

Drought Management Plan

A Contingency Plan for Sierra Leone

Photo credit- Drinking water sold to residents in Yeliboya, Kambia District, Northern Sierra Leone by Abu-Bakar S. Massaquoi



United Nations
Convention to Combat
Desertification

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Abbreviations

CSO	Civil Society Organisations
DAG	Drought Advisory Group
DMD	Disaster Management Department
DMP	Drought Management Plan
DMT	Drought Management Taskforce
DMWG	Drought Monitoring Working Group
DRR	Disaster Risk Reduction
EPA	Environment Protection Agency
EWS	Early Warning System
IAWG	Impact Assessment Working Group
IWRM	Integrated Water Resources Management
LDN	Land Degradation Neutrality
MAF	Ministry of Agriculture and Forestry
MCWG	Mitigation and Communications Working Group
MDA	Ministry, Department, and Agency
MLHE	Ministry of Lands, Housing, and Environment
MLRD	Ministry of Local Government and Rural Development
MTA	Ministry of Transport and Aviation
NAPA	National Adaptation Programme of Action
NCCC	National Council for Climate Change
NDI	National Drought Index
NFP	National Focal Person
NGO	Non-Governmental Organisation
ONS	Office of National Security
PRSP	Poverty Reduction Strategy Paper
SLMA	Sierra Leone Meteorological Agency
SWOT	Strengths, Weaknesses, Opportunities, and Threats
UNCCD	UN Convention for Combating Desertification
WASH	Water, Sanitation and Hygiene

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Disclaimer

The views expressed in this report are those of the author, except for explicit references made to other authors. The views do not necessarily represent the views of the contracting organisation- UNCCD Global Support Mechanism (GSP), or the concerned national Ministries, Departments, and Agencies (MDAs), but reflect the policy and process-level realities for drought monitoring and management in Sierra Leone.

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Executive Summary

Although drought is not documented in Sierra Leone because it has not occurred in the past, it is recognised in many circles as a potential, long-range issue for water management, agricultural and food productivity, health, and environmental protection. This is predicated primarily on the trends in water stress caused by increasing water demand and water pollution as well as climate change effects. The lack of a drought contingency plan in Sierra Leone indicates that decision-makers see drought through a crisis management lens, wherein drought responses involve declaring a national or subnational emergency action to alleviate impacts. This is opposed to the more effective risk management approach, which involves developing comprehensive, long-term drought preparedness policies and action plans that may reduce vulnerability to risks and address varied impacts. In line with the principles of risk management, this Drought Management Plan (DMP) will form the basis of national efforts to establish and develop measures to minimise socio-economic and environmental impacts of drought-related conditions, prevent and alleviate effects in the context of broader climate management and economic development plans.

The DMP consists of six chapters: Chapter 1- background- presents the purpose and objectives of the plan and defines the concept of drought. It also defines the concept of the drought planning process in terms of 10 steps that can be followed in various ways depending on the local context. Chapter 2- status and context- provides a brief country overview and describes the key events, issues, and potential impacts of drought in the country. Chapter 3- assessment and monitoring- enumerates the processes needed to understand and monitor drought incidents, including the development and use of indicators and the deployment of early warning systems. Chapter 4- mitigation and preparedness- describes the measures needed for increasing drought preparedness and mitigating its near-term and long-term effects. It enumerates the field-level actions to take to implement the guidelines discussed in this plan. Chapter 5- implementation framework highlights some of the administrative steps that need to be taken to operationalise the plan. It includes a strategy for capacity development and gender mainstreaming, which are essential components of effective drought monitoring, preparedness and mitigation. The purpose of a governance framework is to institute a functional mechanism for planning, implementing, and monitoring drought management actions across the country. The final chapter- chapter 6- sums up all the key points that are made in the plan, including recommendations for management action at different levels.

Overall, the six chapters of the report present general guidelines for developing drought preparedness, and planning and managing actions for monitoring, impact prediction and assessment, and mitigation. These steps, when considered as fundamental aspects of the risk management approach, will provide a near-term and long-range strategy to decrease the risks associated with extreme weather events like drought by increasing vulnerability and increasing resilience. Moreover, the steps will guide the planning of response actions in advance, and highlight the importance of appropriate policies, effective information management and early warning, and effective communication and networking between and among key stakeholders. Furthermore, the plan promotes incentives for a more proactive, anticipatory approach to drought management, and emphasises the need to learn lessons from previous efforts to manage related risks and impacts while documenting, evaluating, and sharing information at multiple levels. Consequently, the effective application of the measures recommended in this plan will help key structures to establish clear and objective thresholds for drought management, develop appropriate indicators for monitoring and evaluation, link management plans to wider national and subnational strategies for environmental governance and sustainable development, and establish appropriate institutional structures and organisational networks.

Chapter One

Background

1.1 Overall goals and objectives

The Drought Management Plan (DMP) for Sierra Leone is designed as a contingency plan to direct efforts to mobilise technical and financial resources for an effective nation-wide response to drought-related conditions. It should also enable communication and coordination between and among stakeholders and the public through various activities that promote citizen engagement, learning, and policy change. Therefore, the broad goal of the plan is not reactive. Rather, it is designed to facilitate planning, monitoring, and preparedness activities in a structured manner, with the most efficient utilisation of time, effort, and resources. Moreover, the DMP could be useful in delineating roles and responsibilities of different actors and organisations, thus ensuring better preparation and timely communication and coordination within and between all levels of engagement. Furthermore, the plan is intended as a guide toward the establishment of effective operating procedures for foreseeing, monitoring, and mitigating drought risks and impacts. Simply put, it provides a framework by which key organisations will prepare for drought and when and how mitigating processes and procedures should be implemented. These steps are necessary in achieving the greatest public understanding of the risks of drought, as well as benefits for effective use of water resources and management of climate services. Hence, the specific objectives of the plan include, to:

- Outline a framework for research on drought-related conditions in a timely and systematic manner;
- Establish criteria for monitoring and tracking drought emergencies and triggering various mitigation actions;
- Propose an institutional framework and organisational delivery system that ensures learning between and within levels of government and civil society;
- Define the roles and responsibilities of key individuals, organisations, and networks;
- Identify mitigation actions that can be taken to reduce vulnerabilities to drought risks and impacts.

These objectives will ensure that:

- The important issues of addressing risks to lives, property, and livelihoods are addressed purposefully and systematically;
- Measures for drought proofing of significantly risky drought areas are properly defined and effectively operationalised;
- The gravity of risks is clearly understood and effectively communicated with all stakeholders with a responsibility to act in a timely and coordinated manner;
- Standard procedures are developed for drought vulnerability assessment and evaluation of the performance of drought mitigation actions; and
- Meaningful stakeholder engagement and capacity development occurs at all levels of the institutional arrangement, including for planning, implementation, monitoring, and communications.

1.2 Understanding drought

An important feature that distinguishes drought from other natural hazards is its lack of a universal definition. Hundreds of definitions exist because drought is defined in relation to the characteristics of each climate regime and the specific context to which the definition is being applied. The reason is that the impacts that occur from drought are the result of various natural (such as precipitation deficiencies because of natural climate variability) and human factors (such as increasing demand of water and other natural resources). It is also because drought occurs with varying frequency and the impacts differ from one location to the next depending on the setting in which the event is unfolding. Another reason is that drought occurs in high or low rainfall areas, which makes an accurate prediction of either its onset or end a difficult task. Additionally, the severe impacts of drought events make its consequences for the society, economy, and environment challenging, though not impossible to identify, quantify, address, and communicate. The condition itself is triggered by various natural and human factors that ultimately affect the supply of water. The focus on water, thus, places water at the heart of all drought discourses and plans, though context of Sierra Leone, it is considered a relative rather than an absolute condition.

The foregoing perspectives demonstrate that drought has many faces, from being a conceptual to an operational construct. It is conceptual when definitions are formulated in general terms to identify the boundaries of the concept. A conceptual definition reflects the one provided by dictionaries such

as the Oxford Dictionary, which consider the condition as “a long period of time when there is little or no rain”. Such a definition offers little guidance to those seeking to undertake real-time drought assessments and understand real-time situations. Operational definitions, however, focus on identifying the onset, severity, and termination of drought events. Such a definition is suitable for analysing drought frequency and duration for a given historical period, though its utility is limited by the requirement of data on an hourly, daily, monthly or seasonal basis. It is, however, widely used to understand all forms of drought, including meteorological, agricultural, hydrologic, and socio-economic (Subrahmanyam 1967). Meteorological drought involves the degree of dryness and the duration of the dry period; agricultural drought focuses on the linkages between various features of meteorological drought that lead to agricultural impacts; hydrological drought accounts for the effects of dry spells on surface or subsurface hydrology, rather than with the meteorological account of the situation; and socio-economic drought provides an understanding of the characteristics of the social and economic aspects of the other types of drought (Wilhite 1996). In the context of Sierra Leone, drought can be defined in terms of any of the above definitions since the various meteorological and hydrological conditions that lead to drought (and can have agricultural or socio-economic impacts) are identifiable. Some of these conditions include precipitation deficiency, high temperature, reduced streamflow, low agricultural yield, and social and economic impacts etc (see figure 1).

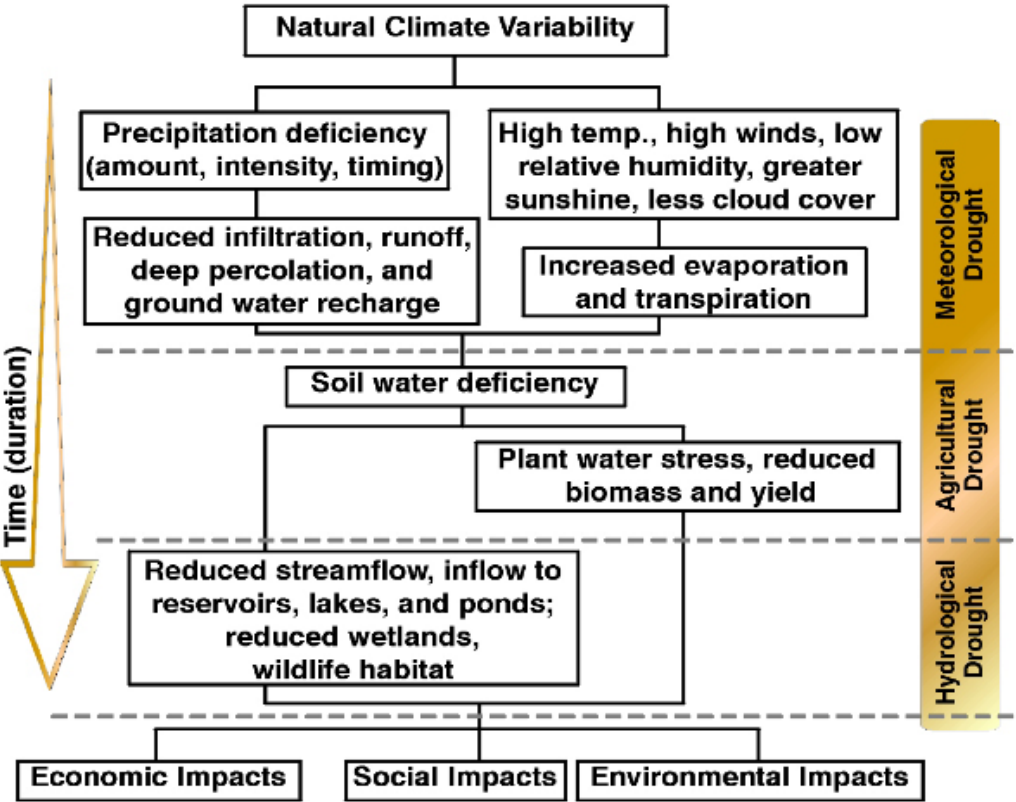


Figure 1: Evolution of drought types (adapted from Robert Stefanski Ppt, WMO)

1.2.1 The 10-step planning process

A widely accepted approach through which practitioners have understood drought and drought management efforts is the 10-step planning process. Ten steps are considered essential to planning for drought in all circumstances. The first four involve appraising the resources available to support planning and management processes, while the last set of six steps consider the principal issues associated with drought preparedness and outline a framework for implementation, communication, monitoring and evaluation. The steps, which are elucidated in table 1, include: 1) establishing a Drought Management Taskforce (DMT); 2) identifying objectives for drought planning and policy formulation; 3) determining and resolving issues relating to human communities and the surrounding environment; 4) compiling all challenges and choices that may be natural, biological, technical, financial and legal; 5) developing a drought preparedness plan; 6) finding research priorities and institutional gaps; 7) understanding relevant scientific and policy issues for drought planning and management; 8) operationalising the drought management plan; 9) developing and implementing multi-level learning programmes; and 10) monitoring and evaluating drought management procedures and outcomes.

Planning steps	Description of tasks
Establish a Drought Management Taskforce (DMT)	The drought planning process in Sierra Leone should be initiated through the establishment of the DMT and the appointment of relevant working groups. The DMT will serve two main purposes: first, supervise and coordinate the development of the preparedness plan, and second, coordinate and communicate policy to ensure the effectiveness of management processes. DMT should include representatives of the most relevant Ministries, Departments, and Agencies (MDAs) as well as Civil Society Organisations (CSOs) and research institutions. The organisational arrangement should recognise the multidisciplinary nature of drought, its diverse impacts, and the importance of both the assessment and response elements in any comprehensive plan, and how this plan must be mainstreamed into long-term sustainable development goals.
Identify objectives for drought planning and policy formulation	The first step for the DMT to take is to formalise this DMP and seek a broad consensus for the achievement of its objectives by formulating a national drought policy. The ultimate goal of the policy should be to reduce vulnerability to drought by encouraging sustainable development. The development of a national policy should lead to an evaluation of all necessary government projects to ensure that they are adequately aligned with the policy. The formulation process should be informed by answers to questions such as (Wilhite 1996): <ul style="list-style-type: none"> ○ What is the purpose and role of government in preparing for drought, assessing impacts, and responding to drought? ○ What should be the scope of the policy (i.e., agricultural, municipal water use, or multi-impact in design)? ○ What consideration should be given to food supply and distribution or maintaining the nutritional status of various population groups?

