LIBERIA NATIONAL DROUGHT PLAN

Environmental Protection Agency
Republic of Liberia

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Acronyms

AAI	Aridity Anomaly Index
ACC	Agricultural Coordination Committee
AFDM	African Flood and Drought Monitoring
AfT	Agenda for Transformation
ARSDRR	Africa Regional Strategy for Disaster Risk Reduction
CAADP	Comprehensive African Agriculture Development Programme
CARI	Central Agriculture Research Institute
CI	Conservation International
CMI	Crop Moisture Index
COP	Conference of Parties
ECU	Environment Coordination Unit
EDI	Effective Drought Index
EP	Effective Precipitation
EPA	Environmental Protection Agency
EPML	Environment Protection Management Law
FACE	Farmers Associated to Conserve the Environment
FAO	United Nations Food and Agriculture Organization
FAPS	Food and Agriculture Policy and Strategy
FCPF	Forest Carbon Partnership Facility
FDA	Forestry Development Authority
FFI	Fauna and Flora International
GDP	Gross Domestic Product
GIZ	Deutsche Gesellschaft für Internationale Zusammenarbeit
HIV/AIDs	Human Immunodeficiency Virus/ Acquired Immune Deficiency Syndrome
iPRS	Interim Poverty Reduction Strategy
IUCN	International Union for the Conservation of Nature and Natural Resources
IWRMP	Integrated Water Resources Management Policy

KBDI	Keetch–Byram Drought Index
KFW	German Development Bank
LATA	Liberia Agriculture Transformation Agenda
LDN	Land Degradation Neutrality
LISGIS	Liberia Institute of Statistics and Geo-Information Studies
MME	Ministry of Mines and Energy
MoT	Ministry of Transport
NAP	National Action Program
NBSAP	National Biodiversity Strategy and Action Plan
NCCCD	National Coordinating Committee to Combat Desertification
NEP	National Environmental Policy
NEPAD	New Partnership for African Development
NDMP	National Disaster Management Plan
NDP	National Drought Plan
NFRL	National Forestry Reform Law
NGOs	Non-Governmental Organizations
PAPD	Pro-Poor Agenda for Prosperity and Development
PDSP	Palmer Drought Severity Index
RDDI	Rainfall Deciles-Based Drought Index
SCNL	Society for the Conservation of Nature of Liberia
SDGs	Sustainable Development Goals
SLM	Sustainable Land Management
SPEI	Standardized Precipitation Evapotranspiration Index
SPI	Standardized Precipitation Index
UNCBD	United Nations Convention on Biological Diversity
UNCCD	United Nations Convention to Combat Desertification
UNDP	United Nations Development Program
UNFCCC	United Nations Framework Convention on Climate Change
WASP	Weighted Anomaly Standardized Precipitation

Executive Summary

Liberia lies within the Inter-Tropical Convergence Zone (ITCZ) and has two major seasons: rainy season (May-October) and dry season (November-April). The country has a tropical climate and a territorial area of 111,369 km^2 with the dry land extending about 96,160 km^2. Annual average rainfall ranges between 4500mm to 4624 mm. There are six major rivers namely: St. John, St. Paul, Mano, Lofa, Cavalla and Cestos, with several tributaries emptying into those rivers thus making its soil and environment moist all year round.

Liberia has never experienced any recorded drought events in its history and would therefore be a surprise for a drought event to occur. The worst event that can happen is the dry spells that rarely occur during the dry season. There are a few ecological hazards affecting the county, most common among them are epidemics, floods, tropical storms, fire, tidal abnormalities, and erosion. The Liberia's National Disaster Risk Management Policy identifies drought as a potential threat in Liberia. There are also reported impacts of climate change which threaten the economies of people and their livelihoods as well as biodiversity and the environment. A few climate change hazards have been recorded in Liberia including change in rainfall patterns, sea level rise, and coastal erosion.

Drought is defined as a protracted period of deficient precipitation resulting in extensive damage to crops, and a consequential loss of yield. It can cause significant impediments for, especially, the most disadvantaged populations ranging from famine to migration and displacement. Hundreds of millions of people are at risk of the impacts of severe drought, and many more are expected to face unprecedented displacement within the next decade. Although the estimated proportion of Liberia's landmass affected by desertification and land degradation is still minimum, the upsurge in extreme climate events documented in both the Liberia National Adaptation Program and the National Policy and Response Strategy on Climate Change, especially changing rainfall patterns, are giving reasons for serious concerns. It is therefore important that Liberia develops a comprehensive drought management plan as a preparedness approach to deal with whatever signs of drought that may appear in the future.

The preparation of Liberia's National Drought Plan proceeded with the guidance received from the Secretariat of the United Nations Convention to Combat Desertification (UNCCD) and a Model Drought Plan with a template describing the structure of a Drought Plan. A Technical Working Group (TWG) for both the Drought Initiative and Land Degradation Neutrality Target Setting was established. The TWG supervised and coordinated the process of developing the National Drought Plan and solicited inputs from relevant sectors stakeholders.

