partners to see and experience coastal adaptation practices in action. • Training of specific media and government officials on coastal climate change resilience issues.
Guidelines and best practices for infrastructure development	<p>The WA BiCC CCVA highlighted various climate change impacts that are increasing the vulnerability of infrastructure in the SLCLC, as well as the socio-economic and ecological systems that it supports. The threats mentioned include threats to health and safety, disruptions in economic activities, disaster events, and interruptions in essential services. This makes a compelling case for facilitating adaptive responses using infrastructure. Generally, there are significant infrastructural needs in the coastal communities ranging from housing, drinking water, health and education facilities, to flood prevention systems. Mangrove depletion presents an additional and substantial challenge because of the risks of erosion, accretion, and damage to local livelihoods. As such, infrastructural development should receive special attention in adaption actions that seek to foster coastal resilience to climate change impacts. Infrastructure in this context can range from traditional, hard infrastructure (such as buildings, energy infrastructure etc) to natural, soft infrastructure (for shoreline protection, for example), to seasonal infrastructure (such as systems that support economic activities that are likeliest to occur in a certain season).</p>	<ul style="list-style-type: none"> • Research into and dissemination of effective experiences on DRR practices and lessons from other developing countries. • Capacity building in coastal climate change resilience issues of relevance to infrastructure development
Policies and plans to guide infrastructure decision-making		<ul style="list-style-type: none"> • Awareness-raising on the vulnerability of coastal ecosystems and other development sectors to the effects of climate change • Strengthening of the capacities of relevant institutions to prepare and respond to natural disasters. • Training of government agencies on how to develop and enforce climate change policies and legislations • Education on the socio-economic value of coastal ecosystems, and specifically, their role in addressing climate change
Prioritize natural infrastructure		<ul style="list-style-type: none"> • Institutionalization of climate change adaptation at the local district level by encouraging local councils and chiefdoms to allocate funds to communities and villages for DRR. • Promotion of sustainable management practices of mangroves and other coastal ecosystems, • Rehabilitation of degraded mangroves and planting of trees in communal areas. • Construction and strengthening of protective networks such as green belts that protect community assets, • Protection and rehabilitation of river banks, • Construction of drainage ways to improve drainage and avoid flooding using sand, other local materials, and concrete.

Fund or incentivize disaster risk reduction and early warning		<ul style="list-style-type: none"> • Engagement with NGOs and INGOs that already have climate change adaptation options in their community development projects • Identification and tapping into complementary programmes implemented by government MDAs, such as fisheries projects, coastal zone management initiatives, and livelihood projects • Mainstreaming of climate change adaptation into coastal development plans, thus using local development funds managed by councils to build resilience • Seeking-out donor agencies that offer national-level climate adaptation funding • Exploration of the utility of environmental performance bonds such as user fees, tourism fees etc.
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Table 10 Climate change adaptation measures and activities for disaster risk reduction and early warning (adapted from WA BiCC options analysis)

3.4 IMPLEMENTATION, FINANCING, MONITORING AND EVALUATION

3.4.1 Implementation of the plan

While the climate change phenomenon has gained unprecedented global traction in recent years, entities have been taking action for many years to curb it. The Government of Sierra Leone has taken various actions to address climate change impacts in recent years, instigated principally by the heavy flood episodes that plagued the coastal city of Freetown in the last twenty years. For this reason, most of the interventions, although implemented in an adhoc manner, have strongly focused on disaster risk reduction and preparedness response actions. The country has also made many efforts in the policy front by signing, ratifying and developing many regional to international climate change conventions and guide policies, such as the UNFCCC, NAPA and NAPs.

The civil society represented by both the local to national civil society groups have also been powerful advocates of change promoting efforts to curb climate change. This plethora of entities have used various tools, including public awareness tool, policy research and advocacy on key socio-economic issues including climate change. For instance, USAID, through WA BiCC have been central to initiating climate change policy discussions and debates in Sierra Leone and West Africa, promoting policy research and analysis with respect to improving coastal natural resources management and key socio-economic issues including climate change impacts to coastal systems and coping mechanisms by local populace. WA BiCC and Wetlands international have also undertaken vulnerability assessments and baseline studies with a view to creating an enabling environment for good governance; information sharing and gender mainstreaming into climate change management in coastal Sierra Leone. Other institutions have indirectly joined in this endeavor, promoting the development of early warning systems; additional livelihood activities; improved fuel wood use technologies and efficient use of energy. The next sections present some carefully selected summary examples of some interesting initiatives implemented over the years to increase resiliency in the SLCLC.

- I) Global Environment Facility Small Grants Programme (GEF SGP) project entitled: *Energy Incentives for Conservation: Providing Fuelwood Alternatives to Enhance Mangrove Regeneration in the Yawri Bay Marine Protected Area (MPA)*.

Box 3 Energy incentives for mangrove conservation in the Yawri Bay

Yawri Bay Community Development Organization (YBCDO) received a one-year grant from the GEFSGP in 2013 to implement in various communities Yawri Bay MPA. The project sought among other things to increase the cover of mangrove vegetation and achieve sustainable utilization of mangrove resources in the Yawri Bay chiefdoms and Tombo. Results included training of local committees in the planting and maintenance of propagules, construction of a solar-powered fish freezing facility in Tombo, and facilitation of community education and media outreach events. A total of 800 beneficiaries were impacted, trained in mangrove restoration and provided with livelihood support (through purchase of seedlings nursed in the communities). The project raised awareness about climate change and provided energy incentives (such as the solar-powered fish freezing facility) to reduce the demand for mangrove wood for fish smoking.

- 2) Environmental Justice Foundation (EJF) project entitled: *developing MPAs and an ecosystem management approach to fisheries in the Mano River Union (MRU)*.

Box 4 Ecosystem-based approach to MPA development

This project was implemented by EJF (Environmental Justice Foundation) with support from government MDAs and Conservation Society of Sierra Leone (CSSL). In Sierra Leone and Liberia, EJF sought to detect and identify illegal industrial vessels through community surveillance. Steps were also taken to designate MPAs in the Sherbro River area, as well as for the development of MPAs in four coastal sites in the country. Key results from the project included: (i) capacity building of civil society organizations through needs assessments and baseline studies, film and media training, community engagement training, and ecological and research training (including a community science initiative); (ii) technical support for the development of MPAs and ecosystem-based approaches, leading to engagement in wider national and regional partnerships, identification of key conservation and management sites; and governmental uptake of an ecosystems approach to fisheries; and (iii) community engagement and livelihoods support, leading to increased awareness and enhanced stakeholder coordination, and improvement in community-based surveillance. Further outputs included the designation of four MPAs in 2012, election of Community Management Associations (CMAs) in 3 community clusters within the Sherbro Bonthe River Estuary (SBRE), and the successful piloting of a community science initiative in 4 communities. Overall, the project contributed towards effective governance in the SLCLC by strengthening local management structures, bolstering community education, and providing livelihoods support.