	<ul style="list-style-type: none"> ○ What are the linkages between drought and land degradation processes? ○ What are the most drought-prone areas of the country? ○ What are the most vulnerable sectors of the nation’s economy? ○ What are the principal social and environmental concerns associated with drought? ○ Who are the most vulnerable population groups? ○ Will the drought policy be a vehicle to resolve conflict between water users during periods of shortage? and ○ What resources (human and financial) is the government (and donor organizations) willing to commit to the planning process and in support of the policy once it is completed?
Determine and resolve issues relating to human communities and the surrounding environment	As a next step, the DMT should also seek to understand the political, social and economic interests that often clash during drought conditions as competition for water intensifies. Members of the taskforce should strive to provide a balanced interpretation of drought conditions to the public through media and other sources. To resolve conflicts and lessen fears, the relevant working group of the DMT should issue regular and accurate press releases to explain changing conditions and complex issues that relate to the management of drought.
Compile all challenges and choices that may be natural, biological, technical, financial and legal	To deepen their understanding of local conditions, members of the DMT should develop an inventory of natural, biological, and human resources, as well as financial and legal constraints. An inventory of these factors and issues would reveal assets and liabilities that might enhance or delay the achievement of objectives of the drought management process. Therefore, the systematic study should include resources available at various levels of government and research institutions, including those available in adjacent or climatically similar countries.
Develop drought preparedness plan	As a follow-up to this plan, and in addition to a national policy, the DMT should develop a preparedness plan that provides a systematic approach to drought as it occurs. The preparedness plan should indicate specific steps that need to be taken during monitoring, evaluating, and mitigating impacts. In addition, the plan should include formal linkages to environmental management plans being implemented at the subnational level, which then provides a framework for data collection and analysis, and communication and coordination.
Identify research needs and institutional gaps	The foregoing steps will go towards identifying research needed in support of the objectives of both the drought policy and preparedness plan. The goal at this stage is to recommend research projects to address gaps in drought knowledge and improve institutional resilience. The role of identifying research and institutional gaps should be played by the Drought Advisory Group (see chapter 5), which should be a multidisciplinary scientific advisory panel that could evaluate research proposals, establish funding needs and priorities, and seek financial support from appropriate national and international sources.
Understand relevant scientific and policy issues for drought planning and management	Next, the DMT should synthesise scientific and policy issues, focusing on both the status of the science of drought in the country (the extant understanding of the condition) and the existing institutional arrangement to support the effective implementation of the plan. This step should be taken to enhance policy-makers’ understanding of the scientific issues and technical constraints involved in addressing problems associated with drought and raise the awareness of scientists about the need for or existence of policies that facilitate drought response. To achieve this, the working groups should promote direct and extensive contact between researchers and policy-makers, so that decisions taken can favour a broad range of science and policy issues. The connection between these two groups of actors will also aid in integrating science and policy during all stages of drought preparedness and management.

Operationalise drought management plan	With the above steps thoroughly followed, the DMT can move on to implementing the plan. The different components of the plan should be tested under simulated drought conditions before implementation. The cooperation of the media is essential to publicising the plan, because they can help with informing the public of the rationale for the plan as well as its objectives, assessment and response procedures, and institutional framework. Moreover, the DMT should train personnel who will be actively involved in the operationalisation of the plan, including not only persons in the principal national agencies but also others at the provincial and local level who will provide invaluable inputs into the decision-making process. In the absence of drought events, the DMT should organise consultative meetings to keep stakeholders informed of their responsibilities during drought, specifically, their roles in implementing the plan.
Develop and implement multi-level learning programmes	To aid in communicating and coordinating within and between all levels of engagement, various educational and training programmes should be designed and implemented. DMT should ensure that a greater level of understanding is established at multiple levels so that it is easier to heighten public awareness of drought and water conservation and the ways in which individuals and communities and public and private sectors can help to mitigate impacts in the short and long-term.
Monitor and evaluate drought management procedures and outcomes	The final step is to design and implement evaluation procedures to maximise the effectiveness of measures adopted for drought monitoring and management. Evaluation procedures should be applied in two contexts: first, as an ongoing audit showing how societal changes such as new technology, the availability of new research results, legislative action, and changes in political leadership may affect the implementation of the plan; and second, a post-drought audit that involves documenting and critically analysing the assessment and response actions of key actors, as well as implementing recommendations for improving the drought management process. It is recommended that this aspect of the process be taken on by Universities or a non-governmental entity so that an unbiased picture of the situation is presented at all times.

Table 1: Roles in the 10-step planning process for the DMT

Chapter Two

Status and context

2.1 Country overview

Sierra Leone is a West African country facing multiple risks from climate change that threaten key economic sectors as a result of a long history of environmental degradation. The climate-sensitive agriculture sector provides livelihoods for 75% of the population and contributes more than 50% of GDP. The country's extensive natural resources are under immense pressure from population growth, dependence on biomass for energy needs, water pollution, and environmentally unsound mining activities, causing increased rates of deforestation, soil erosion, natural disasters (such as flooding, landslides, rockfalls etc) and increasing the potential for drought.



Figure 2: Administrative map of Sierra Leone (UNEP 2015)

The high reliance upon agricultural and natural resources, coupled with high rates of poverty, unemployment, and environmental degradation, make Sierra Leone the 3rd most vulnerable country to Climate Change in the world (Maplecroft 2013). Major sources of greenhouse gas emissions are land use change, deforestation and forest degradation. Many households depend on forest products like charcoal and fuelwood to meet their energy demand. Charcoal production and other activities leading to forest cover loss have intensified over the years, because of the lack of management schemes to regulate harvesting. Forest areas and biodiversity are, thus, rapidly shrinking to meet the domestic demand for fuelwood and charcoal, as well as the export demand for timber and non-timber forest products (such as bushmeat). There are also issues of habitat destruction and biodiversity loss

2.1.1 Climate summary

Sierra Leone has a predominantly hot and humid tropical climate which shows a distinct coast-interior gradient. There are two seasons: the wet season, which runs from May to October, and the dry season from November to April. The wet (rainy) season has an average rainfall of 3000mm, with coastal and southern areas receiving up to 5000mm annually and inland areas about 2000 to 2500mm. In contrast, the dry season is prone to dusty and hot harmattan winds and drought conditions. Temperatures can range between 25 and 27 degrees Celsius at this time of the year. It has been projected that the country will experience increased night time temperatures and reduced annual precipitation in the coming years. There is presently increased variability in the rainy season, with some observations indicating a later onset or shorter duration and increased intensity of single rainfall events.

Although rainfall projections are less certain, the trend is expected to increase, especially the intensity of single rainfall events. In any of these cases, water quality will be adversely affected. Heavy rains that increase surface runoff may pollute coastal waters with nitrogen, phosphorous and sediments, and sometimes, toxic contaminants that could affect dissolved oxygen levels. Similarly, 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. 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, which will further stress human and ecosystem health and cause fires that have the potential of destroying built and natural environments.

Increased rainfall intensities also show a prospect for intense and frequent storms. 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, for example, 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. A related impact is sea level rise, with the Atlantic Ocean projected to rise between 0.1 and 0.56m by 2100. 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. In other words, 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.

2.1.2 Land resources

Sierra Leone has an estimated 41,300 square kilometres of agricultural land, which makes up about 58% of the total land area. So far, it is estimated that only 15% of arable land, or 111,510 hectares, is under cultivation. The two main food sources- rice and fish- are highly vulnerable to climate change. Rice, particularly, is very sensitive to increased humidity and rainfall intensity. It is also vulnerable to pests that thrive in higher temperatures. The practice of shifting cultivation has increased forest cover loss, with most of the country now covered by secondary forest or farm bush. The recent UNCCD-funded research on three land-based indicators- land cover, land productivity, and soil organic carbon- reveals an even grimmer picture. The data shows that in 2000, 66.5% of the land area was converted to cropland, indicating an increased demand for water, competition for arable land, and an increased chance of drought occurrence. Similarly, the trend increased to 66.7% in 2015, indicating a reduction in tree-cover (by 26.9%) and water bodies (by 0.7%). The implication is that cropland gain has increased water demand (especially for irrigation), which in turn, places additional strain on the availability of water for other purposes (such as drinking and industry), and lead to varied effects and impacts of drought.

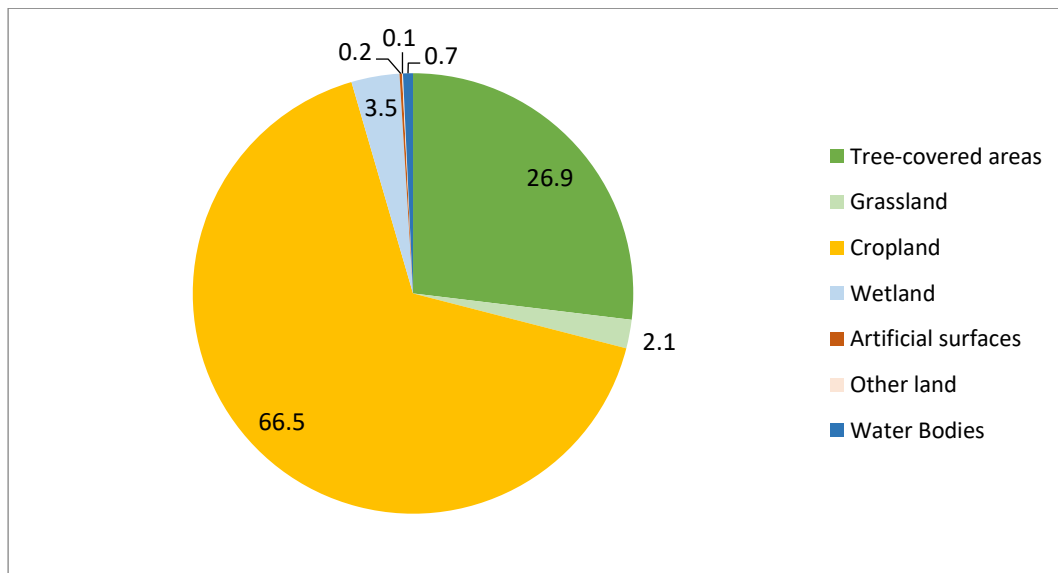


Figure 3: Percent land cover change by land cover class in 2000 and 2015 respectively

Comparing the land cover maps below for 2000 and 2015 also shows that a significant change has occurred in the tree cover across the country, as more croplands are being established, especially in the southern and eastern provinces, and the Western Area. The implication is that agricultural practices (farming, livestock rearing etc) have contributed momentarily to the change observed in land cover across the country. Agriculture is such a major cause of tree-cover loss because more than 60% of the rural population rely on farming to make a living. The final outcome is not only cropland gain, but also the conversion of forests into grasslands and other lands.

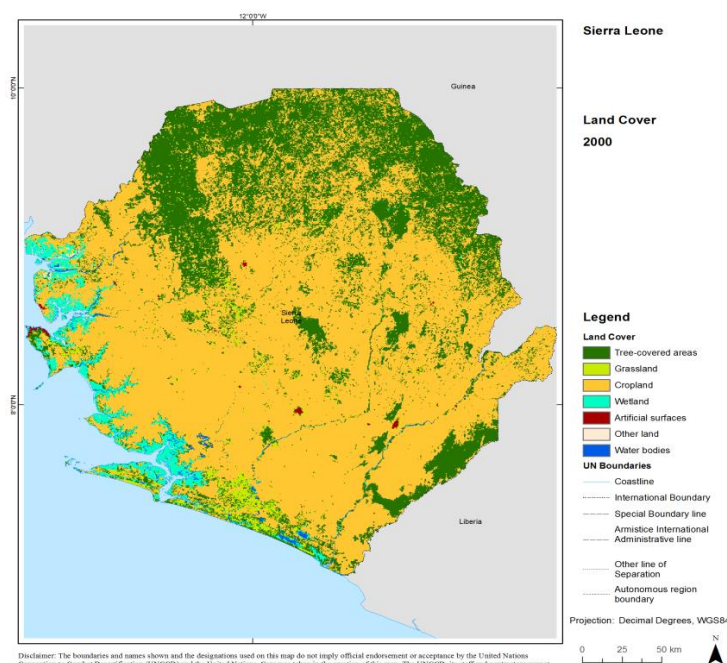


Figure 4: Land cover change (2000)

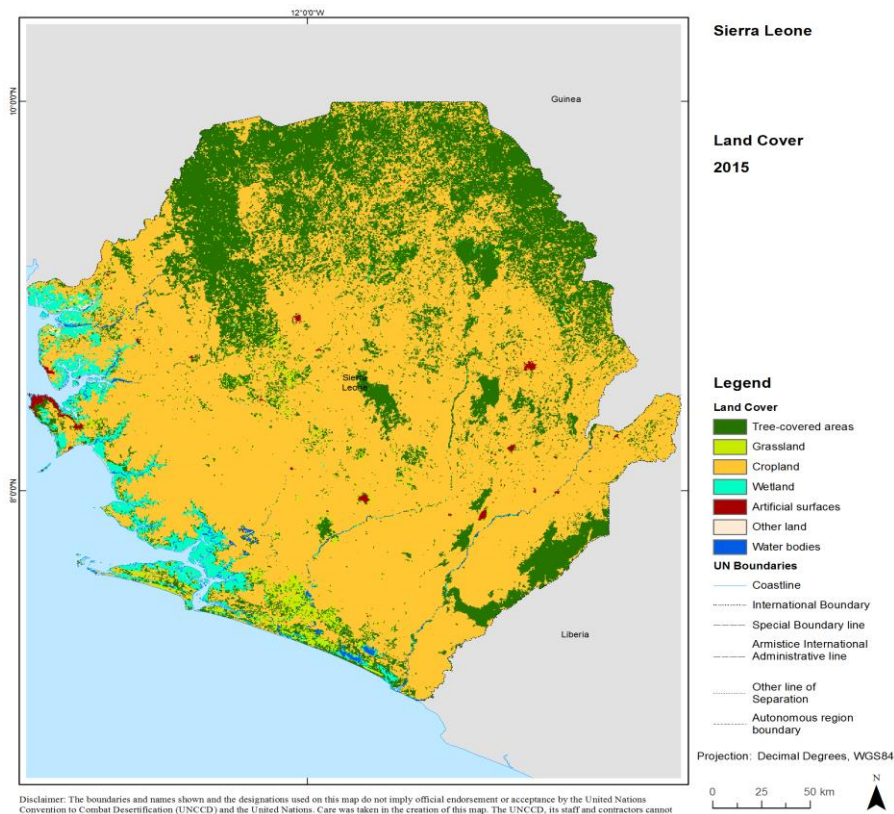


Figure 5: Land cover change (2015)