In adherence to the UN Sustainable Development Goals (SDGs) and National Environmental Policy of Liberia, the overarching vision of National Drought Plan is the establishment of a comprehensive plan where systems are put in place to regularly assess and monitor the adverse impacts of drought and the effects of actions being employed to mitigate same. The Plan also intends to ensure effective communication with all stakeholders and populations about drought in order to deal with whatever future signs that may appear while at the same time maintaining a drought recovery program.

The vision of this Plan will be achieved through the following Strategic Objectives:

1. Identify and build the capacities of national institutions and human resources for early warning and drought monitoring;
2. Identify national and regional hubs for the setting up of National Meteorological Stations.
3. Establish processes, methodologies and identify specific activities for the collection of data on drought;
4. Identify vulnerable landscapes, populations, sectors and build their resilience to drought;
5. Develop and operationalize drought recovery programs;
6. Build knowledge management network to ensure that food production practices and systems are climate proof;
7. Design public education and awareness strategy and communicate with all populations about drought; and
8. Mobilize financial and human resources for the implementation of the drought plan.

The National Drought Plan considers the following priority intervention areas with emphasis on the issue of gender integration:

1. *Early Warning:* In the case of Liberia, it will focus on strengthening specific national institutions to enable them to generate, record, store and share weather related information and data that will improve planning of various interventions in a timely and effective manner. This will allow for appropriate actions to be taken to avoid or reduce their risk and prepare for effective response.
2. *Preparedness and Mitigation***:** There shall be established, a National Drought Task Force. The membership shall be multidisciplinary and shall include all key stakeholders as specified in the stakeholder's involvement plan. The Task Force shall coordinate and supervise the implementation of the drought plan at all levels of government and shall be tasked with the activation of the various elements of the plan during times of need.
3. *Response:* It is important to prepare a drought response plan before a drought occurs. This allows time for the plan to receive public review and comments while not in a crisis mode. A Drought Contingency Plan shall be developed as a short-term response before drought sets in, and such plan shall take into consideration areas that are inaccessible.
4. *Communication:* It is straightforward to construct a message about drought risk; but ensuring your message is understood and the implications of the message are accepted by your audience is most difficult. Communicating more effectively with members of the public and engaging the public around drought risk is important. Key elements to consider include: (a) how drought relieve is expected to be affected; (b) what cooperation and adjustments in living patterns may be expected from communities; (c) enhance people understanding on how to respond to drought once it occurs; (d) what the cost will be and; (e) what funding modalities are available and accessible.

1.0 INTRODUCTION

1.1 Background

Drought is a protracted period of deficient precipitation resulting in extensive damage to crops, and a consequential loss of yield[1]. Drought can also be defined as a prolonged dry period in the natural climate cycle that can occur anywhere in the world[2] and which can most often be accompanied by both short and long-term economic and social consequences to affected people worldwide. This menace can cause significant impediments for, especially, the most disadvantaged populations ranging from famine to migration and displacement. Hundreds of millions of people are at risk of the impacts of severe drought, and many more are expected to face unprecedented displacement within the next decade. Drought can be categorized into four types namely: Meteorological/Climatological Drought; Agricultural Drought; Hydrological Drought; and Socioeconomic Drought.

In Africa, the impact of consecutive seasons of drought have seared harvests and destroyed livelihoods. Farmers, traders and consumers are hit in the most profligate manner; and the scorch has increased the malnutrition rates of children especially those in rural communities and driven up food prices for urban residents. Livestock deaths and fire have slashed the asset wealth of pastoralists, and cumulative bad harvests will make recovery all the harder for small-scale farmers. In the worst cases, where conflict has hampered farming and hindered humanitarian access, famine is likely to be exacerbated. According to Masih *et al* (2014), droughts have become more frequent, intense and widespread on the African continent during the last 50 years. The extreme droughts of 1972–1973, 1983–1984 and 1991–1992 were continental in nature and stand unique in the available records. Additionally, many severe and prolonged droughts were recorded in the recent past such as the 1970s and 1980s droughts in western Africa (Sahel);1999–2002 drought in northwest Africa; 2001–2003 drought in southern and southeastern Africa; and 2010–2011 drought in eastern Africa (Horn of Africa).

[1] http://drought.unl.edu/Education/DroughtIn-depth/WhatisDrought.aspx
[2] https://public.wmo.int/en/our-mandate/water/drought

Liberia has never experienced any recorded drought events in its history. It would therefore be a surprise for drought to occur. The worst event that can happen is the dry spells that rarely occur during the dry season. Droughts occur from the lack of water in a certain area. This is caused by the absence of rain, moisture, and low dew points. There are a few hazards affecting Liberia, most common among them are epidemics, floods, tropical storms, fire, tidal abnormalities, and erosion. And the National Disaster Management Policy of Liberia (2012) forecast droughts as a future possibility.

1.2 Purpose

Although drought has never been reported in Liberia, the upsurge in extreme climate events documented in both the Liberia National Adaptation Program and the National Policy and Response Strategy on Climate Change, especially changing rainfall pattern, are giving reasons for serious concerns. It is therefore important that Liberia develops a comprehensive drought management plan as a preparedness approach to deal with whatever signs that may appear in the future. Thus, the reason for the development of a National Drought Plan. This Plan emphasizes gender equality in its implementation and will adopt best practices from elsewhere in the region to ensure the full inclusion and participation of men and women. It also seeks to reduce the gender gap existing between women and men by detailing actions to empower women and meet the different priorities of men and women in responding to drought and other phenomena.