- 3) *Pilot project for sustainable coastal zone management implemented by Wetlands International in close collaboration with CSSL, FD, IMBO, and MFMR (in 2008 to 2011).*

Box 5 Sustainable coastal zone management

This project involved a partnership between PRCM, Wetlands International and CSSL to support different institutions in the country like the Ministry of Fisheries and Marine Resources, Forestry Division, and the Institute of Marine Biology. The project focused on the establishment of MPAs and demonstration of small-scale pilot activities, supported by communications and capacity building components. It supported key Sierra Leonean institutions in their efforts for sustainable coastal resources management and biodiversity conservation through the establishment of Marine Protected Areas, and promoted the benefits that PRCM involvement can bring to member countries. Results included the identification of two MPAs (including the Yawri Bay) and the development of a management plan; mainstreaming of PRCM approach into decision-making for marine and coastal conservation; and development of stakeholder capacity for effective governance of coastal resources. Lessons learned and best practices compiled have been promoted around the country for the improvement of coastal and marine resources management. They have also been useful for engaging local and national stakeholders through their participation in capacity building and knowledge management initiatives. Key lessons include the need for a more practical integration of community development and coastal ecosystems conservation, further designation of MPAs to improve their functionality and governance, and the sustainable provision of tangible livelihood benefits to enlist local support and meaningful involvement in coastal conservation practices.

- 4) GEF-funded and UNDP-implemented project entitled: *Adapting to climate change induced risks in coastal areas in Sierra Leone.*

Box 6 Addressing climate-induced risks in coastal areas

The GEF CEO endorsed the provision of a grant for the preparation of a project on climate change resilient coastal zone management in Sierra Leone in October 2015. The project includes interventions aimed at strengthening the capacity of coastal communities to manage the impacts of climate change on physical infrastructure and livelihoods. When implementation begins sometime this year, the project will be implemented by UNDP in six sites in the SLCLC (Konakridee, Lakka, Hamilton, Tombo, Shenge, and Turtle Island). Key partners include EPA, Conservation Society Sierra Leone (CSSL), Environmental Foundation for Africa (EFA), Environmental Forum for Action (ENFORAC), Island Aid Sierra Leone (IASL), Women's Network for Environmental Sustainability (WoNES); Climate Change, Environment & Forest Conservation Consortium (CEFCO-SL); Sierra Leone Artisanal Fishermen Union (SLAFU), and Civil Society Alliance on Climate Change (CSACC). Key outputs of the project will include: (i) enhancing the availability of high quality climate risk information that is critical for development decision-making in the coastal zone; (ii) facilitating appropriate protection measures, policy, budgeting, legal tools, and integrated coordination mechanisms to improve and support policy design and implementation in dealing with current and long-term coastal challenges; and (iii) creating public awareness and promoting climate-resilient alternatives to sand mining for better adhesion of communities and policy-makers on adaptation. Further outputs will include the establishment of a climate and oceanographic monitoring network, development of a marine spatial plan framework to complement the ICZM plan developed by the Environment Protection Agency (EPA), and development of a media outreach and communications strategy.

- 5) UNDP project entitled: *Strengthening Climate Information and Early Warning Systems for Climate Resilient Development and Adaptation to Climate Change (CIEWS)*

Box 7 Strengthening Climate Information and Early Warning Systems

This project is funded by the Global Environment Facility (GEF) and implemented by UNDP and the Sierra Leone Meteorological Department (SLMD). The UK Meteorological Department provided financial support in 2013 to build the capacity of the SLMD for rolling out key interventions at the start of implementation phase in 2014. The project is part of a regional intervention in which 10 African countries participate. It principally seeks to improve climate monitoring and early warning systems through various targeted interventions. One key output in Sierra Leone has been the re-establishment of a functional network of meteorological and hydrological infrastructure in order to better understand and predict changes in the climate, as well as climate impacts and consequences. Additional outputs include the provision of early warning data to relevant sectors like transport and agriculture, and the development of capacity for the integration of weather and climate information into national and local policies and development plans.

6) Establishment of a Coastal Chiefdoms Natural Resources Management Network

Box 8 Coastal Chiefdoms Natural Resources Management Network

Achieving the goals on climate change adaptation requires working establishing and strengthening local governance structures. A strong local governance structure will contribute to better involvement of local communities in planning and implementing actions that sustain their livelihoods. As such, WA BiCC is in the process of establishing a Coastal Chiefdoms Natural Resources Management Network (CCNRMN), which will act as an umbrella organization for good governance and sustainable management, and provide a direct link between local communities and the central government. Broadly, the CCNRMN will provide the space necessary for broad stakeholder engagement and a means of empowering all those with an interest in managing coastal resources to facilitate adaptation to climate change.

In November 2017, a 3-day workshop was held in Port Loko in Sierra Leone to establish the network, validate its terms of reference, and develop a year-long work plan. The workshop was attended by traditional leaders of the different chiefdoms, representatives of councils based in the relevant wards and districts, WA BiCC staff, and a team from PACT that facilitated a training in networking and communication. The network was originally named the Traditional Chiefs Network (TCN) following the inaugural meeting held in July 2017 to emphasize the important role traditional leaders play in the management of coastal resources and activities that build the resilience of communities and ecosystems. The expanded network, which is the result of the workshop, now involves local councils, district councils, NGOs, CBOs, government agencies and all other institutions with an interest in managing natural resources in the SLCLC. The core membership of the network includes individuals from the 22 chiefdoms spanning the 4 regions of the SLCLC. Its broad value is to facilitate meaningful and sustained local involvement, foster shared decision-making and encourage knowledge co-production in order to increase local ownership and initiative in the design and delivery of climate adaptation solutions in the SLCLC, specifically for mangrove ecosystems management and livelihood support.



- 7) Restoration of degraded mangrove areas and embankments strengthening in coastal areas that are highly vulnerable to the effects of climate change.

Box 9 Mangrove restoration and community embankment

Two key activities supported by WABiCC in the SLCLC are mangrove restoration and community embankments. A mangrove restoration plan has been developed to outline clear steps and approaches that will be used to restore degraded mangrove areas, as well as sustainably manage remaining mangrove forests in specific regions of the SLCLC. The broad goal is to enhance coastal resilience and adaptation to climate change by improving the function and diversity of mangrove and other coastal ecosystems. To implement the plan, nurseries have been established in various communities. 51,800 propagules/seedlings of mainly red mangrove species have been nursed through nurseries established in 23 communities. This accounts for a 95.8 percent success because all target communities now have established nurseries and have received tools and trainings for such work. The work has involved Community Animators (CA) identified in the different regions of the SLCLC, who have helped in establishing and training Mangrove Restoration Committees (MRC). CAs regularly submit reports on the progress these committees are making, and are coordinating efforts to collect wildings to fill the gap in propagules needed for restoration. Overall, mangrove restoration and conservation activities will seek to promote the economic roles of mangroves in coastal communities, their efficiency in coastal protection, and their biological diversity. The activities will also provide both a source of learning and increased action towards adaptation to climate change in these vulnerable communities.