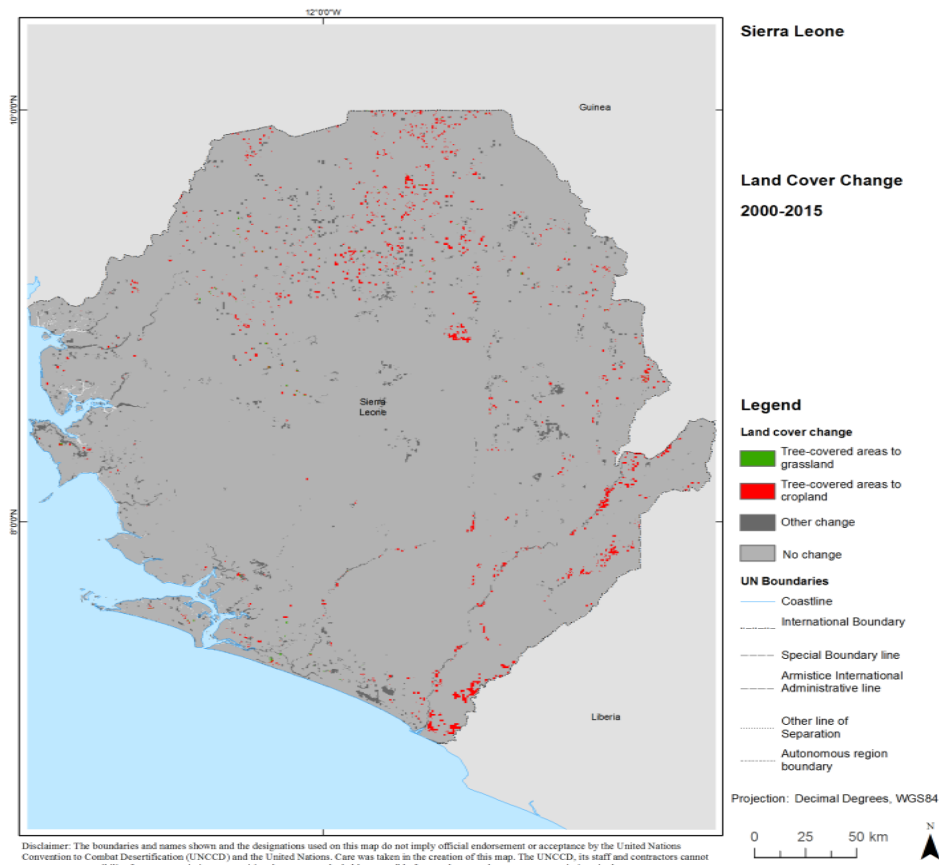


Figure 6: Land cover change (2000 to 2015)

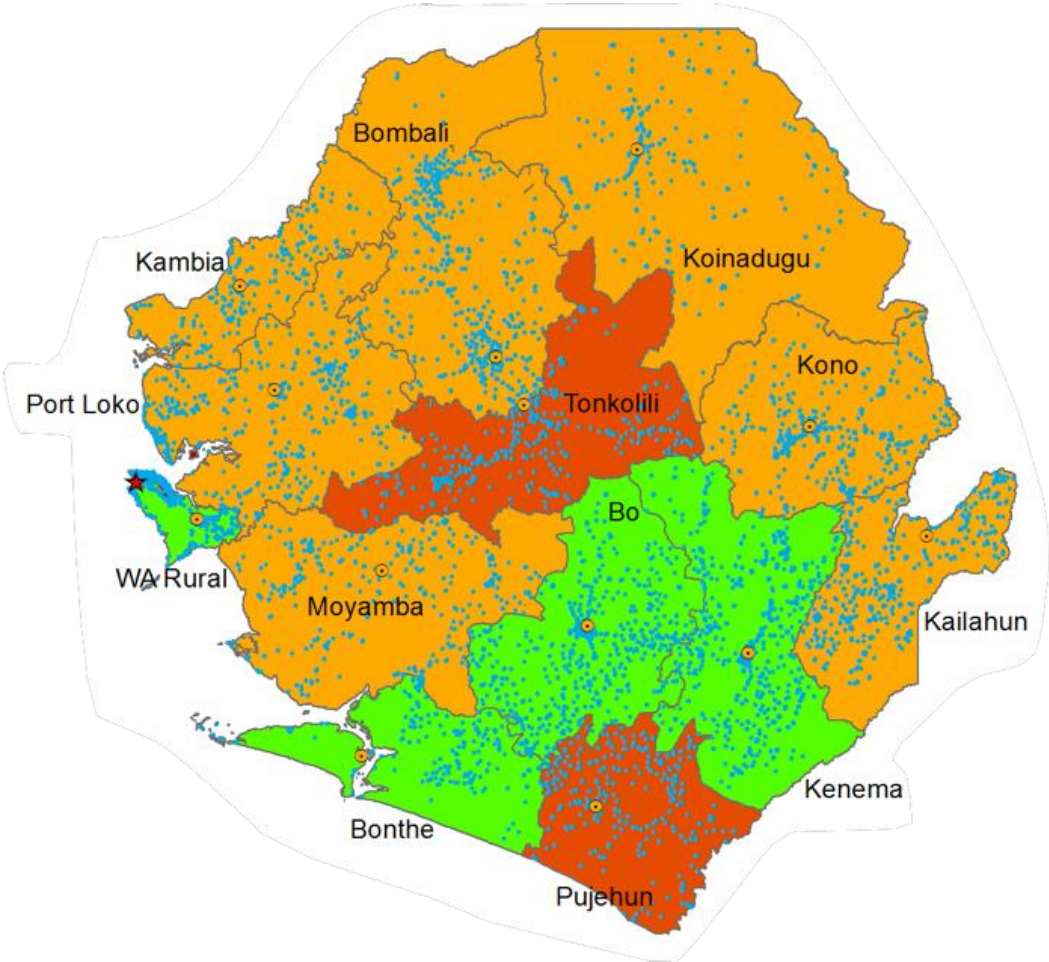
2.1.3 Water resources

Renewable water resources in Sierra Leone are estimated at more than 160 billion cubic metres. Less than half of the available water is used annually, with 70% of the total used for agricultural purposes. The UN Food and Agriculture Organisation (FAO) estimated national water withdrawal at 0.3799 cubic kilometres per year, though the data has not been updated since 2000. Based on this data, irrigation withdraws about 0.3536 cubic km, followed by the municipal sector with 0.196 cubic km and industry with 0.67 cubic km. Additionally, 80% of the water supply in rural areas comes from surface water, though groundwater is used for a limited number of wells, boreholes, and related installations. Overall, the country is considered as having an abundant supply of surface water compared to other countries in the region. Five perennial rivers (Little Scarcies, Rokel, Jong, Sewa, and Moa) flow northeast to southwest, draining the large part of the country's land surface. River Mano is the longest (424km) with its headwaters starting in the highlands Liberia. Four of the country's river basins (see table 2) are transboundary: Great Scarcies, Little Scarcies, and Moa are shared with Guinea, while Mano is shared with Liberia.

Watercourse basin	Length (km)	Basin area inside Sierra Leone (sq.km)	Basin area inside Sierra Leone (sq.km)
Great Scarcies	129	2,979	8,303
Little Scarcies	161	13,383	18,955
Moa	266	9,583	19,835
Mano	424	1,959	7,776
Loko		1,565	1,565
Rokel	290	8,236	8,236
Rokel estuary		579	579
Gbangbaia		3,121	3,121
Jong	97	8,288	8,288
Sewa	209	19,022	19,022
Western WRA		223	223
Ribbi WRA	56	3,670	3,670
Sherbro WRA		612	612
TOTAL		73,220	100,185

Table 2: River basins of Sierra Leone

Despite the abundance of water in the country, climate change is already posing a significant challenge to its availability and quality. For instance, the 2012 nationwide water point mapping (see figure 7 below) revealed that up to 40% (about 7696) of installed water points (about 28,845) suffer water shortages in the dry season. Intense rains increase runoff and sediment loads in rivers, which affect water quality. Increased temperatures can also adversely affect the quality of water by increasing algal growth and making the breeding ground for disease vectors conducive. Similarly, groundwater levels rise when rainfall recharge increases and recede with less rainfall events. The recent unpredictable nature of rainfall across the country is having a direct impact on groundwater levels, and worsening conditions that lead to water stress. A 2013 data from the Bombali District Council well placed groundwater recession in the range of 1.5 and 1m between mid-August to the year end. These data indicate the possibility of a drought situation in the future, if effective management measures are not taken.



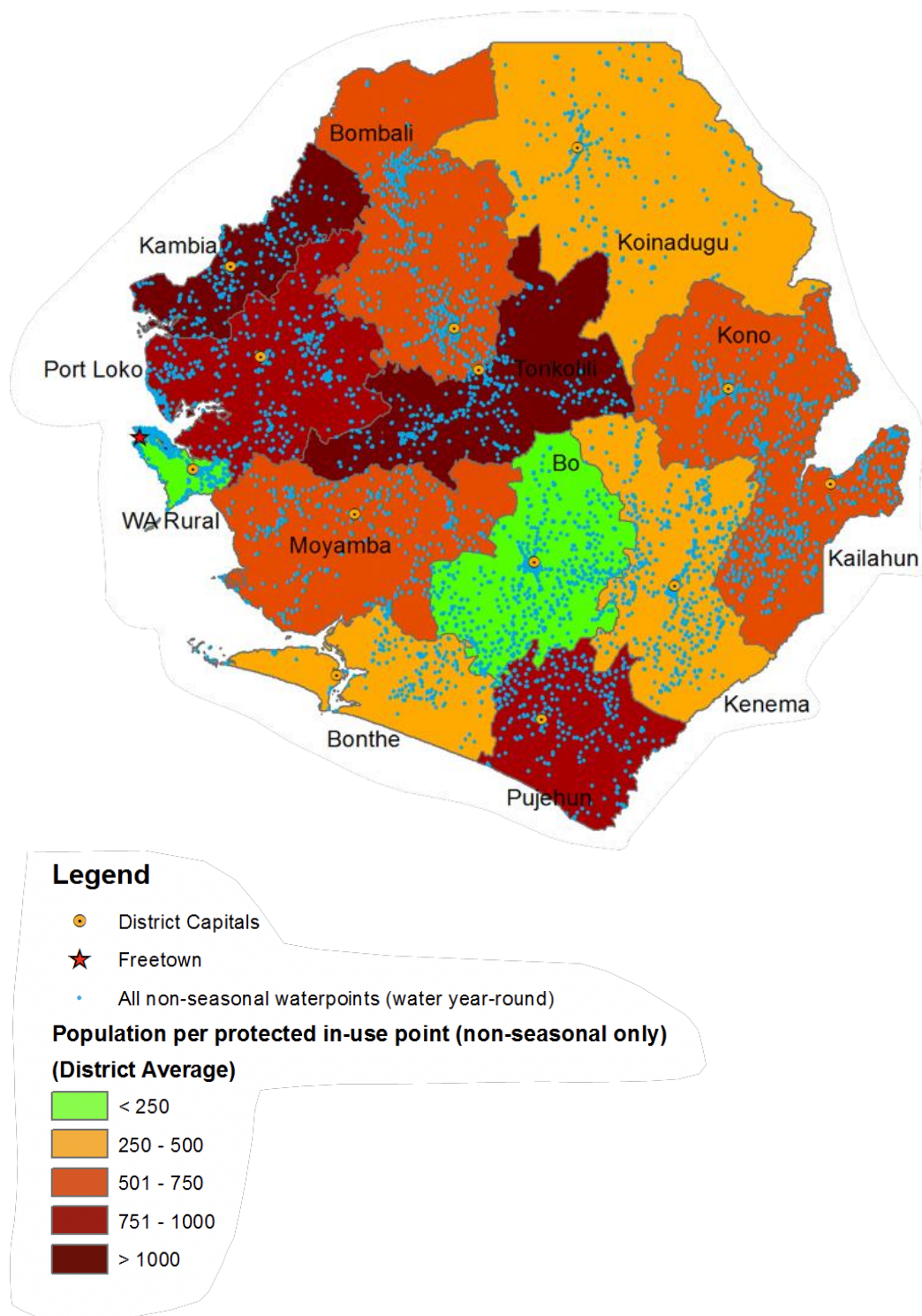


Figure 7: Location of surveyed waterpoints and district average service levels (Map 2 shows non-seasonal points)- source: 2012 waterpoint mapping

2.2 Key drivers and potential impacts of drought

Based on the country overview presented in the previous section, the cause of drought in Sierra Leone is expected to be triggered by many, synergistic effects (natural and human drivers), including: 1) decreasing rainfall, climate variability, and climate change which may increase water stress; 2)

poverty and rural vulnerability in terms of the rural poor occupying exposed land and being unable to access irrigation technology or drought-resistance seeds that could reduce their vulnerability to risks; 3) increasing water demand due to urbanisation, industrialisation, and the steady growth of agribusiness in terms of poor urban planning and agricultural intensification processes that literally discount water supply and management leading to increased and conflicting demands and declining water resources; 4) inappropriate soil and water management; and 5) weak or ineffective risk management due to low capacity to understand and address risks through forecasting, early warning, preparedness, response, and the deployment of compensatory mechanisms such as insurance and livelihood support for persons in water-stressed environments.