1.3 Goals and Objectives

The goal and objectives of the National Drought Plan are consistent with the overall vision of establishing a comprehensive plan that will put in place systems to regularly assess and monitor the adverse impact of drought and the effects of actions being employed to mitigate same. The Plan is developed on the drought preparedness approach principle, which emphasizes the need for prior concrete and comprehensive plan and actions to avoid the associated risk of the impacts of severe drought that may occur in the future considering the danger of doing nothing until drought occurs. The goals and objectives of the NDP are developed with strong emphasis on gender inclusion and consideration.

***Goal 1*:** To design early warning programs and develop drought monitoring systems:

Objectives:

1. Strengthen the collection of meteorological and hydrological data including those on temperature, precipitation, humidity, wind velocity, lake levels, etc.;
2. Maintain a common database or a network of databases for storage and retrieval of data sets;
3. Ensure close and regular monitoring of drought incidences.

***Goal 2*:** To determine vulnerability profile and assess drought risks and impacts:

Objectives:

1. Define most vulnerable economic and social sectors to drought;
2. Determine population groups most vulnerable to drought;
3. Evaluate the risk levels and impacts of specific economic and social sectors and populations;
4. Determine the legal and social concerns of drought;
5. Assess the range of environmental issues arising from drought.

***Goal 3*:** To develop drought risk mitigation programs, preparedness and response measures.

Objectives:

1. Develop drought preparedness plan;
2. Identify ways and actions to reduce drought risk;
3. Design drought recovery operations and financing;
4. Conduct intensive public education and information campaign.

2.0 NATIONAL DROUGHT CIRCUMSTANCES

2.1 Overview of Drought in Liberia

Liberia lies within the Inter-Tropical Convergence Zone (ITCZ) and has two major seasons: rainy season (May-October) and dry season (November-April). With a tropical climate and a territorial area of 111,369 km^2, the dry land of Liberia extends about 96,160 km^2. The country has an annual average rainfall ranging between 4500 mm to 4624 mm making it one of the wettest in the world. It also has six major rivers namely: St. John, St. Paul, Mano, Lofa, Cavalla

and Cestos, with several tributaries emptying into those rivers thus making its soil and environment moist all year round.

There exist no published literature detailing any event and associated impacts of drought in Liberia. However, there are reported impacts of climate change which threaten the economies of people and their livelihoods as well as biodiversity and the environment. Based on available historical records from the Roberts International Airport weather station between the periods 2009 and 2012, the temperature typically varied from 23°C to 33°C and was rarely below 21°C or above 34°C over the course of the year. The records show that there is an extreme warm season that runs from January 1 to May 8 with an average daily high temperature above 31°C. The month of March recorded the hottest average temperature for the recorded period. The projected climate of Liberia from 2010 – 2050 is based on an ensemble of Regional Climate Models (RCMs) which projects an average increase in temperature at 0.6°C in the 2020s with an expected increase by 1.3°C in the middle of the 21st century (EPA, 2013). These impacts indirectly have the potential to cause incidence of drought in the worst case. A few climate hazards have been recorded in Liberia including extreme rainfall and change in rainfall patterns, sea level rise, and coastal erosion (EPA, 2008).

Drought can have a substantial impact on people, biodiversity, ecosystem, environment and agriculture productivity of the affected region and cause harm to the local economy. The National Disaster Risk Management Policy of Liberia (2012) identifies drought as a potential threat and goes further to categorize it into three potential types that would be experienced if adequate planning is not done. These drought types include: Meteorological droughts which measures negative departure of precipitation from the normal trend; Hydrological drought which measures the departure from normal flows in river, lakes and ground water aquifers; and Agricultural drought which considers the reduction in moisture availability below the optimum level required for productivity at various stages of growth. There is a high likelihood for the occurrences of drought events due to unsustainable land use practices especially in the forestry, agriculture, fishery, energy, health, tourism, transport and mining sectors.

2.2 Potential Impacts of Drought by Sectors

Traditionally, the impacts of drought are usually indirect, and their effects are critically dependent on context and underlying population vulnerability. For instance, the impact of

drought on health is particularly dependent on the socio-economic environment that can influence the resilience of the population. Poor health, poverty, and conflict are additional contributing factors to the impact of drought. The degree of impacts depends on the socio-environmental vulnerability of an area. To date, there has been no recorded impacts of drought on any sector in Liberia, but this plan attempts to present the likely impacts on key sectors including gender as a cross-cutting unit.

Forestry

Forests cover about 43% of the total landmass of Liberia but continues to decline annually due largely to climate change and other human induced impacts including unsustainable logging and agricultural practices. The forestry sector is a key contributor to Liberia GDP and is reported to contribute over $15 million per annum (FDA, 2017). According to FDA (2017), the average annual forest cover loss between 2001 and 2014 was 0.46%. This decline has a potential to adversely impact water supply. The northern Foyah landscape of Lofa county is currently experiencing invasion by non-native plant species thereby affecting the structure and function of the forest. Similar situations are happening in other parts of Liberia including central Bong County where invasive *Chromolaena odorata* species have taken over the former dense forest ecosystem.