On embankment, an Embankment Engineer and Community Mobilization Consultant have been hired to support the strengthening of embankment options in two communities most vulnerable to flooding in the Scarcies River Estuary (Kortimoh) and Sherbro-Bonthe River Estuary (Momayah). The Embankment Engineer (EE) recently undertook a 5-day preliminary assessment of the Kortimoh shoreline, which has been prone to erosion and flooding in recent years because of depletion in the existing sea face. The assessment also included ascertaining the nature, extent, and severity of the eroded sections of the shoreline; exploring the possibility of using local materials in stabilizing the embankment; and understanding approaches to preventing erosion and flooding that are in current use. The visit involved staff from WA BiCC and community members, who supported the EE in: 1) informing the community about the purpose of the assessment, and the value in constructing an embankment, including to mitigate erosion, prevent flooding, and provide a platform for natural infrastructure (such as mangrove planting); 2) measuring the entire length affected shoreline to determine the level of embankment effort that is required; and 3) scoping for the availability of local materials for the construction of the embankment. In the coming months, the EE will complete an environmental review form and develop a construction plan, which will inform the delivery of the embankment work, as well as the engagement of individuals in the community. Lessons from this will be replicated in other vulnerable communities to build local adaptive capacity.



Roles and responsibilities for implementing the plan

In respect of this CCAP, public and private institutions, as well as civil society, can prove extremely important in facilitating climate adaptation in the SLCLC (see figure 6 for potential roles they could play). The basic motivation for working together to implement this plan is the specific capacity

constraints faced by these institutions and organisations. In collaboration, each institution will be able to overcome the weaknesses of the others. There would also be a common or complementary understanding of the problem to be addressed, and coordination of strategies to achieve multiple adaptation objectives. By working together to deliver this plan, with coastal communities as the centrepiece of their joint action, stakeholders will be able to harmonize existing plans with the CCAP to achieve maximum coordination and collaboration; strengthen institutional capacities, policies, and practices to diversify roles in assessing and managing climate risks and opportunities; facilitate broad intersectoral and interdisciplinary collaboration to enable the sharing of information, knowledge, and financial resources; align coastal climate change adaptation efforts with broader goals for adaptation at the national, regional, and global levels to increase access to investments being made to build resilience; systematize and disseminate climate change adaptation knowledge to facilitate policy mainstreaming and effective decision-making; and reduce local vulnerability or build resilience through livelihoods support and community learning. Outlined below are roles that existing organisations could play in facilitating the implementation and evaluation of this plan.



Figure 6: Potential roles by stakeholders for CCAP implementation

The Central/National Government is expected to promote the rolling out of this plan through discrimination, proposing requisite changes, presenting plan to various national and international fora to create an enabling environment that will facilitate national and international interest to invest in this plan. Sierra Leone has a national climate change strategy, but it will be useful to promote this plan by instituting a national Climate Change Act. In the implementation of the institutional arrangements, the role of the recently established CCNRMN will be important as an entity that will facilitate linkages with local level actions as well as a platform for knowledge, information and lessons acquired over the years by other initiatives, the councils and chiefdoms. The implementation of the different actions outlined in this document will require the involvement and contribution of all the stakeholders across the different ministerial departments as well as sectors and levels although this plan is limited in scope to ecosystems and local communities. Some of the specific roles institutions might play to promote this plan are outlined below.

Governmental Organisations/MDAs: All MDAs with influence in this region will seek to consider how this CCAP integrates into their specific work results and action plans and designate resources, including a dedicated staff to coordinate the mainstreaming of the CCAP interventions and other climate change challenges into their mandates sectoral strategies for implementation. The government sectoral agencies will report annually to the National Climate Change Secretariat on the status and progress of all assigned climate change duties and functions. In addition, various development agencies in close collaboration with local government organizations such as local councils to mainstream climate change interventions and duties into their funding streams and Development Plans (DPs); and a designated National Committee, to coordinate climate change affairs to; submit a report on the implementation progress of this plan to the County's Assembly for review debate and recommendations for further actions. The EPA and the national climate change secretariat in association with the CCNRMN will be responsible for monitoring for monitoring and enforcing compliance of climate change interventions outlined in this plan. The Disaster Management Department (DMD) will continue to coordinate flood management and disaster risk reduction in the coastal landscape interface. To improve activity implementation and synergies, they will be expected to report annually to the National Climate Change secretariat on the status and progress of climate change adaptation and resilience in the SLCLC.

Private sector: Working directly with local councils, the EPA, climate change secretariat and the CCNRMN should coordinate and agree to impose climate change management on private entities operation at the coastal interface. Particularly entities such as extractive industries (off-shore and on land mining industries), industrial fishing and the coastal tourism industries amongst others. The private sector particularly those located in coastal areas is being impacted by climate change and has suffered negative impacts from landslides and flood risks. As a result, operational sectors in coastal Sierra Leone such as fisheries, agriculture, coastal tourism water, energy, coastal infrastructure, rural and urban development and coastal ecosystems are threatened. Despite these threats, it is difficult to technically predict how climate change is affecting the private sector. It is therefore unequivocal to

for implementing agencies to work closely with the different business sectors to develop business cases for private sector investment in adaptation, particularly in the coastal areas.

Academia and research institutions: This group of actors will have to play a key role in the implementation of this plan by contributing to building the country's adaptive capacity and data generation. They will be central to providing the evidence to support decision making by the decision makers at the government level, as well as within the private sector and development agencies. This will be done through research conducted on different aspects of climate change adaptation and resilience, including improving the understanding of climate change attribution in coastal Sierra Leone and providing information on the appropriate mix of adaptation actions in order to avoid maladaptation.

Non-Governmental Organizations/Civil Society Organisations (CSOs): These include national and international non-governmental organizations (NGOs), Multilateral international aid agencies such as USAID, UNDP, UNEP, GIZ amongst others, and local, national and community-based organisations. These institutions have already been involved in climate change adaptation and mitigation activities in Sierra Leone. The international community acknowledges the role of these entities to drive resiliency to climate change through the promotion of public awareness raising related to climate change, capacity building and formal education.

Media: The print and electronic media can strongly influence climate adaptation efforts by empowering people to effect positive change in their communities. It can alert vulnerable coastal communities of impacts and how they can adapt to them and can promote activities that constrain the emergence of negative perceptions, behaviours, and actions. High-quality media coverage of the actions proposed in this plan will deliver better informed actors and communities in the SLCLC and enable more effective policy-making and practice. Such coverage will also raise global awareness of local vulnerabilities and adaptation efforts and promote sustainable outcomes through increased collaboration and improved capacity. Implementers of this plan, therefore, need to build media capacity, improve communication, and engage stakeholders broadly.

To better coordinate all activities proposed in this plan, recognize and support the role of each institution (or actor) further, and promote synergy of actions and mutual support, a results framework has been proposed in table II below.