While these possibilities exist, it is difficult to provide a nation-wide account of patterns and trends in drought occurrence and impact because of the lack of data. Nonetheless, the issues highlighted in the foregoing section denote that a major decline in water and land resources could result from the occurrence of drought events, or related climatic conditions. There could be impacts on rural livelihoods, food security, agricultural production, economic and urban development, the environment, and public spending. Direct impacts could include reduced tree-covered areas, reduced crop and wetlands, reduced forest productivity, increased fire hazard, reduced water levels, increased livestock and wildlife mortality rates, and damage to wildlife and fish habitats. Indirect impacts can take the form of reduced income for farmers, increased prices for food and timber, reduced government tax revenues, and unemployment. These consequences of drought can be verified through targeted assessment and monitoring activities, as have been advised in the next chapter. At that time, a better picture of the drought situation can be presented with adequate examples of near and long-term economic, environmental, and social risks and impacts.

2.3 Existing approaches, plans, and policies

At the national level, many disparate institutional arrangements (approaches, plans, and policies) exist for forecasting, monitoring, assessing, and mitigating drought-related conditions in Sierra Leone. This calls for an implementation framework (see chapter 5) that can facilitate the coordination of inputs from different levels of governmental and non-governmental organisations, without undermining the functional autonomy and effectiveness of the institutions concerned. Examples of existing approaches, plans, and policies that could apply to the management of drought are presented in the table below.

Instrument	Key goals and objectives
National land policy	The 2015 land policy seeks to clarify the complex and ambiguous constitutional and legal framework for sustainable management of land resources; 2) promote law reforms that will further harmonize the two separate jurisdictions of the current land tenure systems; 3) ensure the security of tenure and protection of land rights to all legitimate landholders, regardless of their form of land tenure; and 4) promote equitable access to land.
Disaster management policy	This policy seeks to enhance increased political commitment to disaster risk management, promote public awareness and the incorporation of disaster risk management into development planning; ensure the integration of disaster risk management into sustainable development programmes and policies to ensure a holistic approach to disaster management; and ensure priority and requisite institutional capacities for disaster risk reduction at all levels. An initial step in the implementation of the policy has been the establishment of a national platform for Disaster Risk Reduction (DRR) by Disaster Management Department (DMD) of the Office of National Security (ONS).
Disaster management measures and response plan	This plan harmonizes vulnerability and capacity assessments jointly conducted by the Sierra Leone Red Cross Society and the Disaster Management Department and the National Hazard Profile developed by the Disaster Management Department in the Office of National Security. The purpose of the plan is to establish a comprehensive all-hazard approach to national incident management including preparedness, prevention, mitigation, response and recovery; provide a framework of interaction between the state and non-state actors; and establish a mechanism to maximise the integration of incident-related prevention, mitigation, preparedness, response and recovery.
National action plan for land degradation	The NAP outlines a framework for understanding and addressing land degradation in various sectors and regions, including through mainstreaming and capacity building.
Land degradation neutrality target setting process	In the Land Degradation Neutrality (LDN) Target Setting process, Sierra Leone's Technical Working Group (TWG) identified and established hotspots of degraded areas using the three indicators of land cover, land productivity dynamics and soil Organic carbon content. The hotspots provided useful guidelines for establishing baselines of land degradation, from which the national voluntary targets were set.
Climate change policy framework	The policy framework for climate change includes actions to: revise the already adopted Draft Climate Policy into a comprehensive Climate Act; establish the enabling legislative framework to implement the National Climate Change Strategy and Action Plan (NCCS&AP) actions; strengthen the high-level National Climate Change Council (NCCC), in the Office of the President; and establish a Sierra Leone Climate Fund to be a financing mechanism for priority climate change actions and interventions.
National WASH policy	The 2010 WASH policy aims to develop a comprehensive framework for managing water resources and sustainable development of water supply and sanitation services within an effective legal and institutional framework.; and address cross-sectoral interests in water resources through integrated and participatory approaches in the planning, development and management of water resources.
Environment Protection Act	The 2008 EPA act established the Environment Protection Agency with an overarching responsibility for dealing with matters relating to environmental protection. Its mandate includes responsibilities to coordinate and monitor actors involved in activities relating to environmental protection legislation, implement and ensure compliance with national environmental policies and regulate and monitor the processing of waste, pollution and other environmental hazards.
Sustainable Development Goals	The national document for achieving the 2030 Agenda for Sustainable Development seeks to inform the United Nations about the progress Sierra Leone has made in sensitizing stakeholders to the new goals and in adapting them to national development processes. Under goal 15, a list of indicators has been provided to show how progress in achieving land degradation neutrality will be measured.
National Adaptation Programme of Action	The NAPA document deals with the identification of key adaptation needs. It focuses on the past and present adaptation practices to climate change and climate variability and provides a summary of hazards posed by climate and climate change and a summary of vulnerability based on past studies and or from stakeholder contributions.

Sierra Leone Meteorological Agency Act	The 2017 SLMA Act establishes the Sierra Leone Meteorological Agency as the sole authority for providing meteorological and climatological services across Sierra Leone
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Table 3: Relevant policies and plans for drought management

2.4 Current institutional arrangement

National and local institutions are part of a loose crisis management framework with roles and responsibilities ranging from disaster management to emergency and relief response. The main institutions with an explicit or implicit mandate for managing drought-related conditions as may relate to land and water resources, climate change, disasters, socio-economic impacts, and citizen engagement include: 1) Ministry of Lands, Housing and Environment; 2) Ministry of Water Resources; 3) Ministry of Agriculture and Forestry; 4) Ministry of Local Government and Rural Development; 5) Ministry of Health and Sanitation; 6) Ministry of Development and Economic Planning; 7) Environment Protection Agency; 8) Sierra Leone meteorological Agency; 9) Disaster Management Department; 10) Sierra Leone Water Company; 11) Guma Valley Water Company; 12) Sierra Leone Water Management Agency; 13) National Protected Area Authority; and 14) different NGOs and CBOs (e.g., Sierra Leone Red Cross). All of these organizations strive to promote the sustainable management of water resources as its use may relate to the sector. However, there is a lack of clarity in roles and responsibilities and a formal organisational structure for ensuring communication and coordination. This institutional gap necessitated the development of the implementation framework proposed and described in chapter 5.

MDA	CONSIDERED ROLES
Ministry of Lands, Housing and Environment (MLHE)	MLHE is in charge of implementing policy relating to country planning, housing, and environmental governance. Its Directorate of Environment hosts the UNCCD focal person, who will be primarily responsible for the implementation of this plan. The directorate previously supervised the Environment Protection Agency (EPA), one of the leading climate management agencies in the country.
Ministry of Water Resources (MWR)	MWR was previously part of the Ministry of Energy and Water Resources that was devolved in 2013. It is responsible for formulating and monitoring the implementation of water policies, undertaking research on water resources, designing and delivering water supply projects, and setting standards to regulate water use across the country. The ministry's Water Division and Water Management Agency will be critical partners in the implementation and further elaboration of the drought management plan.
Ministry of Agriculture and Forestry (MAF)	MAF was previously the Ministry of Agriculture, Forestry, and Food Security (MAFFS). Its primary mandate is to formulate agricultural development policies and advise on other matters relevant to agriculture and forestry. The importance of water to agriculture security and the role forestry plays in water availability, make MAF a key partner in the implementation of this plan. The Planning, Evaluation, Monitoring and Statistics Division (PEMSD) in the ministry can play a key role in monitoring agricultural drought as well as recommending strategies for effective mitigation. Other bodies supervised by the ministry like the Forestry Division (FD)

	and National Protected Area Authority (NPAA) can provide strategic advice on drought matters relating to deforestation and forest degradation.
Ministry of Local Government and Rural Development (MLGRD)	MLGRD directs local government affairs in the country, being the coordinating ministry for local and district councils, and other local authorities. The implementation of this plan at the subnational level will involve traditional leaders and council representations, which the ministry can effectively facilitate. It will therefore need to be a member of the DMT for operationalizing this plan.
Ministry of Health and Sanitation (MHS)	Given the potential health impacts of drought, MHS can become a critical partner in the delivery of this plan. The ministry could be a source of information on current and previous health impacts of circumstances similar to drought, and lead on preparedness in this regard.
Ministry of Planning and Economic Development (MPED)	MPED is responsible for planning all aspects of national development, including mainstreaming sustainable economic development policies and strategies into national laws, projects, and policies. The ministry could take on the responsibility of mainstreaming drought measures recommended in this plan into the national budget and all development plans seeking to achieve sustainable development goals at both national and subnational scales.
Environment Protection Agency (EPA)	EPA has a responsibility to design, coordinate, and evaluate the implementation of national environmental policies and plans. It supervises the National Secretariat for Climate Change (NSCC), which is responsible for addressing climate change issues, including slow onsets, flooding etc. The operationalisation of this plan will, however, not sit within the EPA because the Environment Directorate in the MLHE, which is expected to soon lead on the supervision of the EPA, directs all UNCCD-related projects.
Sierra Leone Meteorological Agency (SLMA)	Previously the Meteorological Department, SLMA is responsible for collecting meteorological data and delivering various levels of climatological services across the country. Following the passage of a new act in 2016, SLMA now leads on all climate management efforts in the country. Essentially, it will not only be a critical partner in forecasting drought, but also lead in devising and implementing systems for early warning and drought mitigation.
Disaster Management Department (DMD)	DMD is a unit in the Office of National Security (ONS) with the responsibility of forecasting and managing disasters and related events. DMD and related national security structures will play a key role in developing strategies for drought preparedness, mitigation, and relief support. Data from previous functions could be useful in further elaborating this plan to identify specific short-term and long-range measures to take at both national and subnational levels.
Sierra Leone Red Cross (SLRC)	SLRS is many NGOs who offer relief support in times of emergency. Their expertise and experience will be useful in planning for relief support, as well as in seeing drought management efforts through a human development and security lens.
Local government	See MLGRD for comment on the role for councils and other local authorities.

Table 4: Current roles of relevant national Ministries, Departments, and Agencies

Chapter Three

Assessments and monitoring

3.1 State of play

There is a general lack of data on drought conditions across the country. Most rainfall and river gauging sites were either destroyed or abandoned during the civil war and existing records mostly lost. The paucity of risk and impact assessments has limited the capacity of national entities, including the Ministries, Departments and Agencies identified in chapter 2, to anticipate and respond adequately to potential drought events. The lack of data for multiple sectors and for all potential drought risk areas, places monitoring and impact assessments at the heart of this drought management plan. A guide for assessments and monitoring for the purpose of implementing this plan should stem from previous research efforts across the country. Monitoring of drought-related conditions, especially water stress, can be attributed to work done by 24 rain gauging stations in the 1970s, though data on the utilisation of these sites is not available. The Sierra Leone Meteorological Department (now Agency) has gathered data from 7 synoptic stations and 42 climate stations for which grid references are given for only 3 stations. In 2013, SLMA indicated that only 4 stations were in operation (in Makeni, Bo, Bonthe, and Lungi Airport). As such, historical data is not readily available from any sources in the country, and little, if any, is available in digital format.

Data type	Item	Period	Source reference
Rainfall	Daily rainfall, Makeni	Jan 1975 – Dec 2012	Sierra Leone Met Department station, Makeni (pers comm)
	Monthly rainfall data, Makeni, Kabala, Teko	Jan 1921 to Nov 1978	Nippon Koei UK 2005.
	Rainfall analyses for 38 stations across Sierra Leone	1941-1960	Gregory 1965
	Daily rainfall at Bumbuna dam site	Jan 2007 – Dec 2012	Bumbuna Dam Site data records (pers comm)
River flow	Monthly mean river flow at Bumbuna	Jun 1970 – Apr 1979	Bumbuna Dam Site data records (pers comm)
	30 minute/15 minute river flow at Bumbuna downstream weir	Apr 2010 to Dec 2012	Bumbuna Dam Site data records (pers comm) / Project monitoring since Aug 2013

Lake level	2-hourly water levels in Bumbuna Dam Reservoir	Jan 2009 – Aug 2012	Dr. Mustapha Thomas University of Sierra Leone, Fourah Bay (pers comm).
Groundwater	Summary data for over 350 bore holes in Sierra Leone (spreadsheet)	Undated	Dr. Mustapha Thomas University of Sierra Leone, Fourah Bay (pers comm).
	Register of wells and boreholes in Sierra Leone	2012	MEWR / WSP 2012, Water point mapping survey

Table 5: Some historical data sources

Spatially averaged rainfall time series data are available on websites such as www.cru.uea.ac.uk (Climate Research Unit at the University of East Anglia) and www.worldclim.org, though little if any raw data from Sierra Leone is included in these models. Some assessments are being done on groundwater by agencies in government, academia, and civil society. There is a wealth of expertise and knowledge in this area, though very limited information is publically available for others to use. An academic at the University of Sierra Leone (Dr. Mustapha Thomas) has developed a spreadsheet of over 350 boreholes, which lacks critical information on their location, water levels, and well yields. Recently published papers (e.g., Adekile 2013) and GIS maps do not provide an account of the ground truth, indicating why such data have been used cautiously for determining drought conditions in the country. While not particularly focused on drought monitoring, water monitoring network sites can be found in various parts of the country, as river monitoring, meteorological monitoring and groundwater monitoring networks (see figures 10 to 12).