The impact of climate change has a potential to induce drought associated impacts on the forest ecosystems thereby decreasing the economic and social benefits of the sector. This could exacerbate the incidence of poverty. Forecasts from climate models suggest an increased risk of droughts in tropical forests including the forest of Liberia over the next few decades, potentially threatening the large existing carbon sink.

Agriculture

The agricultural sector of Liberia is dominated by large scale monoculture plantations and traditional farming practices which result in biodiversity and soil fertility loss and unsustainable shifting cultivation respectively. In addition to the unsustainable human practices in this sector, climate change further aggravates the negative impacts on the already infertile mineral-rich latosols found in Liberia. This has the potential to cause low yields. Agricultural productivity is

mainly dependent on rainfall. Drought associated climate change predictions show that the impacts of climate phenomenon will continue to exert significant pressure on the agriculture sector (EPA, 2018). The traditional subsistence farming practice in Liberia is season based and rain fed. The rainy season traditionally began in May and ended in October each year which farmers are accustomed to. But in recent years, there have been a significant shift in seasonal rainfall pattern, duration and distribution with the season sometimes beginning earlier and sometimes later. Recent climate variations resulting in fluctuation and shift in the rainy season is impacting agricultural productivity of farmers and their annual yields are reducing due to confusion in the planting season. Based on personal interview with some farmers in Liberia, it is confirmed that they are struggling to adapt to the variation in rainfall pattern in order to guide their farming activities. The occurrence of any drought event will also result in deaths of both domestic and wild animal population due to extreme weather conditions, dry spills and resulting poor health conditions. Farmers are likely to be faced with inadequate harvest to feed their families and further fulfill other economic requirements.

Fisheries

Fisheries make up a significant proportion of needed animal protein in the diets of Liberians. The fishery market is gender inclusive and booming one with a double stage marketing channel involving fish mongers (mostly women) trading between the fishermen (mostly men) and the consumers (men and women) thereby providing for the livelihoods and economic needs of rural dwellers. There is no recorded data on recent stock assessment of the sector. However, it is been observed by subject matter experts and key stakeholders of the sector that the stock is declining due largely to unsustainable fishing practices. It is therefore assumed that any occurrence of drought event will impact negatively on the already dwindling stock.

Climate change has the potential to impact the fisheries sector. Annual variation in temperature and rainfall patterns resulting from climate change has a high potential to impact fish stocks and their survival. In the worst-case scenario where there exists an extended dry season, and depending on the severity, drought can have several impacts on fishes in rivers, streams and lakes from both a water quantity and quality perspective. Any incidence of drought will affect fish production due to decreased water levels and even drying up of lakes, rivers, streams, dams

and ponds, thereby affecting fish habitats and breeding sites for most fish species, which will affect the future availability of fish stocks. During normal rainy season, high flows provide stream channel maintenance such as scouring, and sediment transport and fishes rely on regular channel maintenance for the creation of habitats, from spawning to adult life stages. In a worst case, the quantity of water in a stream and lake will be substantially reduced during the periods of droughts, leading to direct reductions in living space for various life stages of fish species. During low-water years, important spawning areas might be left dry, and fishes inhabiting water bodies may be forced into small pockets of water in pools. Cover, such as woody debris and vegetation, may not be accessible to juvenile fishes making them susceptible to predation. Reduced stream flows will also lead to increases in water temperature. Under these conditions, some fish species might become stressed resulting in decreased growth or even death (FAO, 2009).

Health

The Liberian healthcare system and infrastructures are recognized globally to be poor. The Ebola Virus Disease outbreak further exposed the already weak, vulnerable and broken healthcare system that resulted in the unnecessary death of more than three thousand citizens and inhabitants. Any occurrence of drought event will have a high reaching negative impact on the health of the population. Drought impacts might range from those associated with nutrition-related effects, water related diseases, airborne and dust-related diseases and vector-borne diseases to mental health effects. Any occurrence of drought incidence in Liberia has the potential to disrupt natural systems, making the population very vulnerable to the spread of diseases (cholera, malaria, onchocerciasis, tuberculosis, HIV/AIDS, etc.).

Mining

Liberia is reported to be endowed with impressive stock of mineral reserves and has traditionally relied on iron ore, gold, and diamonds, as a major source of foreign exchange earnings. Mineral resources of varying types are reported to be located across the country (MME Report). The mining sector contributes significantly to the country's GDP and has a high growth potential which is subsequently associated with the creation of employment, income generation, and

infrastructure development. However, the environmental impacts associated with these mining activities are often unnoticed.

The sector is extremely energy-intensive and therefore, one of the major emitters of greenhouse gases. It requires several suitable natural conditions including habitable climate and access to water resources to enable the extraction of resources and their subsequent processing for the end users. The occurrence of drought associated with changing climatic conditions will have direct and indirect impacts including water and heat related impacts on the mining sector (Sharma *et al*. 2013). These impacts will incapacitate this very productive sector from contributing to the economy of the country. Any impact on the mining sector will also have far reaching impacts on human population within and around the footprint areas.