Adaptation measure	Activities	Lead agency	Partners	Success indicators	Implementation status
Impact identification and measurement	Collect physical and socioeconomic data to better understand vulnerabilities and impacts	NPAA	MFMR, EPA, IMBO, NU, NMA	<p>Nature and quality of reports generated on community and ecosystem dynamics</p> <p>Number of organisations with access to report and data produced</p> <p>Number of new projects and trainings undertaken on the basis of knowledge generated</p>	WABICC has undertaken assessments of ecosystem conditions for mangrove restoration (including CCVA, biophysical assessment report, and options analysis)
	Develop and coordinate research initiatives and partnerships with governmental and NGOs	NPAA	IMBO, EPA, NU	<p>Number of local stakeholders involved in research to identify direct and indirect users of mangrove resources</p> <p>Hectares of mangrove forests in MPAs with identified uses and species distribution</p> <p>Number of new research initiatives designed and funded</p>	
Multi-stakeholder forum for coastal adaptation	Operationalize Coastal Chiefdoms Natural Resources Management Network (CCNRMN)	NPAA	EPA, CCNRMN	<p>Work plan developed for CCNRMN activities</p> <p>Number and type of activities undertaken by CCNRMN</p> <p>Number of by-laws developed and enforced by CCNRMN</p>	
	Annual roundtable events for coastal stakeholders and key climate change agencies	NPAA	MFMR, IMBO, NU, EPA, CSOs, MAF	Number of stakeholders attending roundtable events	
	Establish CSO forum for CCAP implementation	CEFCO, CCSL, Green Scenery	Other CSOs	<p>Number of awareness-raising and community engagement events organised</p> <p>Number of policy forum events organised for mainstreaming CCAP into NDP</p>	

Ecosystem restoration, creation and enhancement	Scale-up/revise Mangrove Restoration Plan (MRP)	NPAA	MFMR, EPA, IMBO	<p>Revised MRP to support mangrove restoration work</p> <p>Number of plans or projects adapting MRP to address related conditions in other coastal areas</p>	WABiCC developed and is delivering a Mangrove Restoration Plan
	Mangrove restoration and ecosystem management	NPAA	MFMR, EPA, IMBO	<p>Number and type of mangrove species identified for restoration and management</p> <p>Categorisation of mangrove hotspots and development of a Restoration/Management Action Plan</p> <p>Number of mangrove nurseries established</p> <p>Number of hectares of seedlings/wildings produced and transplanted</p> <p>Number of trainings and community consultations for mangrove monitoring</p> <p>Quality of community-level monitoring activities undertaken (e.g., number of woman-led or chief-led activities)</p> <p>Number of Mangrove Restoration Committees established and equipped</p>	WABICC is implementing various activities geared at mangrove restoration and management across the SLCLC
	Participatory zoning and Adaptive co-management of MPAs	NPAA	MFMR, EPA, IMBO	<p>Number of MPAs successfully zoned for management</p> <p>Number of participatory monitoring activities undertaken based on M&E plan developed</p> <p>Development of an MPA management plan</p>	

				<p>Number of MPA management MOAs signed between government and communities</p> <p>Number of MPAs successfully applying Adaptive Co-Management activities</p> <p>Number of communities involved in network of chieftdom or district-level monitoring and surveillance</p>	
Awareness raising and community learning	Education of local community leaders and community members with the aim of influencing behavior change.	CEFCO, CSSL, Green Scenery	NPAA, MFMR, EPA	<p>Number of households demonstrating increased awareness of climate risks and impacts on coastal communities</p> <p>Gender disaggregation of individuals with increased capacity to constructively engage in resource management processes</p> <p>Number of learning and community engagement events organised</p> <p>Number of functional School Nature Clubs</p> <p>Copies of video and audio materials distributed</p> <p>Nature of shifts in local resource management knowledge, attitudes, and practices</p>	WABICC through PCI Media Impact is undertaking behaviour change communications across the SLCLC
Skills training, capacity development, and policy learning	Establishment and capacity development of CMGs	NPAA	CEFCO, EPA, MFMR	<p>Number of community animators with skills and knowledge to transition into Mobile Adaptation Experts</p> <p>Number of CMGs established (membership reported based on gender disaggregation)</p> <p>Number of adaptation-focused trainings facilitated for CMGs</p>	<p>Mangrove Restoration Committees established by WABICC and Community Animators have been identified and trained.</p> <p>MFMR has extensively worked on the development and training</p>

				Number of CMG members involved in project delivery processes	of Community Management Associations
	Training of relevant national institutions on climate change adaptation and mangrove conservation	UNDP, WABICC	NPAA, EPA, MFMR, IMBO, NU	<p>Number of national institutions benefiting from regular adaptation-focused training sessions</p> <p>Nature of training manuals/modules developed and delivered</p> <p>Number cross-organisational learning sessions facilitated</p>	
	Establishment of knowledge sharing platforms	UNDP, WABICC	NPAA, MFMR, EPA	<p>Number of policy engagement fora established (including number of meetings held)</p> <p>Government adaptation knowledge repository established</p>	
Policy mainstreaming and influencing	Review/streamlining of existing policies and legislation	MFMR, EPA	NPAA, IMBO, NU, MLHE, MLGRD, MTCA, CSSL	<p>Number of existing laws, plans, and policies revised to integrate climate change considerations</p> <p>Number of new laws, plans, and policies with consideration for coastal adaptation</p> <p>Finalisation and operationalisation of the draft Wetlands Act</p> <p>Action plan for operationalising the ICZMP</p>	<p>EPA has developed a NAP framework plan and drafted a climate change strategy and action plan</p> <p>NPAA has drafted a Wetlands Act, awaiting passing in parliament</p> <p>EPA has proposed an ICZMP. Operationalisation pending, though UNDP coastal resilience project is supporting delivery of some elements</p>
Diversify and strengthen coastal livelihoods	Research to assess local uptake potential of livelihood techniques and technologies	IMBO, NU	NPAA, MFMR, EPA	Number of studies/reports to identify feasible options for livelihood support and community development	WABICC has conducted research into the feasibility of IFSS, CSA and other livelihood and community development strategies

	Development of livelihood improvement strategy and action plan	NPAA	EPA, MFMR	Livelihood improvement strategy developed and validated by relevant stakeholders	Livelihood development strategy drafted by WABICC
	Implementation of livelihood improvement action plan (to include IFSS, VSLAs, rain harvesting kits, agri-silviculture, CSA etc)	NPAA	EPA, MFMR, NTB, MTCA	<p>Number of farming groups or community cooperatives established</p> <p>Gender disaggregation of membership of cooperatives</p> <p>Nature of by-laws developed to support use of livelihood technologies provided</p> <p>Number of farms applying agri-silviculture activities because of knowledge transferred by adaptation project</p> <p>Nature of impacts on mangrove resources due to local uptake of agri-silviculture techniques</p> <p>Number of communities (and CMAs) applying sustainable mangrove wood harvesting practices</p> <p>Number of MOUs signed to increase local commitment and involvement in fisheries governance practices</p> <p>Number of households applying improved techniques for salt production</p> <p>Number of households using kits for rainwater harvesting</p> <p>Number of days of water shortage reduced because of rainwater harvesting procedures adopted</p>	<p>Various activities for livelihood support and community development are being implemented by WABICC</p> <p>UNDP coastal resilience project to support various livelihood interventions</p>

				<p>% increase in financial capital (gender disaggregated) because of VSLAs established</p> <p>Number of individuals with adequate information about the utility of livelihood strategies</p> <p>Number of individuals with increased access to additional credit facilities (such as microfinance) as a way to bolster financing secured through VSLAs</p> <p>Number of individuals with increased access to existing market network systems</p> <p>Nature and type of ecotourism products developed and marketed</p>	
Climate change observation, monitoring and surveillance network	Build collaborative partnerships with existing local networks	SLMA	NPAA, EPA, CSSL, MLGRD	<p>Number of institutions with a written commitment to the coastal adaptation network</p> <p>Number of joint community-driven initiatives developed and delivered</p> <p>Quality of coastal adaptation monitoring and learning generated from local feedback</p>	
	Establishment of robust and long-term mangrove ecosystem health surveillance	NPAA, MFMR	EPA, IMBO, NU	<p>Nature of activities with a direct impact on mangrove work</p> <p>% of survived mangrove seedlings that have been planted</p> <p>Proportion of survived wildings that have been planted</p> <p>% of physically healthy mangroves in restoration sites</p>	