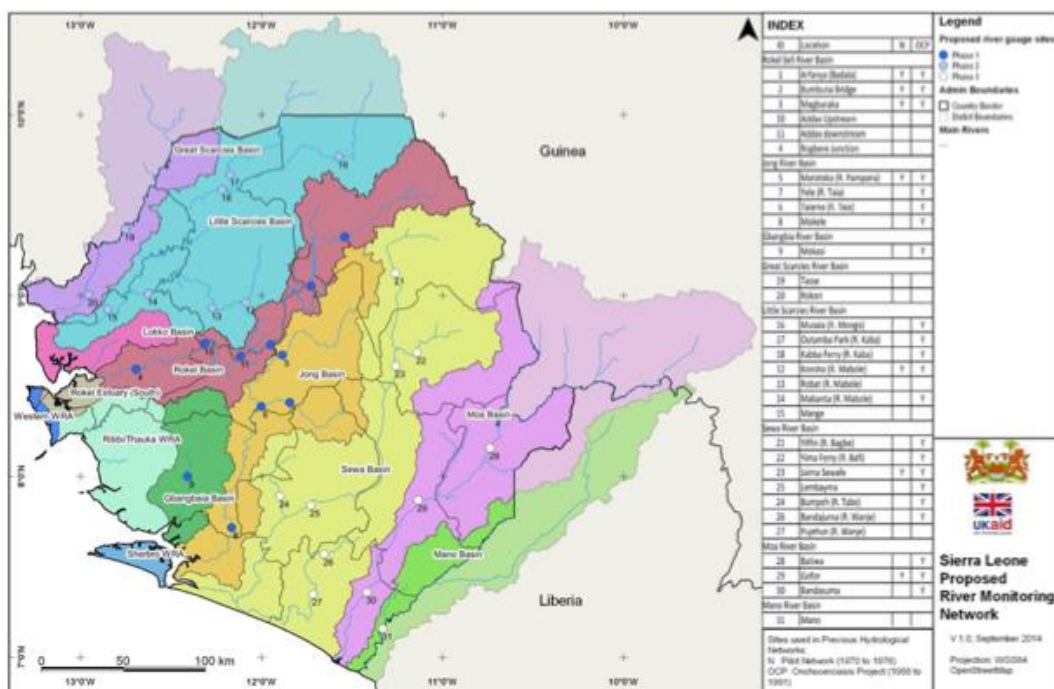


Figure 10: Proposed river monitoring network, 2014

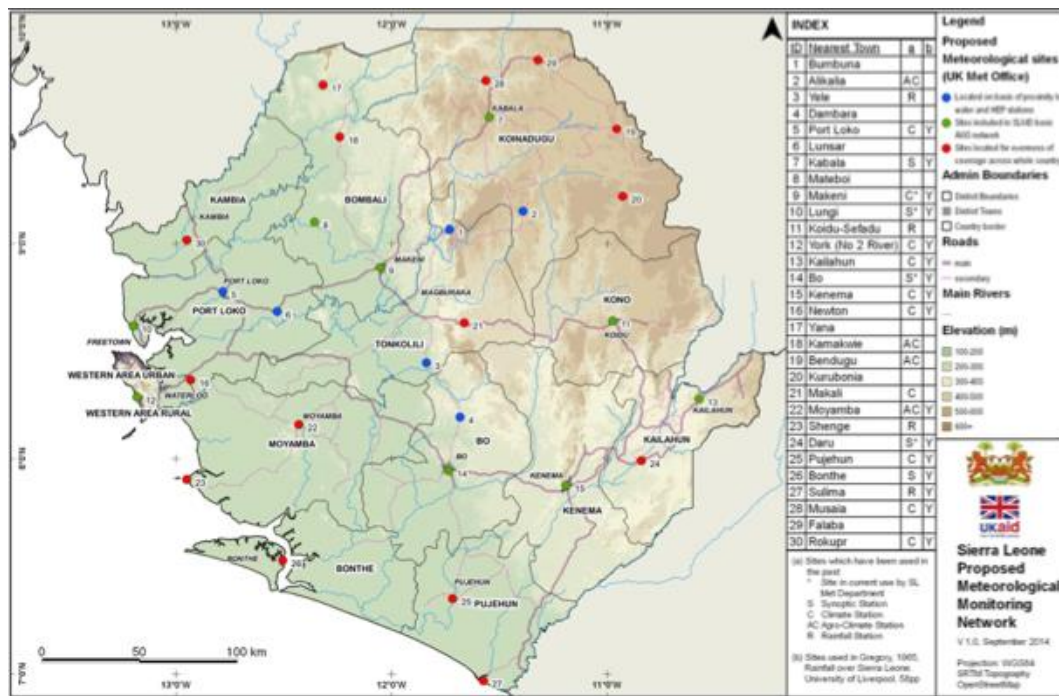


Figure 11: Proposed meteorological monitoring network, 2014

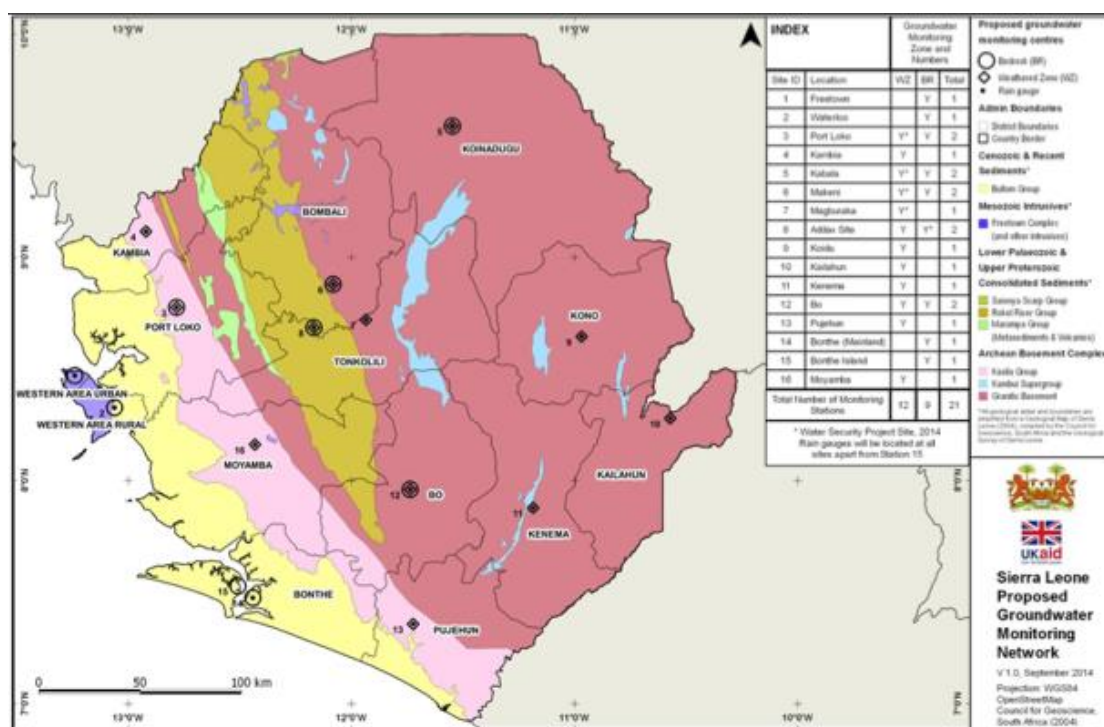


Figure 12: Groundwater monitoring network, 2014

Twenty-four monitoring sites have been operating in the Rokel-Seli middle basin area since 2012, with additional hydrological data collected from monitoring stations operated by other organisations in the same area (see the following tables). Monitoring has focused on establishing measurements of rainfall, groundwater level, and surface water flows. These efforts are part of the DFID-funded Sierra

Leone Water Security Project that the Ministry of Water Resources (MWR) is leading. The project (through the monitoring networks) has provided an opportunity to learn what is feasible through a national network by working with stakeholders at the local level. The pilot networks also provide a practical insight into the ways in which government organisations, local communities, and the private sector can work together to deliver high quality monitoring data for the benefit of drought planning at a country scale.

3.2 National Drought Indicators and Indices (NDII)

To bridge the data gap described in the previous section and carry out real-time and effective monitoring, the first step should include the development of national drought indicators and indices. Indicators are meteorological, hydrological, or biophysical variables, such as precipitation, temperature, stream flow, groundwater and water storage levels, and soil moisture that describe drought conditions (World Meteorological Organization and Global Water Partnership 2016). On the other hand, indices are computed numerical representations of drought severity, often calculated using combinations of meteorological, hydrological or biophysical indicators (World Meteorological Organization and Global Water Partnership 2016). An index basically provides quantitative information about the severity, timing, duration and extent of a drought. Indices and indicators should work to integrate the duration of the drought event and its associated impacts, especially environmental and socio-economic impacts. They should serve the purpose of: 1) identifying the occurrence of a prolonged drought event, using natural factors such as precipitation as the main parameter; 2) showing that drought conditions have caused a temporary deterioration of water resources, which relate mainly to environmental impacts engendered by drought; and 3) showing the socio-economic impacts of drought such as impacts on drinking water supply, farming, industry. Generally, a set of indicators and indices should be designed to inform both water users and managers about the occurrence of droughts, their impacts and the outcomes of management processes.

For the purpose of developing indicators or indices for drought assessments and monitoring, the Drought Resilience Adaptation and Management Policy (DRAMP) Framework is widely recommended. The DRAMP framework is an integrated, multi-pronged approach to reducing risks and impacts of drought. It identifies pragmatic actions for countries to better prepare and respond to drought and guides the design and implementation of drought policy at national to sub-national level. The framework is organized around the following six cross-cutting goals (see figure 13):

- Reducing exposure to drought by reducing the potential for loss of people, livelihoods, ecosystem services and resources, infrastructure, and economic, social, or cultural assets in places that could be adversely affected by drought;
- Reducing vulnerability to drought by reducing the propensity or predisposition to be adversely affected by drought;
- Increasing resilience to drought risk by strengthening the ability of communities, ecosystems and economies to anticipate, absorb, accommodate, or recover from the effects of drought in a timely and efficient manner by ensuring the preservation, restoration, or improvement of natural capital;
- Transforming fundamental attributes of social, economic and ecological systems (including value systems; regulatory, legislative, or bureaucratic regimes; financial institutions; and technological or biological systems);
- Preparing, responding and recovering from drought by reducing risk through the development of comprehensive drought monitoring and early warning systems; and Sharing drought risks among a wider section of society to include everyone who benefits directly or indirectly from robust drought risk management.

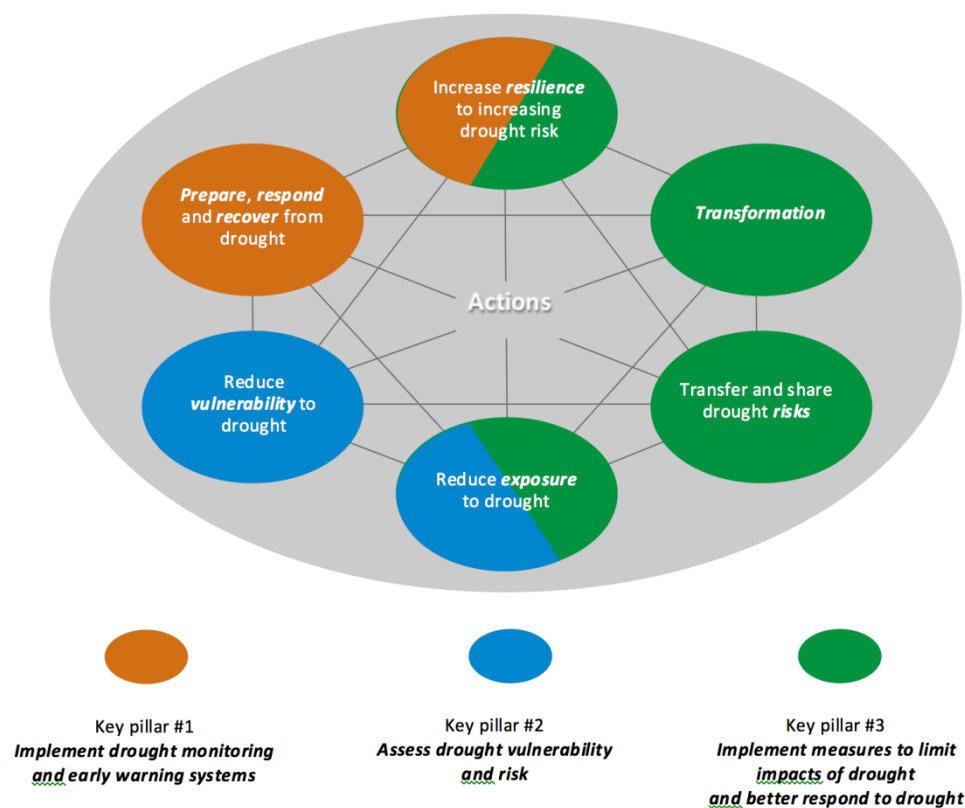


Figure 13: DRAMP framework

Following the framework, indicators or indices should be carefully selected to address questions such as: how to tell it is drought; how severe the drought is; when action should be taken; and how do we tell the drought event has ended. The variables to be used for monitoring drought occurrence and impacts as well as forecasting drought should be selected in a transparent and scientifically dependable manner to ensure validity of measures outlined in the DMP. The choice will be determined by specific national or sub-national circumstances, such as availability of spatio-temporal data, technical capacity, and the nuances of the climatic, social, economic and environmental conditions. While the process may be complex, there are benefits in selecting more than one drought indicator or index because they help to better characterise droughts, examine the sensitivity and accuracy of tools used for drought monitoring, and explore coherence in relation to specific research and management objectives (see table 6). In the context of Sierra Leone, as table 4 shows, indicators or indices to be used for monitoring drought impacts as well as forecasting drought events should be suitable for assessing rainfall and precipitation, stream flow, flow and water level in artificial reserves such as dams, soil moisture content, and environmental change. These variables can enable the identification and evaluation of drought conditions and the quantification of drought impacts. Moreover, the variables will support the work of an Early Warning System (EWS), which is described in greater detail in the next section.