Gender

Gender, as used in most part of the world leans towards the weak and vulnerable women and youthful population. This is the case of Liberia. Gender should be treated as a socio-cultural variable encompassing both male and female population. While women and children are recognized to be striving for equality and integration, their men counterparts are equally facing various levels of inequality and marginalization in the society. It is therefore prudent to treat them as a unit for serious consideration especially in the event of disasters and other related natural phenomena. For example, in Liberia both men and women are traditionally involved in the labor-intensive agricultural practices without any forms of protection against diseases, extreme weather and other climatic conditions. Should there occur any drought or extreme climate event, those vulnerable men and women will be most impacted under very difficult and challenging situations. The National Drought Plan therefore considers the issue of gender as key in achieving equality between men and women of different social groups, age, tribes, backgrounds, etc. in order to build their resilience to the impact of drought and other natural phenomena including climate change.

2.3 Existing Legal and Policy Framework Influencing Drought Management

Legal and Policy Framework

The National Drought Plan (NDP) is developed in conformity with national laws, legislations and protocols as well as other international protocols and agreements governing the environment, natural resource management and climate change. The NDP is aligned with other sector-specific instruments on the environment, land, forestry, agriculture, and natural resources that are associated with climate change, sustainable land use, drought management and recovery.

Links to National Instruments

Constitution of Liberia (1986)

The Constitution of Liberia is particularly silent on the issue of natural resources and sustainable development; but in Article 7, some reference is made in reference to managing the economy and natural resources, as quoted: "The Republic shall, consistent with the principles of individual freedom and social justice enshrined in this Constitution, manage the national economy and the natural resources of Liberia in such manner and shall ensure the maximum feasible participation of Liberian citizens under conditions of equality as to advance the general welfare of the Liberian people and the economic development of Liberia".

Pro-Poor Agenda for Prosperity and Development 2018 to 2023 (PAPD)

The Pro-Poor Agenda for Prosperity and Development is the second in the series of 5-years National Development Plans anticipated under the Liberia Vision 2030 framework. It follows the Agenda for Transformation 2012-2017 (AfT) and is informed by lessons learned from the implementation of the Interim Poverty Reduction Strategy 2007 (iPRS) and the Poverty Reduction Strategy (2008-2011). This National Agenda focuses on strengthening the capacities of the people to thrive and further draws all Liberians into the national development process. The PAPD, which is a five-years national development plan, intends to address the basic needs of Liberians for income security, better access to basic services, and greater opportunities for self-improvement in an enabling environment that is inclusive and stable with the long-term aim of raising per capita income levels and economic status of Liberia to a middle-income country as outlined under the Vision 2030 framework.

The goals of the PADP are: 1. To build a stable, resilient, and inclusive nation embracing Liberia's triple heritage and anchored on the people's identity as Africans and 2. To lift an additional one million Liberians out of absolute poverty over the next six years through sustained

and inclusive growth driven by scaled-up investments in agriculture, infrastructure, and human capital development. These goals are expected to be achieved through four key pillars which form the pathways for the next five years: Pillar one: Power to the People— To reduce developmental inequalities so the people can prosper; Pillar Two: Economy and Jobs—Economic stability and job creation through effective resource mobilization and prudent management of economic inclusion; Pillar three: Sustaining the Peace—Promoting a cohesive society for sustainable development; and Pillar Four: Governance and Transparency—An inclusive and accountable public sector for shared prosperity and sustainable development. Each pillar has a goal and a set of development outcomes to be produced over the next five years in support of the two high level national goals.

National Disaster Management Policy of 2012 (NDMP)

The National Disaster Management Policy provides an overall framework for disaster management in Liberia. The NDMP compliments other national plans, policies and legislations related to drought and climate change management and provides a platform for the harmonization of all disaster risks management strategies/policies in Liberia. It particularly aims at integrating risk reduction as appropriate into development policies and planning at all levels of government, including the new Pro-poor Agenda for Prosperity and Development, the environment, land, agriculture and forestry sectors, among others. The NDMP recognizes the importance and specificity of local risk patterns and trends and decentralize responsibilities and resources for disaster risks management to relevant regional or local authorities. The Policy forecasts drought as a future possibility and therefore emphasizes the need for the development of a drought management plan to tackle future events.

Environment Protection and Management Law of 2003(EPML)

The Environment Protection and Management Law forms the legal framework for sustainable development, management and protection of the environment and natural resources by the Environmental Protection Agency in partnership with relevant ministries, autonomous agencies and organizations as well as in a close and responsive relationship with the people of Liberia. It addresses a wide range of environmental issues including environmental impact assessment, guidelines and standards, international obligations, education and awareness.

National Environmental Policy of 2003 (NEP)

The necessity for formulating a national environmental policy is in recognition of the severe impact of man's activities on all components of the natural environment, especially the influences of population dynamics, high density urbanization, resource exploitation and the further realization regarding the critical importance of restoring and maintaining environmental quality for the welfare and development of the people. The overall goal of the NEP is to ensure long-term economic prosperity of Liberia through sustainable social and economic development, which enhances environmental quality and resource productivity on a long-term basis that meets the requirements of the present generation without endangering the potential of future generations to meet their own needs. The aim of the national environmental policy is to ensure the improvement of the physical environment, the quality of life of the people, and the economic and social living conditions of the entire citizenry. It seeks to ensure reconciliation and coordination between economic development and growth with the sustainable management of natural resources.