				% of physically healthy mangroves in management sites	
				Type of impact from increasing sedimentation in restoration and management sites	
	Facilitate and formalize collaboration among government MDAs and coastal communities to ensure the joint monitoring of climate change impacts	EPA	NPAA, MFMR, CSSL	<p>MOU (and work plan) developed with ONS/DMD to engage District Disaster Risk Reduction Committees</p> <p>MOU (and work plan) developed with SLMA to update and publish weather and related data</p> <p>MOU (and work plan) developed with FAO to deliver the “early signs project” and propose pilot initiatives for the SLCLC</p> <p>Number of intergovernmental consultation meetings held</p>	
	Sensitization of communities living in the coastal landscapes, particularly slums and eroded areas across the SLCLC	CEFCO, CSSL, Green Scenery	NPAA, EPA, MFMR	<p>Number of communities benefiting from sensitization and community education activities (disaggregate attendance by gender)</p> <p>Number of affected/exposed households (or sensitive community assets) with increased adaptive capacity due to access to new knowledge</p> <p>Number of radio talk shows organised (and recordings disseminated)</p> <p>Number of communications materials distributed (posters, leaflets etc) and</p>	Behaviour change communication and community education activities by WABICC and partners are ongoing

				processes facilitated (village competitions, in churches, mosques etc)	
	Improvement of the capacity of local community members to monitor local weather conditions	SLMA	EPA, IMBO, NU, MFMR, NPAA	<p>Number of community-based adaptation champions identified and trained</p> <p>Number of local weather monitoring stations installed</p> <p>Number of successful weather forecasts generated in a year</p>	UNDP coastal resilience project to support early warning activities in coastal communities
Network of climate adaptation learning centres	Provision of support and guidance to climate secretariats in various government MDAs	UNDP, WABICC	NPAA, EPA, IMBO, NU, MFMR, MLHE, CSSL, other INGOs and development agencies	<p>Number of learning centres established at Universities</p> <p>Number of climate change curricula developed</p> <p>Percentage enrolment in climate change course by gender</p> <p>Gender disaggregation of graduates from climate change programme</p> <p>Number of targeted knowledge services in areas such as disaster management, biodiversity conservation, climate-resilient development, policy mainstreaming, and climate education</p> <p>Number of adaptation-focused knowledge products published in a year</p> <p>Number of stakeholders with access to climate adaptation materials</p>	UNDP coastal resilience project to work with Universities to produce and disseminate adaptation-focused knowledge materials
Guidelines and best practices for infrastructure development	Research into and dissemination of effective experiences on DRR practices and	UNDP, WABICC	NPAA, EPA, IMBO, NU, MFMR, MLHE, CSSL, other	Number of handbooks/guidebooks targeting practitioners planning/undertaking coastal adaptation activities	

	lessons from other developing countries.		INGOs and development agencies	<p>Number of best practices improved/success stories disseminated (as factsheets, policy briefs etc)</p> <p>Number of exchange visits/study tours organised</p> <p>Number of stakeholders benefiting from learning exchange</p>	
Policies and plans to guide infrastructure decision-making	Strengthening of the capacities of relevant institutions to prepare and respond to natural disasters.	ONS/DMD	SLMA, NPAA, MFMR, EPA, MLHE, World Bank (FERP), other INGOs & development agencies	<p>Number of trainings conducted on climate change vulnerability assessment</p> <p>Number of trainings conducted on climate adaptation programming and monitoring</p> <p>Number of new legislations for coastal adaptation</p> <p>Nature of amendments to existing coastal adaptation laws and regulations</p>	
Prioritize natural infrastructure	Institutionalization of climate change adaptation at the local district level by encouraging local councils and chiefdom authorities to allocate funds to communities and villages for DRR.	EPA	CCNRMN, ONS/DMD, SLMA, MFMR, NPAA, CSSL, Decentralization Secretariat, MLGRD	<p>Number of Local Development Strategies integrating climate adaptation considerations</p> <p>Number of hectares of mangrove forest restored through funds allocated by local council</p> <p>Number of private sector players applying knowledge on coastal adaptation using soft infrastructure</p>	
	Construction and strengthening of protective networks such as green belts that protect community assets	NPAA	CCNRMN, MFMR, EPA, MLGRD	<p>Number of disaster-prone communities identified and surveyed</p> <p>Number of embankment projects conceived and delivered using soft infrastructure</p>	WABICC piloting community embankment project in select SLCLC communities using natural infrastructure

Fund or incentivize disaster risk reduction and early warning	Engagement with NGOs and INGOs that already have climate change adaptation options in their community development projects	NPAA, UNDP, WABICC, GEF Small Grants Programme	EPA, CCNRMN, MFMR, MLGRD, CEFCON, other INGOs & development agencies	<p>Number of partnership agreements signed with NGOs and INGOs involved/interested in supporting coastal adaptation</p> <p>Number of projects/plans implemented by local councils with climate change adaptation considerations</p> <p>Percentage of local development funds used for building coastal resilience</p> <p>Number of additional financing modalities explored to support coastal adaptation activities by NGOs and CSOs</p> <p>Number of NGOs and CSOs funded for coastal adaptation activities</p> <p>Number of people (gender disaggregated)/communities (disaggregated by SLCLC region) benefiting from NGO, CSO, and Local Council interventions</p> <p>Number of women-led households or initiatives supported</p>	
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Table 11: Proposed CCAP results framework

3.4.2 Mainstreaming

The CCAP is based on WA BiCC's experience in the SLCLC. A major achievement in its delivery, therefore, will be to become a means through which best practices and lessons could be mainstreamed into local and regional policies and interventions. The CCAP will stand at the heart of delivering WABiCC's Theory of Change (see figure 7) at the national level, by stressing the importance of drawing lessons and adopting further actions to foster links between national and regional strategies and operational activities.