Measurement unit	Indicator or index	Source and/or example
Meteorology	Deciles	Gibbs and Maher (1967)
	Percent of normal precipitation	Hayes (2005)
	Standardized Precipitation Index (SPI)	Guttman (1999); World Meteorological Organization (2012) http://drought.unl.edu/monitoringtools/~downloadablespiprogram.aspx
	Crop Moisture Index (CMI)	Lyon (2004) http://iridl.ldeo.columbia.edu/maproom/ Global/~Precipitation/WASP_Indices.html
Hydrology	Palmer Hydrological Drought Severity Index (PHDI)	Jacobi et al. (2013)
	Streamflow Drought Index (SDI)	Nalbantis and Tsakiris (2009) http://drinc.ewra.net
Agriculture	Normalized Difference Vegetation Index (NDVI)	Huete et al. (2002) https://www.star.nesdis.noaa.gov/smcd/emb/~vci/VH/vh_browse.php
	Temperature Condition Index (TCI)	Kogan (1995)
	Vegetation Condition Index (VCI)	Liu and Kogan (1996)
	Vegetation Drought Response Index (VegDRI)	Kogan (2001) https://www.star.nesdis.noaa.gov/smcd/emb/~vci/VH/vh_browse.php
	Water Requirement Satisfaction Index (WRSI and Geo-spatial WRSI)	Verdin and Klaver (2002) http://chg.geog.ucsb.edu/tools/geowrsi/index.html

Table 6: Useful drought indicators or indices for Sierra Leone (source DRAMP)

3.3 Early Warning Systems (EWS)

The timely collection and effective analysis of drought information (using appropriate indicators or indices) will characterise the utility of an early warning system (or a network of EWS) across the country. Early warning is “the provision of timely and effective information, through identifying institutions that allow individuals exposed to a hazard to take action to avoid or reduce their risk and prepare for effective response” (UNISDR 2003). Given the unique features of some drought situations, different approaches need to be developed for monitoring emergence, development, cessation, and impacts on people and communities at multiple levels. EWS, as one critical tool in current use, focus mainly on the socio-economic impacts of drought, especially the potential stress on lives and livelihoods. Therefore, it is essential that indices or indicators establish the means by which the EWS can detect the early emergence of rainfall deficiencies, which is considered a critical indicator of an incipient drought condition. In this regard, an EWS must not only encompass procedures for data collection and analysis, but also include mechanisms for disseminating data through appropriate channels to potential end users (see chapter 5 for a detailed description of procedures for communication and coordination). The effective operation of an EWS requires a multidisciplinary team that can design products that better communicate information to decision-makers in climate-sensitive sectors so as to reduce risks associated with drought. The goal is typically to provide timely warnings about actual drought events in real time to enable decision-makers to take appropriate measures, and to monitor drought severity and impact intensity to understand stakeholders that could be potentially affected by drought, now or in the near future, enabling them to take the right measures.

Clearly, the EWS will constitute an essential component of drought preparedness and mitigation (discussed in the next chapter) with many potential benefits for people and society. Actors need to be wary of certain shortcomings, however, including: 1) inadequate density and data quality of meteorological and hydrological networks; 2) inadequate data sharing between core institutions and the high cost of data; 3) lack of a user friendly data interface and users lack of training in the application of available information to decision-making; 4) unreliable seasonal forecasts and the lack of specificity of information provided by forecasts; 5) inadequate indices for identifying the early onset of drought; 6) poor or no integration of monitoring systems, hence limited understanding of drought magnitude, spatial extent, and impacts; and 7) delayed delivery of data and information on emerging drought conditions to end users. They should also carefully consider the mechanism used

for conveying information, as it is best to use existing media such as radio, TV, brochures, press releases, smart phone applications and other forms of ICT.

3.4 Risk and impact assessment methodology

Drought assessments and monitoring need to be guided by a methodology that offers a dynamic framework for understanding and explaining an ongoing set of actions, including those measures used to respond to drought. Assessing drought risks and impacts sit at the core of activities aimed at establishing effective drought monitoring and early warning. The process can provide important information for setting priorities and developing actions that prevent drought and mitigate its impacts. Critical in the assessment process is an understanding of vulnerability in the context of people, communities, and sectors. Vulnerability assessments should be comprehensive and include various elements- social, economic, physical, environmental, and institutional. Generally, the methodology for assessing and monitoring drought should cover institutional responses such as periodic reviews of key achievements and priorities, readjustment of goals; means and resources; and strengthening of organisational networks, planning and policy structures for drought mitigation. Furthermore, the methodology should form the basis for effective drought policies and action plans, as well as inform effective networking and coordination between and among key stakeholders and institutions. For all these, especially where a long-term strategy for drought management is needed, national institutions should adopt a methodology that allows for building institutional capacity to assess the frequency, severity, and localisation of droughts, and the effects they can have on people and their settings (including the resources on which their livelihoods depend). In broad terms, the methodology should focus on identifying and assigning priorities to drought risks and impacts, determining their proximate and underlying causes, and determining measures to address identified issues.

The effective application of the methodology requires an interdisciplinary analysis of management options and impacts, following these six steps:

- Officials of the DMT or competent entities can take responsibility for assembling a team, including individuals with a working knowledge of drought risks and impacts on primary sectors, regions, and people;
- Evaluation of historical occurrences to determine how drought has affected specific regions, groups, and sectors, and predict what would happen if a similar event recurred considering changes in land use, population size, and community development;

- Ranking of drought impacts to determine which effects are most urgently in need of attention (considering factors such as cost, spatial extent, trends over time, social equity, and local recovery capacity);
- Identification of proximate and underlying drivers, focusing on those factors and conditions causing the highest levels of risk for various sectors, regions, and populations;
- Identification of measures to determine actions that can be taken before drought events so as to reduce risk (such as identifying alternative sources of water); and
- Development of an action plan that assigns priority to measures that are more likely to be feasible, cost-effective, and socially equitable.

More specifically, the 6-step methodology should entail an examination of historical events as well as current outcomes and processes. To assess historical occurrences, it is necessary to analyse all available historical datasets recorded during long-term monitoring activities. Meteorological (e.g., precipitation and air temperature) and hydrological data (e.g., water outflow, stream flow, spring discharge, groundwater level etc) should be used, as well as other indicators that can help understand past occurrences of drought (such as soil moisture). Beyond these understandings, the approach should help to examine the impacts of drought events on human and economic activities as well as on the environment to predict future risks and determine measures for near-term and long-range mitigation. In both contexts, the assessment should identify groups and sectors that could be impacted by drought conditions using varied criteria. For economic sectors (e.g., industry, agriculture, power supply, forestry etc), economic criteria are usually used. For agriculture, for instance, drought impacts can be quantified in terms of production losses. In the case of water supply, the shortage of water in meeting demands (for drinking water etc) should be measured. It is necessary to stress that a cross-sectoral effort is required to collect and analyse relevant data to find connections between impact indicators or indices, and physical conditions. Since records of sectoral impacts don't exist in Sierra Leone, and related climate data (such as water stress, land cover change, land productivity etc) is scattered across many institutions with limited access for other users, the first step in implementing this plan is to establish a monitoring and information system that will facilitate data collection and analysis using established drought indices or indicators. The output of such efforts is a clear, effective, and efficient identification of potentially affected groups and sectors, identification of direct and derived impacts, assessment of expected losses and damages, effective ranking of impacts, and prioritisation of mitigation actions.

Chapter Four

Mitigation and preparedness

4.1 Drought mitigation

The next step in the drought management process, after assessments and monitoring, is mitigation. Drought mitigation comes about by the effective and efficient application of a combination of structural and non-structural, long and short-term measures. Short-term measures are mostly reactive or relief-centric in nature and relate to in-season drought management through contingency planning and relief distribution. Long-term measures focus on adaptation to climate change, restoration of ecological balance through the adoption and promotion of best practices. In Sierra Leone, drought mitigation measures could be translated on the ground through water and soil conservation, watershed management, agronomic practices suited to rain-fed agriculture, and forestry interventions that seek to integrate soil, water, and forest conservation in an ecologically compliant and sustainable manner. As such, drought mitigation should be mainstreamed into national sustainable development plans and projects, because some of the most significant economic development processes may have a decisive bearing on drought mitigation at multiple levels. Examples of such measures for either building drought resilience or reducing drought impacts include:

- Water harvesting, protecting water sources against contamination, developing water sources etc;
- Recovering the water holding capacity of soils through tree planting;
- Restoring pastures and balancing land and water resources;
- Protecting riverbanks and wetlands;
- Improving irrigation schemes;
- Implementing Integrated Water Resources Management (IWRM);
- diversifying and improving rural livelihoods through social protection, cash transfer projects, or improved access to markets and rural extension services;
- Crop insurance;
- Shifting to drought-tolerant crop varieties;
- Managing livestock within the landscape, including use of special rangelands and relocation of herds;
- Public education, awareness raising, and outreach; and

- Developing early warning systems and implementing specific measures in water management sectors and water dependent sectors such as energy, agriculture, tourism, transport, urban development, and industry.

These measures can be categorised either as preventive (strategic), operational (tactical), organisational, follow-up, or restoration, with those sectors and institutions affected falling under these broad categories. The purpose of their application is to reinforce the structural system at national and sub-national levels in order to increase response capacity (to meet supply demands and environmental requirements) towards drought-related conditions. Choice of such measures in Sierra Leone can be informed by: 1) the accessibility of legal support; 2) technical viability; 3) cost-effectiveness and cost-benefit analyses; 4) compatibility with other measures; 4) environmental impact; and 5) time required for implementation. Any of these choices could serve the purpose of safeguarding ecosystem resources, formulating effective policies and cost-effective alternatives, establishing appropriate organisational structures to develop and follow-up implementation actions, and creating and implementing communication and coordination protocols. Meaningful public participation (public engagement) cuts across these considerations because all stakeholders need to be given the opportunity to contribute to management decision-making. Their involvement in the process could help achieve the necessary equilibrium between social, economic, and environmental aspects of mitigation while ensuring effective planning and timely delivery of actions.

Typical implementation actions could include developing better awareness and understanding of potential drought hazards and the underlying causes of societal vulnerability; facilitating the improvement and utilisation of seasonal forecasts; developing integrated prediction, monitoring and evaluation capabilities through the effective use of EWS and associated information delivery mechanisms; developing preparedness plans at various levels of government; mainstreaming mitigation actions and projects into broader climate adaptation and mitigation strategies; developing an institutional arrangement that ensures coordination and communication within and between levels of government and with stakeholders; and creating a safety net of emergency response programmes that ensure timely and targeted relief. In broad terms, implementation actions should seek to provide timely and reliable information on which to base management and policy decisions; develop policies and institutional structures that facilitate engagement, assessment, and coordination; develop and apply a suite of risk management measures; and collect feedback to inform consequent rounds of decision-making and improve nest practices.

For each of these objectives, different actors from different institutions can play many significant roles (see chapter 5 for a description of the institutional framework for implementing the DMP). For instance, whereas primary responsibility to monitor, declare, plan, and manage drought response is that of the DMT through the UNCCD NFP in the Ministry of Lands, Housing and Environment (MLHE), the Sierra Leone Meteorological Agency (SLMA) can monitor the risks and impacts of drought-related conditions in relation to multiple sectors, while the Disaster Management Department (DMD) can work closely with other departments and agencies (such as the National Secretariat of Climate Change at the Environment Protection Agency) in dealing with potential drought issues. Furthermore, Civil Society Organisations (CSOs) and Non-Governmental Organisations can lead on public education and outreach as well as interventions seeking to increase water access across the country (see figure 14 below). Besides, CSOs can help with monitoring various indicators of drought, particularly its impact on people and resources and bring such concerns to the attention of competent bodies at the decision-making level. Likewise, print and electronic media can strongly influence drought planning and management efforts by empowering people to effect positive change in their communities. They can also alert groups of risks and impacts and channel information on ways to adapt or respond to such situations. High-quality media coverage of the actions proposed in this plan will deliver better informed sectors, regions, and groups, and facilitate more effective policy-making and implementation action.

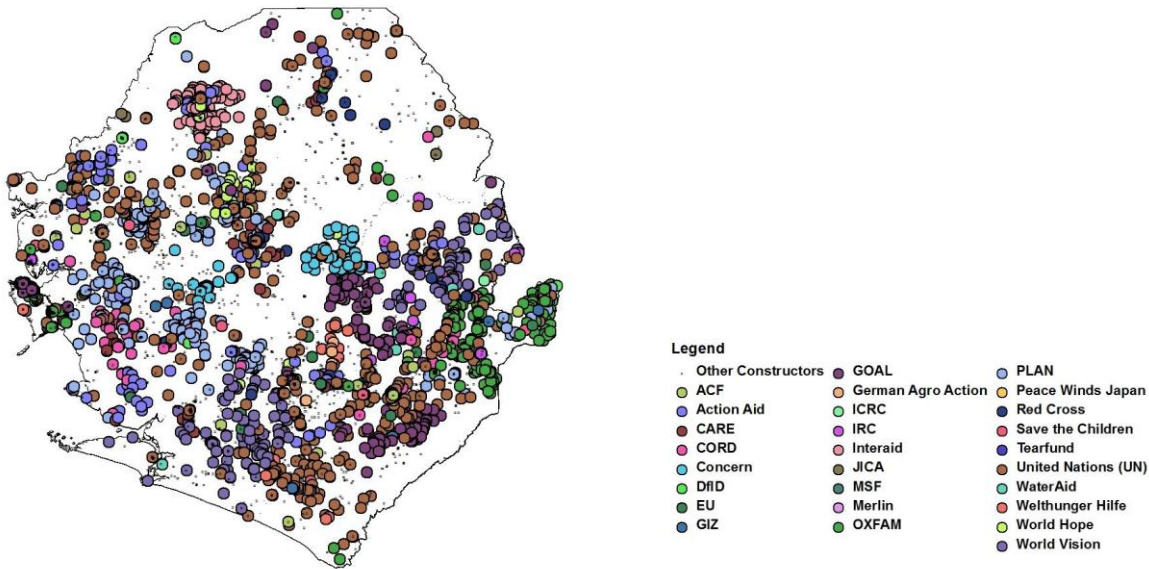


Figure 14: NGOs constructing waterpoints across the country (Source: Sierra Leone waterpoint mapping, 2012)

Generally, the focus on “implementation” to achieve drought mitigation is recent, because, rather than seeking to lessen future impacts and lessen the need for government or donor intervention in the future, drought managers had previously sought to manage drought as a crisis with little, if any,

reduction in risk. The measures outlined above can allow drought managers to treat risks and impacts as part of climate management strategies across the country, so that planning is undertaken in preparation for emerging and subsequent drought events. Such planning actions must be done at the level of various sectors, groups, and regions, and be distinguished by effective, cross-sectoral coordination and communication. A results framework should be developed to establish a clear set of principles or operating guidelines to govern the management of drought and its impacts across the country. The activities and roles in the framework should be consistent and equitable for all regions, population groups, and economic sectors, and consistent with national goals for sustainable development. The overarching emphasis should be on risk management through the application of preparedness and mitigation measures.