National Policy and Response Strategy on Climate Change of 2018

The National Policy and Response Strategy on Climate Change is a vehicle developed to support climate change adaptation, disaster risk management and mitigation capacity in Liberia. It focuses on the implementation of Liberia's commitment to achieving the Sustainable Development Goals (SDGs), especially Goals 13, 14 and 15 which all focus on combatting climate change and fostering sustainability. It also focuses on achieving Africa's vision for promoting positive socio-economic transformation (Agenda 2063 adopted in 2013) over the next 50 years. The Agenda 2063 recognizes climate change and natural disasters as major threats to Africa's development now and in the future.

Liberia National Action Program to Combat Desertification 2011-2018 (NAP)

The Liberia National Action Program to Combat Desertification aims at tackling the impacts of land degradation in Liberia and is conscious that sustainable economic growth, social development and poverty reduction are current national priorities, and are essential to meeting sustainability objectives. The NAP focuses specifically on four main strategic objectives: Improvement of the standard of living of the people in areas affected by land degradation and its

associated negative impacts; Improvement of the condition of the affected biodiversity within its habitats and affected ecosystems within the political boundaries of Liberia and its political sphere like the Liberian air space and the Liberia's continental shelf; Generation of global benefits like improved biodiversity and reductions in climate change accrued from the implementation of the NAP on sustainable land management (SLM) and; Mobilization of financial and human resources.

Land Rights Policy of 2013

The Land Rights Policy of Liberia is premised on the former Land Commission's policy recommendations for land rights in Liberia, centered on four basic types of land rights:

i. Public Lands – lands designated for future use and managed in the public interest; these are not Government lands, or owned by a community and used or managed in accordance with customary practices and norms, or owned as Private Land;
ii. Government Lands: land owned by the Government and used for the buildings, projects, or activities of the Government;
iii. Customary Lands: land owned by a community and used or managed in accordance with customary practices and norms. These lands may include, but are not limited to: wetlands, communal forestlands, and fallow lands.
iv. Private Lands: land owned by an individual or private entity, in which management and use decisions are based solely on formal law (i.e. statutes, regulations, executive orders, and court decisions), where the owner enjoys the full bundle of land rights, which include, but are not limited to, the right to: exclude all others, use and possession, own natural resources on the land (e.g. forest), and to transfer all or some of the rights through sale, lease, concession, gift, donation, will, or any other lawful means.

The legal ownership of land will provide security of tenure to land users and holders thus giving them rights to sustainably manage and use their lands.

National Forestry Reform Law of 2006 (NFRL)

This Act amends the National Forestry Law of 2000 and the Act creating the Forestry Development Authority in 1976. It is an updated reflection of current day's realities

incorporating sustainable management principles. The NFRL mandates the FDA to ensure sustainable management of forest and forest resources and further is charge them with ensuring the effective governance and management of the country's Protected Areas system. The core functions of the FDA are: to prepare long and medium-term plans in the forestry sector; to prepare documents or guidelines for forestry policy, law and administration; to monitor adherence to forest legislation and concession agreements; to assess forestry fees and evaluates investment proposals; to execute reforestation programs and forest research and training; and to monitor activities of timber companies.

Mineral and Mining Law of 2002.

The Mineral and Mining Law of Liberia calls for "reasonable preventive, corrective and restorative measures to limit pollution or contamination of, or damage of streams, dryland surfaces and the atmosphere in general". The Law states that "minerals on the surface of the ground or in the soil or top-soil, rivers, streams, water courses, territorial waters and continental shelf of Liberia are the property of the Republic and anything pertaining to their exploration, development, mining and export shall be governed by the laws". It considers the sustainable management and protection of water bodies and other key features and gives stakeholders the management rights through licensing processes and further ensures the sustainable management of the forests, environment and related natural resources for the benefits of the country.

Integrated Water Resources Management Policy of 2009 (IWRMP)

The Integrated Water Resource Management Policy constitutes the national policy on water resource utilization in Liberia and covers two broad areas, water resource management and water resource use. The goals of the IWRMP are to ensure: (i) full socio-economic benefits for present and future generations; (ii) access to safe and adequate water for the people; (iii) the availability of quantity and quality of water for the environment and ecology; (iv) the availability of sufficient quantity and quality of water for food security; (v) the availability of water for other uses such as hydropower generation, industry, transportation, recreation, etc. Key strategies of this Policy comprise: (i) decentralization of economic incentives and efficient and proper disposal of solid and liquid wastes; (ii) establishment of appropriate bodies responsible for water resources management; (iii) development and enhancement of national human resources and

technological capacities; (iv) fostering of international cooperation in the management of shared river basins; (v) ensuring efficient means of domestic water supply; (vi) integrated and sustainable development and management of water resources for all sectors; (vii) protection of all water resources; and (viii) prevention of natural disasters and the effects of climate change.