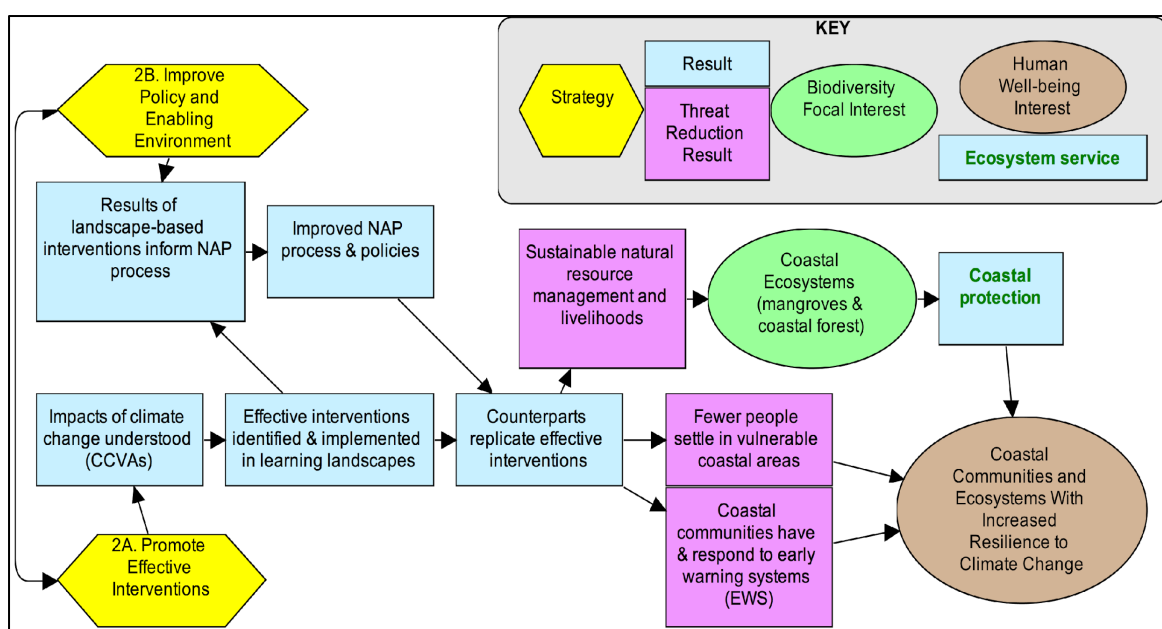


Fig 7: WA BiCC Theory of Change for Component 2

In the national sense, the CCAP could provide a basis for operationalising the NAP framework (recently developed by the Environment Protection Agency) by supporting a community-driven adaptation approach, fostering community learning and meaningful engagement, and expanding opportunities for building livelihood resilience. Moreover, the CCAP will undertake the groundwork for the future enforcement of the draft Wetlands Act developed by the National Protected Area Authority (NPAA), as well as for establishing structures for the delivery of a Mangrove Restoration Plan in the Bonthe-Sherbro River Estuary (BSRE) and other Marine Protected Areas (MPAs) across the country. Furthermore, the plan expands existing options for successfully delivering the Sierra Leone Climate Change Strategy and Action Plan by proposing a country-led, community-driven climate adaptation approach, ensuring sustainability of local actions and responses, carrying-out a consultative, cost-effective, and participatory process, and ensuring equity-based local development. Broadly, WABiCC's work in undertaking a full-blown CCVA of the SLCLC, preparing a management plan (options analysis), developing action plans for mangrove restoration and livelihood diversification, and many more, will go towards guiding national processes seeking to roll-out new climate change

adaptation projects or replicate and scale-up new ones. At the same time, effective policy mainstreaming at the national level will take the form of developing tools, methods, and approaches for knowledge management, gender mainstreaming, and community involvement; all as a way to develop the capacity of stakeholders at the local and policy levels to act. These national-level mainstreaming processes are summarized in the flow chart presented in figure 8.

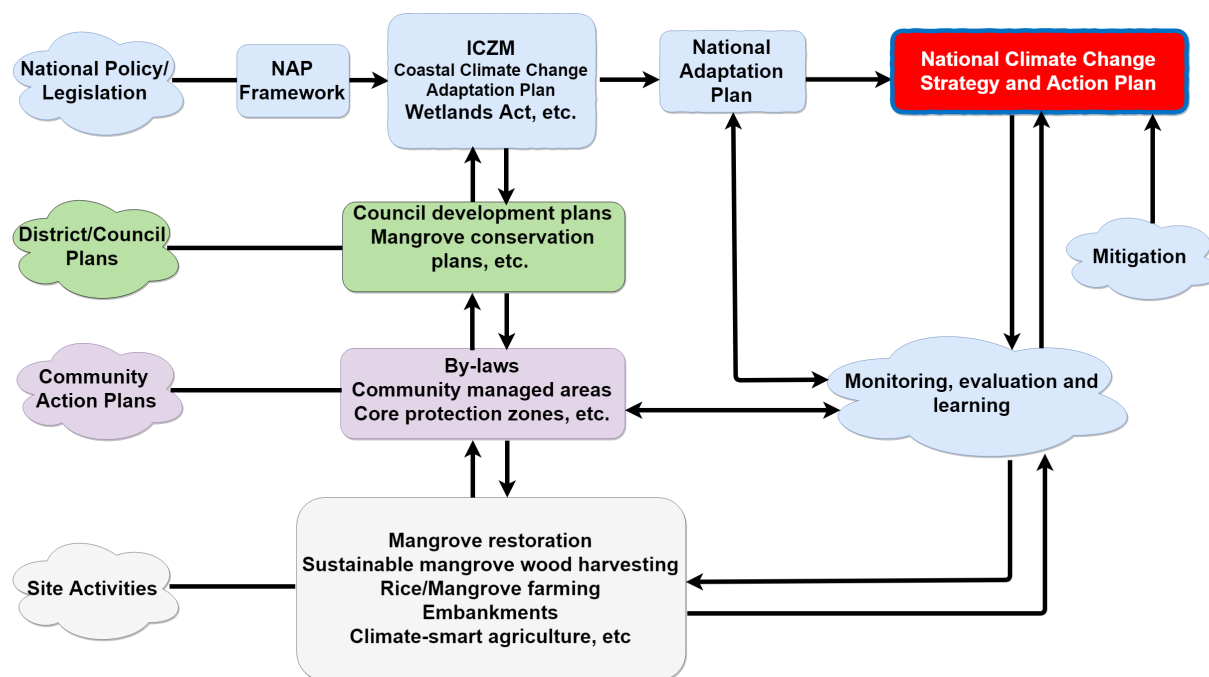


Figure8: Mainstreaming CCAP into national plans and strategies

From a regional perspective, WABiCC's regional positionality means that lessons from activities implemented at the local and national levels will feed into regional policies and strategies, especially those delivered by the Mano River Union (MRU), Abidjan Convention (AbC), and ECOWAS. One example of policy mainstreaming at the regional level that CCAP implementation can leverage is the establishment of a Parliamentary Network by WABiCC to support the delivery of relevant protocols by the AbC, such as the one on Integrated Coastal Zone Management and Sustainable Management of Mangroves. Another example is the ongoing support that WABiCC is providing to MRU countries, Ghana, and Togo in the development of their NAPs, and the regional strategy that has been developed on invasive species with a focus on *Sargassum*.

More specifically, in the case of ECOWAS, this plan could provide lessons towards the establishment of a sub-regional mechanism for environmental governance, promote sustainable management of resources to improve the sub-regional economy in an environmentally friendly manner, and promote cross-scale learning and policy engagement. The CCAP could form the basis for achieving specific objectives of the ECOWAS Forest Convergence Plan (FCP) by developing monitoring and management strategies, supporting mangrove conservation and sustainable use activities, and

increasing rule compliance. Concerning the AbC, the plan should be seen as a framework for working closely with the convention to implement its protocol on ICZM, as well document and disseminate best practices and lessons to stimulate transboundary adoption and local-scale operationalisation. For the MRU, the CCAP is mainly a source of information for updating plans for mainstreaming adaptation concerns into development planning (budgets, national policies etc).