4.2 Drought preparedness

The development of this plan is a call to drought management action at various levels across the country. Whereas both external and internal factors are important in achieving drought preparedness, internal support must be present for the process to move forward. The goal is to focus local resources on reducing vulnerability to drought-related conditions, rather than seeking relief support or providing emergency assistance. Mobilising internal resources to increase drought preparedness requires building consensus, because meaningful participation enhances the chance of successfully initiating and completing implementation actions. The consensus building process should focus on how and whether existing or previous plans and projects can be incorporated into a broader strategy for drought mitigation. It typically entails addressing constraints to drought management planning such as participation, budget, political will, institutional capacity, among other factors, to ensure implementation success. Preparedness also requires developing knowledge about drought planning and mitigation at the policy level, as well as improving communication and collaboration among key entities at the process level. It also needs adequate financing to ensure that institutions function effectively and efficiently. All of these considerations can increase local understanding of drought and increase mitigation efforts at all levels. The implication is that drought preparedness can reduce vulnerability through more reliable forecasts, improve early warning, and ensure appropriate and timely mitigation measures. A plan detailing the steps mentioned already will be a significant step in adopting a preventive, anticipatory approach to drought management in the country. Done well, the ability of institutions to act in circumstances of drought (and post-drought) can significantly improve.

Chapter Five

Implementation framework

5.1 Proposed institutional framework

Considering the fragmented master plans and institutions that exist for managing drought-related conditions and climate change in the country (see section 2.4), it will be difficult to situate the operationalisation of this plan within the current climate management regime. Therefore, it is recommended, based on the 10-step process introduced in the introductory chapter, to establish a competent entity. A Drought Management Taskforce (DMT) should be constituted to identify drought impacts affecting various administrative regions in the country and propose measures for monitoring and mitigation. As described previously (in chapter 1), DMT will principally comprise representatives of the Sierra Leone Meteorological Agency; Ministry of Water Resources; Ministry of Agriculture and Forestry; National Secretariat of Climate Change (in the Environment Protection Agency); Disaster Management Department (in the Office of National Security); Ministry of Finance; Ministry of Planning and Economic Development; Ministry of Local Government; Ministry of Information and Communications; Ministry of Lands, Housing and Environment; Local and District Councils; INGOs (such as the Red Cross and Crescent Societies, Water Aid, Save the Children UK, GOAL, OXFAM etc); multilateral banks (such as the World Bank and African Development Bank Group); international development agencies (such as UNDP, FAO, UNICEF etc); universities; civil society groups and community development organisations, the press, among others. These representatives should be grouped into the following three working groups based on their functions and competencies: 1) Drought Monitoring Working Group (DMWG); 2) Impact Assessment Working Group (IAWG); and 3) Mitigation and Communications Working Group (MCWG). Each of the working groups will focus on one important drought management component, specifically, monitoring, impact assessment, and mitigation (based on Wilhite 1996).

The roles of the working groups will be as follows:

1. DMWG will primarily monitor current and estimate likely future water availability and moisture conditions. The working group will focus mainly on developing inventories, determining primary users' needs, develop/modify information delivery systems, define drought and develop response strategies, develop early warning systems, and identify drought

management areas. The chairperson of this committee should be a member of the DAG and must be working for an agency charged with generating data on drought related conditions and early warning, such as the Sierra Leone Meteorological Agency. Similarly, members of the group should be representatives from agencies with responsibilities for forecasting and monitoring relevant indicators or indices.

2. IAWG will include those economic sectors most likely to be affected by drought (such as agriculture, transportation, water, health etc) as well as university scientists and representatives of international organisations that have expertise in early estimations of drought risks and impacts. Key roles for the group will include developing mechanisms to lessen drought impacts, determining how to target drought relief to vulnerable population groups and sectors, and analysis and communication of drought data to alert concerned groups on potential risks and impacts.
3. MRWG will principally lead the creation of long-range programmes to lessen vulnerability to drought while acting on the information and recommendations of the other working groups. For example, MRWG can act on recommendations resulting from IAWG assessments to evaluate the range of support available from government and other sources to assist those vulnerable to drought risks and impacts.

The implementation framework proposed above (see figure 15) will direct coordination among relevant ministries, departments, and agencies, and facilitate the meaningful engagement of key stakeholders to achieve a participatory drought management process. Once the working groups are fully constituted, the members should work together to identify and establish the organisational networks that need to be in place for effective drought monitoring and mitigation. The DMT, which will serve as the nucleus of drought management operations, will take responsibility for constituting the working groups, as well as determining who should play a role in: 1) monitoring the development of drought conditions; 2) implementing measures recommended in the plan as the drought develops and recedes; 3) mapping and mitigating the risks and impacts of the drought; and 4) reporting on changes observed and recommending future steps. In the performance of these roles, the DMT will be supervised and advised by the Drought Advisory Group (DAG), which will function as a technical working group that will include actors with a keen interest in and specific roles for managing drought-related conditions across the country. The UNCCD National Focal Person (NFP) will chair the DAG and take responsibility for coordinating the execution of all aspects of the drought management process, including the dissemination, implementation, and update of the Drought Management Plan (DMP) through the DMT's activities.

Important to note for the effective operationalisation of this plan is that the proposed institutional arrangement should not sit within the national stakeholder space only. Its creation and functionality should be regulated at the sub-national level as well, ensuring that actors at all levels where drought management performance is required (such as the river basin or process level) are involved. Accordingly, the implementation framework can be adapted in various ways to suit the conditions at multiple levels and allow for action and integration at various scales (in different settings). No matter the context and actor make-up, the institutional framework prescribed for drought management in Sierra Leone should: 1) coordinate relevant authorities, entities, and stakeholders; 2) implement, monitor, and evaluate management measures; 3) undertake research and assessments to obtain the background information required to act; and 4) inform the public and engage them in the design and delivery of measures to encourage meaningful participation and sustained institutional response.

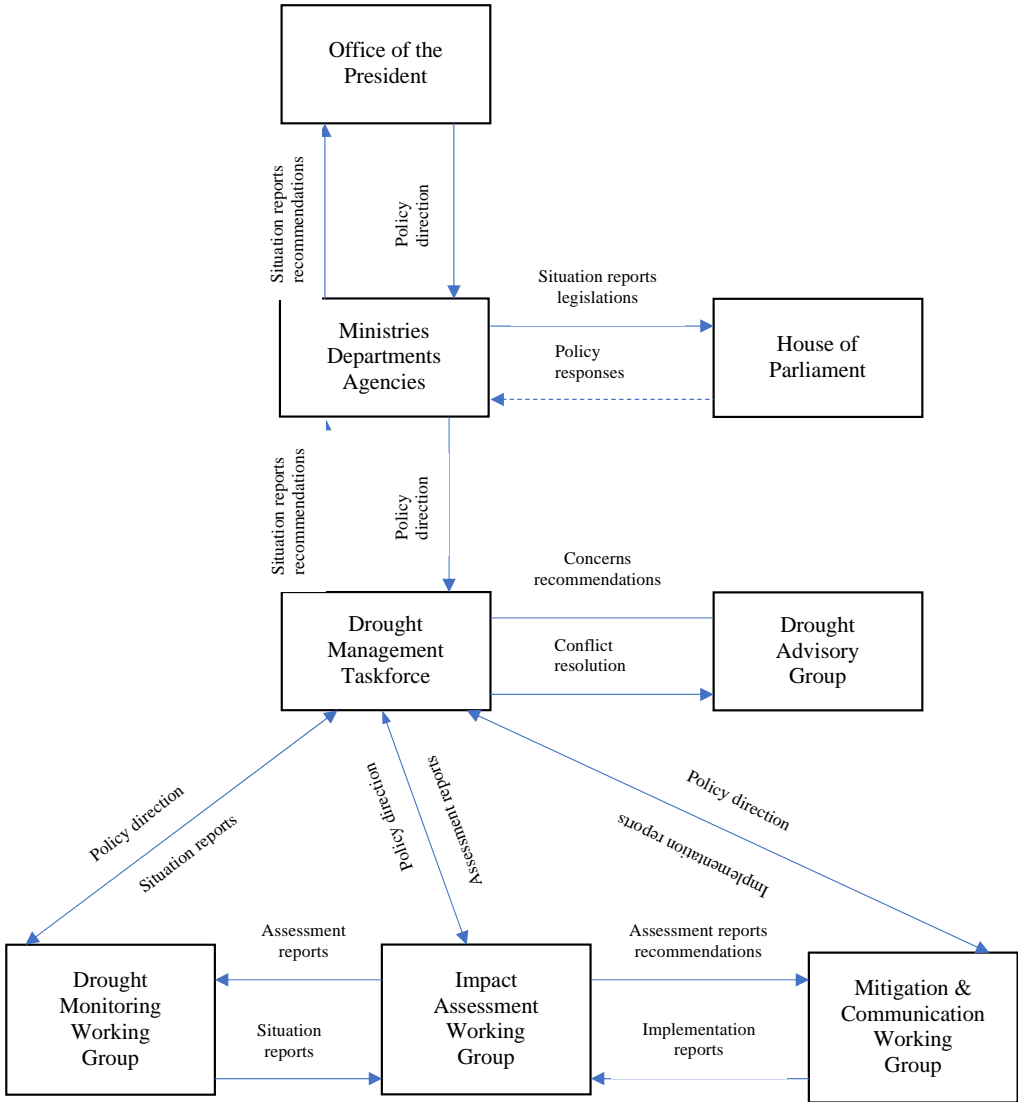


Figure 15: Proposed implementation framework of the DMP

5.2 The Drought Management Taskforce (DMT)

This section sheds more light on the important role of the DMT in the institutional framework. While benefiting from policy and technical advice from the DAG, the DMT will make recommendations on steps to take to implement drought management measures in varied situations, including the validation and implementation of this plan. DMT will comprise individuals who are knowledgeable in the different aspects of drought management, and who have a keen interest in addressed related conditions at various scales. Members will come from Government Ministries, Departments, and Agencies (MDA), universities, think tanks, Civil Society Organisations, national and international NGOs, and the donor community. Through the working groups mentioned in the previous section, the taskforce will principally seek to:

- Determine drought levels across the country by utilising, as baseline information, the drought intensities published by all competent entities such as the Sierra Leone Meteorological Agency (SLMA);
- Promote and increase preparedness to facilitate measures proposed for drought mitigation and management;
- Explore opportunities for the long-term monitoring of drought, as well as the evaluation of mitigation outcomes;
- Provide drought management information to the public to make the process participatory and collaborative;
- Provide regulatory oversight to ensure that plans and processes are implemented effectively and efficiently, and structures comply with existing standards and improve best practices;
- Communicate and coordinate information on drought-related conditions, impacts, and response actions;
- Determine mitigation and management measures for each of the principal impact sectors, in close coordination with concerned entities;
- Develop an inventory of all forms of assistance available (including technical, mitigation, and relief support) from local, state, and international partners before, during, and after severe drought conditions;
- Evaluate drought management projects for their ability to address short-term emergencies and long-term vulnerabilities;
- Establish drought management areas by understanding the impacts of drought on different economic sectors and social-ecological systems; and

- Coordinate the collection, analysis, and dissemination of data to ensure effective mainstreaming into drought management decision-making.

5.3 Communication and coordination

Of the roles outlined in the foregoing section, communication and coordination stand-out as two of the most important roles for the DMT in managing drought-related conditions across the country. Basically, understanding the frequency and severity of drought is the basis of effective planning and management of control measures to mitigate the impacts of drought. Communication and coordination processes will be guided by data produced and interpreted through activities undertaken by the working groups. Communication, specifically, will focus on the following five categories of drought magnitudes, using the indicators or indices described in chapter 3 (section 3.2): 1) abnormally dry; 2) drought moderate; 3) drought severe; 4) drought extreme; and 5) drought exceptional. A range of colours have been associated with these different severities of drought to help with communication and coordination of mitigation measures (see table 7). Green is used to denote normal status, yellow is used to mean pre-alert status, orange is for alert status, while red is used for emergency or extreme status. These different levels of drought (described in terms of statuses) are declared as follows:

- Normal status is declared when no significant deviation is observed in water stress levels. It is when strategic and long-term measures are applied such as water demand management to ensure water efficiency, improvement of storage and regulation capacity, and promotion of services that increase water availability such water reuse systems.
- Pre-alert status is declared when monitoring indicates the initial development of drought-related conditions. The purpose of communicating at this stage is to prevent further depletion of water resources by taking informative and control measures such as water-saving.
- Alert status is declared when observed conditions intensify, to draw attention to the occurrence of drought as well as potential impacts in the future if appropriate measures are not taken immediately.
- Emergency status is declared if previous measures are insufficient to meet essential water demands. This stage of the drought is communicated to the public to state that drought has occurred, and water supply cannot be guaranteed.