Links to National International Instruments

The National Drought Plan of Liberia is also linked to several international instruments including:

- Sustainable Development Goals;
- United Nations Framework Convention on Climate Change (UNFCCC);
- United Nations Convention on Biological Diversity (UNCBD)
- United Nations Convention to Combat Desertification (UNCCD)
- Africa Regional Strategy for Disaster Risk Reduction (ARSDRR); and,
- Comprehensive African Agriculture Development Programme (CAADP)

The Sustainable Development Goals (SDGs)

In September 2015, the global community agreed on "The 2030 Agenda for Sustainable Development", including 17 Sustainable Development Goals (SDG) and 169 targets. Goal 15 urges countries to "protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss". More specifically, target 15.3 aims to "combat desertification, restore degraded land and soil, including land affected by desertification, drought and floods, and strive to achieve a land degradation-neutral world" by 2030. This National Drought Plan goes beyond SDG 15 and considers the issue of security, environment and climate change.

United Nations Framework Convention on Climate Change (UNFCCC)

There exist direct links between the impact of drought and climate change as drought defines a period of below-average precipitation in a given region, resulting in prolonged water shortages. Drought is impacting millions of people globally and is one of the most far-reaching natural disasters, bringing short and long-term economic and social losses to millions of people worldwide. Drought and water scarcity resulting from climate change – interconnected

phenomena that often aggravate each other's effects – can trigger major setbacks for the most disadvantaged populations: from famine to migration and displacement. A single year of drought can set back years of social development, for vulnerable members of society. As a global agreement, UNFCCC is link directly to the National Drought Plan of Liberia as the plan addresses issues related to impacts of both drought and climate change. Liberia's National Policy and Response Strategy on Climate Change focuses on all of the sectors which are considered under this National Plan and works in similar scopes in tackling the projected negative impacts of drought and climate change.

United Nations Convention on Biological Diversity (UNCBD)

The United Nations Convention on Biological Diversity, also known as the Biodiversity Convention, is a multilateral treaty with three main goals including: ensuring the conservation of biodiversity; sustainable utilization of its resources; and the fair and equitable sharing of benefits accrued. Liberia has domesticated the UNCBD and developed its National Biodiversity Strategy and Action Plan (NBSAP) which considers the integration of biodiversity conservation into sustainable management of the environment and natural resources. The NBSAP largely mirrors and details the vision and strategy for the Aichi Biodiversity Targets and a ten-year action plan (2015-2025) which ensures the conservation and sustainable management of Liberia's biodiversity. The National Drought Plan of Liberia is developed in line with Liberia's revised and updated NBSAP and the overall UNCBD objectives.

United Nations Convention to Combat Desertification (UNCCD)

The twelfth session of the Conference of Parties (COP 12) of the United Nations Convention to Combat Desertification (UNCCD) agreed to integrate the SDGs and related targets into the implementation of the Convention and decided that "striving to achieve SDG target 15.3 is a strong vehicle for driving implementation of the UNCCD" (decision 3/COP.12). The UNCCD was designed to address land degradation and desertification challenges in countries experiencing serious droughts in arid and semi-arid regions of the world particularly in Africa. Liberia National Action Program (NAP) developed in 2016 is aligned with the UNCCD ten years strategic plan and framework and estimates the total landmass currently affected by

desertification to be insignificant (5–7%). The NAP also raises concerns that increased unsustainable land utilization coupled with creeping northern savannah gives reasons for serious planning ahead of any drought event. The government therefore began taking steps to address the issues of potential drought in Liberia through the development of this National Drought Plan which will detail how the country will prepare for droughts.

Africa Regional Strategy for Disaster Risk Reduction (ARSDRR)

The Africa Regional Strategy for Disaster Risk Reduction aims to contribute to the attainment of sustainable development and poverty eradication by facilitating the integration of disaster risk reduction into development.The strategic objectives of the ARSDRR are as follows: increase political commitment to disaster risk reduction; improve identification and assessment of disaster risks; enhance knowledge management for disaster risk reduction; increase public awareness of disaster risk reduction; improve governance of disaster risk reduction institutions; and integrate disaster risk reduction in emergency response management. The National Drought Plan of Liberia is consistent with the strategic objectives of the ARSDRR.

Comprehensive African Agriculture Development Programme (CAADP)

The Comprehensive Africa Agriculture Development Program (CAADP) is a critical Pan African initiative launched by the New Partnership for African Development (NEPAD) concerning the agricultural sector policies in Sub-Saharan Africa. The objective of CAADP is to help African countries reach a higher path of economic growth through agriculture-led development which eliminates hunger, reduces poverty and food insecurity, and facilitates expansion of exports. As a member of the CAADP, the Agricultural sector of Liberia has developed several instruments to enable her take national level actions in order to contribute to the CAADP objective. Key among them is the Liberia Agriculture Transformation Agenda (LATA) which focuses on six agro-clusters, or sectors, moving away from raw commodities to manufacturing and processing of priority value chains — cocoa, rubber, oil palm, fisheries and aquaculture, rice and cassava on a sustainable basis with serious emphasis on the environment, land, natural resources and climate change. This National Drought Plan is also consistent with the LATA and other instruments developed in the agriculture sector.

Gender inclusion in existing Legal, Institutional and Policy Framework

Ensuring gender inclusion into all legal and policy frameworks is key to achieving Liberia's national development as well as the objectives for the establishment of institutions governing the management of the environment, agriculture, natural resource management and climate change. The Constitution of Liberia, the PAPD, and other national and sector specific legal instruments emphasize the importance of mainstreaming gender into all aspects of the society and the environment. It is therefore prudent to emphasize the significance of gender integration and mainstreaming into all national planning processes including the development of the NDP.