The mainstreaming work expected both at the national and regional levels will support the delivery of the WABiCC Theory of Change, which requires partnerships that will continuously seek to effectively and efficiently implement the CCAP at all levels. because of the transboundary nature of most coastal landscapes, integrated and joint activities will be encouraged and supported at each watershed and marine/coastal ecosystem level and involving all relevant stakeholders. In the same vein, national agencies like NPAA and EPA will have to exploit these strategic partnerships to improve relationships with other MDAs, and hence, synergise political commitments with technical and sectoral interests and build cross-level capacity as needed. This could be part of a broader risk management strategy because the CCAP enables relevant MDAs to respond actively to climate change by using risk-based information to improve governance decision-making. By mainstreaming adaptation into policy, programmes, and operations, MDAs can mobilize their authorities, investments, and economic instruments to build internal capacity, disseminate information, and develop new knowledge.

3.4.3 Knowledge management

CCAP implementation will entail pooling of experiences and lessons that would feed into broader policy and international negotiations for climate change adaptation. In this regard, capacities at the relevant departments or agencies will be strengthened so that lessons and experience can be replicated. Knowledge products would be prepared for creating awareness and behavioural changes towards a culture of adaptation; and publications and flagship events organized at various levels to increase visibility and showcase success stories in national & international fora. Knowledge management (for the purpose of capacity development) will specifically involve collation of best practices, and dissemination and policy development functions with the goal of ensuring effective implementation and replication at multiple levels and across scale. These processes will provide key inputs to help better inform adaptation policy making, create awareness and spur behaviour change, increase visibility and showcase successful stories in various fora, initiate dialogue on local experiences, lessons and best practices, support strategic partnerships and resource mobilisation, and design and deliver methods and tools for targeted trainings and professional development. They will emerge through the effective functioning of the multi-stakeholder fora, learning centres, and other knowledge management and capacity development measures proposed for adaptation in the preceding sections.

3.4.4 Citizen (public) engagement

The plan stresses the importance of a sector-wide communication strategy and proposes adaptation measures that seek to address the challenges for meeting this need. For example, at the centre of the proposal to encourage and support learning through cross-level engagement, the CCAP has provided insights into the relevance of multi-stakeholder fora, learning centres at universities, community training and engagement sessions, and dissemination of knowledge products. The idea is to enable the mobilization of critically-needed support from different sectors to improve the capacity of policy and local stakeholders to engage and elicit positive messages in coastal adaptation among target audiences. Importantly, the Communications and Engagement Strategy (CES) will invoke the pathways outlined within this plan by fostering shared understanding and engagement. A shared understanding of adaptation priorities can be leveraged to motivate and promote action at all levels across the SLCLC, and Sierra Leone more broadly. It could begin an effort to engage stakeholders and facilitate expert discussions on assessing the need for adaptation, and ways to adapt within their sectors. Therefore, a CES can highlight the efforts and lessons learned in ways that provide audiences with adequate information to make informed decisions about their own personal and institution action.

3.4.5 Financing

It is clear that there is a need for additional funding to implement this plan, since WA BiCC can only provide some limited support in line with its objectives and financial capacity. To that end, In addition to the contribution of WA BiCC, other possibilities for funding will be explored from multilateral and bilateral, and private partners (e.g.: Global Environment Facility (GEF), Adaptation Fund, Climate Investment Funds (CIF), Green Climate Fund (GCF), Special Climate Change Fund (SCCF), Least Developed Countries Fund (LDCF), Community Development Carbon Fund provides carbon reduction financing to small scale projects in the poorer rural areas of the developing world, Climate Finance Options) and private sectors (e.g., foundations, trust funds, donations, taxation, voluntary financial allocations, philanthropy etc). At the same time, the World Bank could be approached, as well as various international financial institutions, funding aid agencies at regional level and through bilateral agreements with developed countries, or any other funding mechanisms for which Sierra Leone is eligible. The World Bank and regional development banks (like the African Development Bank) provide financing for investment in mitigation and adaptation measures to developing countries.

WA BiCC recognizes that implementation of climate change adaptation plans creates new costs for governments and beneficiary stakeholders. These new costs result from, first, expenditure for direct adaptation initiatives, such as the construction of coastal protection structures to protect vulnerable communities from sea-level rise; and second, diversifying livelihoods options to increase the resilience of communities. It is also known that the capacity of existing revenue sources has a number of practical constraints, which act as a limit on the ability of organisations to implement climate change

adaptation plans. Adaptation planning needs to take account of these constraints, and to consider potential mechanisms for financing adaptation actions.

However, it is useful to consider not only financial mechanisms for climate change adaptation but also a range of existing mechanisms which, while they have not been extensively applied to climate change adaptation, have been applied to other areas of local government expenditure such as infrastructure delivery. It is critical to work closely with the decision-makers to ensure that they are not promoting maladaptation: this occurs, for instance, when governments intentionally or unintentionally promote an activity that increases or fails to reduce exposure to climate change (e.g., land use policies that provide incentives for building houses on floodplains, on waterways, or on steep slopes).

3.4.6 Monitoring and Evaluation (M&E)

An M&E system will be set-up to measure progress towards achieving the goals and objectives of the CCAP. At the national level, an outcome evaluation will determine whether the plan has achieved its broader goals as specified in the results framework above. It will also identify and document lessons and practices that can be replicated or scaled-up and disseminated. Additionally, the limitations and gaps in the process that could affect the overall outcome of CCAP implementation will be identified to bypass similar lapses in future. The M&E tools and methods used will promote learning at multiple levels, which will be used to adapt process-level strategies accordingly (see examples in table 12). The partners that have been assigned responsibilities in the results framework will jointly have the responsibility to monitor the delivery of the plan through regular field visits, quarterly review meetings and progress reports.

M&E approach	Purpose	Frequency	Support required	Key indicators
Mangrove mapping	Direct impacts such as clearing for fish smoking, rice cultivation and other economic activities, will be monitored through mangrove mapping, which will provide current information on mangrove distribution, depletion, and restoration.	Bi-monthly	Designated agency to lead in the development of appropriate monitoring tools and approaches, as well as the initial analysis of data Designated agency to contribute to disseminating monitoring results Community Animators to support in the application of tools for data collection	Nature of activities with a direct impact on mangrove work % of survived mangrove seedlings that have been planted Proportion of survived wildings that have been planted
Mangrove health survey	Monitor indirect impacts, such as changes in mangrove health using regular visual assessments, which help to determine the condition of mangroves in both	Quarterly		% of physically healthy mangroves in restoration sites

	restoration and management sites			% of physically healthy mangroves in management sites
Sedimentation survey	Provide an early warning of potential impacts and take appropriate mitigation steps	Quarterly		Type of impact from increasing sedimentation in restoration and management sites

Table 12: Model M&E framework for mangrove restoration activities in the SLCLC (source: WABiCC Mangrove Restoration Plan)

At the same time, implementing partners can pool resources toward the day-to-day monitoring of CCAP activities through periodic field visits, interactions with national and local-level stakeholders, and documentary analysis. An annual review should be conducted during the last quarter of each year to measure the extent to which partners are making progress towards outputs and ensure that activities remain aligned to relevant outcomes. Evaluations conducted in the medium-term and at the close of the implementation period should involve all relevant stakeholders and produce lessons that can initiate dialogue, policy influencing, up-scaling and resource mobilization. Furthermore, monitoring and evaluation activities should feed a broader technical research process with the aim of working with stakeholders at different levels to co-produce and co-manage new knowledge (see table 13 for possible research activities that could be supported through CCAP implementation).