Generally, the threshold levels described here embody a programme of measures that can be preventive or strategic, operational, or organisational. Preventive or strategic measures are taken

under normal status to increase resilience to drought and mitigate potential impacts on the economy, society, and environment. Operational measures focus principally on actions that need to be taken when drought events occur, especially during the pre-alert and emergency status. Such measures should be based on the objectives set for the thresholds as identified in the communication protocol. Organisational measures involve steps to ensure effectiveness, efficiency, and equitability across all levels of drought management. All of these measures rely upon the existence and effectively delivery of an institutional framework such as the one proposed for implementing this plan in the current chapter.

Level	Conditions	Significance	Goal/objective	Target
1 (Green)	Normal	There is sufficient water to meet human and ecosystem needs	Preparedness	Ongoing reductions in community water use
2 (Yellow)	Dry	First indications of a potential water supply problem	Voluntary conservation	Minimum 10% reduction
3 (Orange)	Very dry	Potentially serious ecosystem and socio-economic impacts are likely	Voluntary conservation and restrictions	Minimum additional 20% reduction
4 (Red)	Extremely dry	Water supply insufficient to meet human and ecosystem needs	Voluntary conservation, restrictions, and regulatory response	Maximum reduction
Loss of water supply		Potential loss of a community's water supply	Emergency response	Ensure health and safety

Table 7: Drought communication protocol

The overall essence of developing and implementing the communication protocol proposed above, is to maintain a level of drought awareness and provide a conduit through which the various bodies supported by the DMT can deliver their functions effectively. A communications protocol allows the DMT to work with other groups to network and develop decision-making strategies that have a broad utility at different management levels. Moreover, the protocol can be used to determine water conservation requirements and the potential consequences of failing to meet goals set for drought management. It, therefore, specifies the communication strategy to follow for the corresponding drought level, as well as the stakeholders (audiences) needed to participate in planning and implementing drought management actions (table 8). Target audiences may vary according to the drought situation, but core stakeholders should be involved at all levels. The rule of thumb is that having the right stakeholder mix helps to devise effective procedures and actions for any advisory or stage communication. It also determines the information release work plan because it provides insights into who oversees and distributes information, and who receives and evaluates information on changing conditions.

Level	Conditions	Goal/objective	Audience	Statute
1 (Green)	Normal	Drought preparedness	General public and key institutions, groups, and sectors	All policies, laws that apply
2 (Yellow)	Dry	10% reduction in water use through voluntary conservation		
3 (Orange)	Very dry	20% additional reduction in water use through voluntary conservation		
4 (Red)	Extremely dry	Maximum compulsory reduction in water use		

Table 8: Specific restriction targets for the corresponding drought level

As message consistency is most critical to the process, the message mapping matrix outlined in table 9 can help with coordinating communication processes by guiding the DMT in developing and delivering appropriate messages to the right audiences. The matrix draws on the drought situation or response, the risk, and implementation action to effectively target communication processes and coordinate with all stakeholders necessary for implementing actions to mitigate drought. Practitioners can use a SWOT analysis to understand existing needs, processes and structures, and propose ways by which actors can work together to address challenges and reduce confusion. The use of these tools should make certain that communication and coordination protocols do not involve a one-size-fits-all process because the messaging will be too broad, too complicated, or too confusing. Every communication or coordination effort should be suited to the conditions in view and the steps that can be taken to understand, monitor, and mitigate them in the safest time possible.

Key message 1	Key message 2	Key message 3
Describe situation	Define risk	Outline actions
Supporting evidence 1.1	Supporting evidence 2.1	Supporting evidence 3.1
Supporting evidence 1.2	Supporting evidence 2.2	Supporting evidence 3.2
Supporting evidence 1.3	Supporting evidence 2.3	Supporting evidence 3.3

Table 9: Message mapping template

Strengths	Weaknesses
<ul style="list-style-type: none"> ○ Easily understood message ○ Accurately portray a big picture perspective ○ Interconnectedness ○ Leverage more resources/skills – e.g. coordinating graphic resources, etc. ○ Would allow to tell story in a richer way, e.g. using video/graphics that wouldn't be as easy alone ○ Consistent messaging would explain system differences/variations in a regional context ○ Regional users – live in one part but work in another part ○ Each system would be “forced” to have a dedicated webpage/information in a single area so that media could have one go-to location 	<ul style="list-style-type: none"> ○ Can obscure the local issues; i.e. sub-watersheds can have different issues ○ Messages designed to apply to everyone could become inflexible ○ Could lose local control over the messaging ○ Real differences in utility water shortage programs, triggers, and responses ○ Hard to hit all demographic groups (e.g. urban, rural, etc) with a single clear message ○ Coordinated messages can get really complicated (esp. at the local level) if you're trying to explain the differences of each system ○ Temptation to look at regional average – maybe red dot doesn't really illustrate a hot

Opportunities	Threats
<ul style="list-style-type: none"> ○ Get in Front of the media - Divide and conquer way to get the message out ○ Opportunity to craft a regional message together (how much communication before a drought is declared) ○ Pre-drought “Advisory” messaging ○ Regional networking/cooperation/education about interconnectedness ○ Cost-savings for consolidated advertising through shared buys ○ Lead to other coordinated emergency responses ○ Connect to other associations and communication outlets ○ Coordinate more with other agencies ○ Raise awareness of water in general 	<ul style="list-style-type: none"> ○ spot; could dilute a critical local specific message ○ No single, central message ○ Not everyone is affected equally ○ Too busy to meet - people in thick of it might not be invested enough to participate ○ Oversimplified message, media waters it down ○ Early warnings could be a problem, i.e. premature messaging ○ Communication breakdowns based on difficulty of maintaining list of current contacts (maintenance challenge) and staff turnover ○ Stakeholder interests will turn to self- interest - isolationism ○ Messaging errors – too specific/vague, too early/too late, too confusing, just wrong, nuance ○ Coordinated message, but can lose control to media ○ Overreacting from people in utilities that are less impacted/under reaction from others ○ Level of trust/mistrust among group, regions, and sectors ○ State legislation putting out conflicting messaging

Table 10: Sample communications SWOT Analysis

5.4 Capacity development

Capacity development is an essential component of the strategy outlined above for implementing this plan in Sierra Leone. The goal is to have a systematic, functional national drought management mechanism with skilled human resources. Therefore, implementing the plan will require a Training Needs Assessment (TNA) to identify the urgent and medium-term needs of key stakeholders, and develop and deliver adequate, demand-led training modules at the respective management levels. Ideally, a National Drought Management Capacity Building Strategy (NDMCBS) should be developed by the DMT, and approved by the DAG, to direct all levels of coordination for improving skills, knowledge, attitudes, and resources for drought management. Specific areas for capacity building include water conservation and management, watershed development, emergency response and relief support, drought monitoring and forecasting, gender mainstreaming, public engagement, policy advocacy and coordination, resource mobilisation, and programme-level operationalisation. Accordingly, the capacity development process should be approached as a long-range effort

involving the development of tools and methods and the delivery of policy at the institutional, community, and individual levels.

5.5 Participation and gender mainstreaming

Citizen engagement is as important as mainstreaming gender concerns into the steps proposed for implementing this plan. All key stakeholders will need to be involved to the point of influencing the final outcome of management decisions. This will promote greater equity, improve participation and learning, and enhance efficiency and effectiveness. Effective participation will ensure feedback creation and improved decision-making, so that all manner of relevant concerns can be mainstreamed into the drought management process. Concerns about women's engagement and empowerment should be considered throughout planning, implementation, and monitoring, so that the local diversity needed to understand, and address drought-related conditions can be achieved. Indicators or indices developed for various monitoring and forecasting purposes will also not be gender-neutral, so that all hues of opinions and concerns can feature in the implementation framework. This can be best achieved through a mainstreaming plan, which will exploit outcomes from communication activities seeking to increase public engagement and understanding, to identify concerns that can be feature in the revision of management plans and the making of crucial decisions.

Chapter Six

Conclusion and recommendations

6.1 Conclusion

Despite not been observed in any region of Sierra Leone, at least based on the publically available research materials reviewed in this work, drought is widely recognised as an example of slow onsets to which multiple sectors, populations, and regions of the country are vulnerable. It is seen as a pervasive natural hazard that is a normal part of the climate of the country because it concerns the lack of water or its inadequacy for various purposes. What is worrisome, however, is the lack of planning and mitigation actions, which could significantly exacerbate the impacts of drought and associated conditions when they occur. As shown in chapter 2 and 3, whereas many interventions have provided data for water availability and quality across the country, they do not, in the most specific terms, establish a relationship between these data and the occurrence of drought.

Hence, this DMP will establish clear guidelines and operating principles to govern the monitoring and management of drought and its impact. The plan is consistent with current plans to monitor similar conditions because it shows how such information can be utilised to enrich both planning and mitigation efforts. The overarching purpose of the plan has been to stress the importance of monitoring, forecasting, and mitigation measures. The plan is therefore rooted in the spirit underlying separate laws and policies for disaster management, water conservation and climate change, though it proposes an implementation framework to address existing issues regarding communication and coordination at institutional and sectoral levels. It is timely in that it draws attention to the social, economic and environmental risks and impacts of drought-related conditions. It can provide the basis for future efforts to systematically document changing conditions, including quantifying the spatial extent and financial costs, as well as environmental damages and individual and collective losses related to drought events. Policy and local stakeholders can benefit from this planning exercise by implementing the implementation framework proposed, to understand current and future vulnerabilities, and engender more investment in monitoring, prediction, mitigation, and preparedness.

6.2 Recommendations

This contingency plan for drought management recommends all sorts of actions that are required to effectively anticipate, and address drought risks and impacts at multiple scales in Sierra Leone. It includes all the major pillars of drought action and principally recommends a paradigm shift from the traditional approach of responding to drought as a crisis to managing it as a risk. One way this can be done is by operationalising the proposed implementation framework, which could increase drought awareness by strengthening institutional capacities for research, communication, coordination, and ground-level action. Next, the key organisational structures need to pool resources to effectively identify, disseminate, and improve best practices that are appropriate to local conditions. Strategic investments are also needed in EWS to understand who and what is vulnerable, where, why, and to what extent. Likewise, stakeholders need to work together to develop indicators or indices that can be used for broadly for drought monitoring, impact assessment, and evaluation, and to support communication and coordination activities. This facilitates timely and appropriate mitigation actions and can reduce impacts from future drought events.

Additional recommendations include the need for greater collaboration and synergy in sharing experience and success stories, as well as the need to build institutional capacity on all aspects of drought prediction and management. Both angles of drought management can be achieved through cross-sectoral planning, trainings, and knowledge exchange. A further need is the mobilisation of technical and financial resources to support the establishment, proliferation, and effective functioning of drought preparedness networks, so the work of the DMT can be adequately financed and sustained. Strategic funding partnerships can also improve institutional synergy and stakeholder collaboration, as well as provide a mechanism for understanding and addressing many of the important and urgent issues raised in the different chapters of this plan.

6.3 Future updates and revisions

It is important to stress that the science of drought risk management is evolving, and to fully account for emerging trends and new knowledge, planning and implementation actions should be continuous and adaptable. Therefore, this plan is expected to be a living document that will be revised and updated periodically to attain the desired objectives and outcomes. The DMT, for instance, should carry out a full-blown review to update the plan every few years, as determined by key stakeholders involved at different levels of the process. The revised plan should typically include performance

stories that give stakeholders the chance to promote and improve best practices while replacing or modifying mitigation and monitoring measures that are not yielding the desired results.

Glossary

ADAPTIVE CAPACITY: The potential or ability of a system, region, or community to adapt to the effects or impacts of climate change. Enhancement of adaptive capacity represents a practical means of coping with changes and uncertainties in climate, including variability and extremes

CAPACITY: A combination of all the strengths and resources available within a community, society or organization that can reduce the level of risk, or the effects of a disaster. Capacity may include physical, institutional, social or economic means as well as skilled personal or collective attributes such as leadership and management. Capacity may also be described as capability.

CLIMATE CHANGE: Climate change refers to a statistically significant variation in either the mean state of the climate or in its variability, persisting for an extended period (typically decades or longer). Climate change may be due to natural internal processes or external forcings, or to persistent anthropogenic changes in the composition of the atmosphere or in land use

DISASTER: A disaster is an unusually severe and/or extensive event that usually occurs unexpectedly and has such a severe impact on life and health of many people and/or causes considerable material damage and/or impairs or endangers the life of a large number of people for a long period of time to such an extent that resources and funding available at local or regional level cannot cope without outside help.

DISASTER RISK REDUCTION: The conceptual framework of elements considered with the possibilities to minimize vulnerabilities and disaster risks throughout a society, to avoid (prevention) or to limit (mitigation and preparedness) the adverse impacts of hazards, within the broad context of sustainable development.

EARLY WARNING: The provision of timely and effective information, through identified institutions, that allows individuals exposed to a hazard to act to avoid or reduce their risk and prepare for effective response.

FORECASTING: Definite statement or statistical estimate of the occurrence of a future event

(UNESCO, WMO).

INDICATOR: An indicator is the representation of a trend. It trends measurable change in some social, economic, or environmental system over time.

MITIGATION: A collective term used to encompass all activities undertaken in anticipation of the occurrence of a potentially disastrous event, including preparedness and long-term risk reduction measures.

PREPAREDNESS: Activities and measures taken in advance to ensure effective response to the impact of hazards, including the issuance of timely and effective early warnings and the temporary evacuation of people and property from threatened locations.

RELIEF/RESPONSE: The provision of assistance or intervention during or immediately after a disaster to meet the life preservation and basic subsistence needs of those people affected.

RESILIENCE: The capacity that people or groups may possess to withstand or recover from emergencies and which can stand as a counterbalance to vulnerability

RISK: The probability of harmful consequences, or expected loss of lives, people injured, property, livelihoods, economic activity disrupted (or environment damaged) resulting from interactions between natural or human induced hazards and vulnerable conditions.

RISK MANAGEMENT: Risk management is a methodology for considering all factors affecting the safety or the operation of large structures or systems of structures.

VULNERABILITY: The conditions determined by physical, social, economic, and environmental factors or processes, which increase the susceptibility of a community to the impact of hazards.

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