Sample theme	Description	Support required	Key outputs	Outcome
Effects of agricultural pollution on mangrove resources Research questions TBD	Mangroves capture carbon (carbon sequestration) and provide a sink for pollutants like organic and inorganic heavy metals.	Designated agency to provide fieldwork support and mentorship to graduate students at Njala and IMBO/USL	Copy of thesis, policy briefs and any journal articles Slide presentation to an expert audience Non-technical summaries for a non-expert audience	Policy and practice-level understanding of the nature of climate risks and impacts, as well as near-term and long-term solutions and challenges to be provided, which helps in designing and delivering cross-level, sustainable and successful Interventions for climate adaptation and coastal resilience.
The effect of mangrove degradation on fish abundance and diversity Research questions TBD	Mangroves play a critical role in providing spawning, nursery, breeding and feeding grounds for fish. However, the indiscriminate degradation of these critical habitats might have adverse effects on fish abundance and diversity due to habitat loss and alterations.		Policy briefs on each research output Papers/book chapters in internationally recognised journals/book projects	
Climate change impacts on humans and communities and the potential for and performance of	Human environments in the SLCLC continue to experience impacts from climate change and these occurrences cut across			

mangroves as an adaptation solution	sectors. Data to inform adaptation decision-making and targeted actions that build resilience are critical.			
Research questions TBD				

Table 13: Model framework for research activities in the SLCLC (source: WABICC Mangrove Restoration Plan)

Consequently, the monitoring of this plan will be critical to ensuring that the prospective benefits of adaptation interventions are effectively contributing to building adaptive capacities and enhancing ecosystem and human well-being, as well as ensuring that lessons and data are being taken into consideration to improve policies, and the perceptions of decision-makers about climate change. Although this plan is limited to coastal ecosystems and society, it is anticipated that effective monitoring will lead to a channelling of lessons to targeted government departments and hence anticipated improvement of the Government of Sierra Leone's local and coastal sector plans and programs in climate change.

Therefore, any M&E system needs to have a feedback mechanism which will ensure the continued building of resilience and reduction of vulnerabilities to climate change in the longer term. As a result of the need to track progress in building adaptive capacity a results framework has been developed and indicators have been proposed against the major expected changes to demonstrate resilience (see table 11). Tracking and reporting the proposed adaptation indicators will be useful for evaluating how implementation of interventions is contributing to adaptation policy, project intended objectives and outcomes of the adaptation goal; attracting additional international funding to contribute to international development by curbing climate threats; informing the development of prospective adaptation initiatives; mainstreaming adaptation into coastal sectoral development through links with related indicators resulting from intervention performance; communicating adaptation progress to various stakeholders and the general public to raise awareness and improve perceptions on the advantages and disadvantages of climate change; using data and information generated from research and lessons learnt to inform Sierra Leone's climate change negotiations in the international arena; and targeting, justifying and monitoring adaptation funding and programs.

3.5 CONCLUSIONS

This CCAP offers a mechanism for implementing, tracking, evaluating, and communicating adaptation actions and results, which are critical to the climate change adaptation plan's overall success. For each of the adaptation categories and measures included in the plan, it is important to emphasize that the science is evolving, and to account for this, planning should be continuous and adaptable. Climate change adaptation plans are living documents that should be updated to attain the expected utility.

Therefore, in addition to regularly appraising the status of the plan, coastal managers will need to carry out a full-blown review and update every few years, as determined by stakeholders involved at different levels of the process. The updated plan should, essentially, include examples of successes,

challenges and lessons learned. This will give coastal managers the opportunity to promote successes and modify or replace adaptation measures that may be challenging to implement (or not yielding the desired results). Going forward, slide presentations, summary notes, and a validation workshop should be considered, so that the plan will benefit from the endorsement and ideas of key policy and local stakeholders. Validation will indicate formal adoption and legitimization of the plan, which will demonstrate the commitment of national and local-level structures to climate change adaptation in coastal areas and authorize implementation.

Key Definitions

Adaptation- means anticipating the adverse effects of climate change and taking appropriate action to prevent or minimize the damage they can cause or taking advantage of opportunities that may arise.

Adaptive capacity- In the context of climate change adaptation is a property of social-ecological systems and generally refers to the ability of the systems to adjust, in order to adapt to climate change impacts.

Climate change- Refers to a change of climate that is attributed directly or indirectly to human activity, altering the composition of the global atmosphere.

Coast- Is a strip of soil between the mainland and the sea. The coast is constantly shaped by the action of the sea (waves and tides), the wind and atmospheric agents.

Coastal ecosystem- Is a collection of organisms that are found on the boundaries of oceans, lakes, rivers, and other forms of liquid water. The intrusion of water into the land creates unique environmental conditions characterized by a large number of habitats.

Coping – Sometimes used as a synonym for adaptation, but coping measures are generally short-term actions to ward off immediate risk, rather than to adjust to continuous or permanent threats or changes.

Disaster management- Is defined as the organization and management of resources and responsibilities for dealing with all humanitarian aspects of emergencies, in particular preparedness, response and recovery in order to lessen the impact of disasters.

Impact assessment – The practice of identifying the effects of climate change at a given location. Impact assessments require a reference baseline and a projected climate change scenario.

Maladaptation – Any changes in natural or human systems that inadvertently increase vulnerability to climatic stimuli; an adaptation that increases vulnerability to climate change instead of reducing it. Maladaptation can take place when the development context is not considered explicitly in designing and implementing adaptation measures.

Mangroves- Are trees or large shrubs which are salt-tolerant and grow in intertidal zones in tropical and subtropical regions.

Resilience- Is generally defined as the capacity for a socio-ecological system to: (1) absorb stresses and maintain function in the face of external stresses imposed upon it by climate change and (2) adapt, reorganize, and evolve into more desirable configurations that improve the sustainability of the system. In other words, resilience may refer either to the extent to which a system is able to absorb adverse effects of a hazard or to the recovery time for returning after a disturbance. In this sense, highly resilient systems are characterised either by their ability to endure despite high stress or their ability to bounce back quickly.

Sensitivity- Is the extent to which a given community or ecosystem is affected by climatic shocks and stresses.

Sustainable livelihood- A livelihood is sustainable when it can cope with and recover from the stresses and shocks and maintain or enhance its capabilities and assets both now and in the future without undermining the natural resource base (Chambers & Conway).

Household livelihood security

Vulnerability- In this context can be defined as the diminished capacity of an individual or group to anticipate, cope with, resist and recover from the impact of a natural or man-made hazard.

Vulnerability assessment – the practice of identifying the factors causing vulnerability, sometimes to quantify it for comparative purposes. Sometimes vulnerability is assessed in order to identify capacity – when vulnerability is seen as the opposite of capacity.

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