Ensuring sustainable development and the management of the environment and natural resources requires mainstreaming gender into key policy and legal frameworks governing various aspects of the society which will eventually contribute to reducing poverty and achieving livelihood and food security among rural women and men. Such policies and legal frameworks should emphasize on the roles and responsibilities of men and women and further underscore the provision of support to the vulnerable population, especially rural women and children who are impacted greatly during incidences of disasters. Although the issue of gender is considered at a lower scale in existing legal instruments in Liberia, the government continues to throw more emphasis on gender inclusion and mainstreaming in all aspects of the society including the legal and institutional frameworks governing the various sectors of the society. A review of the policies and legal frameworks associated with drought and other potential disasters shows that issue of gender is not significantly captured in those documents. It is therefore important that gender be included in all legal and policy frameworks governing the sustainable management of land, environment and natural resources in Liberia if we are to achieve the Sustainable Development Goals and our national agenda as a country.

It is important to note that rural women and men have different roles, responsibilities, and knowledge in using and managing land, the environment and natural resources in Liberia. Although their respective roles and responsibilities vary across counties and cultures, they often follow similar gender divisions of labor across the country. In most parts of Liberia, men use natural resources in agriculture, logging, and fishing for commercial purposes more than women. In crop production, women often grow a wider diversity of crops. In most cases, men and women

perform complementary roles—for example, men clear land, women plant and tend crops, and men harvest and market crops. It is therefore important that the issue of gender be captured in all legal and institutional frameworks to spell out the roles and responsibilities of men and women in the various sectors of concern.

3.0 DROUGHT MONITORING, FORECASTING AND IMPACT ASSESSMENT

3.1. Drought Indices

Adequately preparing and planning for drought and its associated impacts depends on information about the extent, severity and duration of drought events. Such information can only be obtained through monitoring and forecasting using drought indices which provide quantitative information to decision makers about drought characteristics (Dogan *et al.*, 2012). The selection of a specific index for monitoring drought occurrence and impacts, and forecasting drought is determined by specific regional to national circumstances, such as availability of spatio-temporal data, technical capacity and the nuances of the climatic, social, economic and environmental conditions. Dogan *et al*., (2012) recommends the consideration of more than one drought index because comparing and combining different indices may help to: better characterize droughts; examine the sensitivity and accuracy of drought indicators; investigate the correlation between indicators, and; explore how coherent the drought indicators are in the context of a specific objective. Several indices have been proposed by various authors for drought characterization including: Aridity Anomaly Index (AAI, Gommes *et al*.2010); Keetch–Byram Drought Index (KBDI, Keetch and Byram, 1968); Weighted Anomaly Standardized Precipitation (WASP, Lyon, 2004); Crop Moisture Index (CMI, Palmer, 1968); Standardized Precipitation Evapotranspiration Index (SPEI, Vincent-Serran *et al.*, 2009); Palmer Drought Severity Index (PDSI, Palmer, 1965); Rainfall Deciles-Based Drought Index (Gibbs and Maher, 1967), Standardized Precipitation Index (SPI, Mckee *et al.,* 1993); Effective Drought Index (EDI, Byun and Wilhite, 1999); among others. Choosing the appropriate index will depend on the available information, drought type, impacts of drought events on vegetation, agriculture, water levels, etc., and on the spatial scales of the event.

The four main types of drought, meteorological, agricultural, hydrological and socio-economic drought, are often represented in sense of drought indices. It is important to consider time scale

when accessing the different types of drought. For example, meteorological drought is a precipitation deficiency, possibly combined with increased potential evapotranspiration, extending over a large area and spanning an extensive period (Van Loon, 2015) while agricultural drought is a deficit of soil moisture (mostly in the root zone), reducing the supply of moisture to vegetation and oftentimes leading to crop failure (Van Loon, 2015). On the other hand, the hydrological drought is a lack of water in the hydrological system, manifesting itself in abnormally low stream flow in rivers and abnormally low levels in lakes, reservoirs, and groundwater (Van Loon, 2015) while socio-economic drought occurs when the demand for an economic good exceeds supply because of a weather-related shortfall in water supply (Wilhite and Glantz, 1985).

Since the issue of drought is new to Liberia and there is no recorded drought incidence in the past, this National Drought Plan is geared towards taking the first step in preparing for any event of future drought. As a tropical rainforest country, Liberia still holds a significant proportion of the Upper Guinean Forest of West Africa with abundant rainfall and excellent temperature. The country is however deficient in data availability that could be used for forecasting and monitoring drought events. The Ministries of Transport, and Mines and Energy have recently began making minimal efforts to generate hydrological and rainfall data to support forecasting and monitoring efforts.

As this plan is being developed in the absence of country-specific data to prepare for future drought events, the government of Liberia have deemed it prudent to adopt indices generally used for forecasting drought events within Sub-Saharan Africa with special emphasis on those used in environments like ours with abundant rainfall and moderate temperatures. The National Drought Plan will put in place processes, mechanisms and build the capacities of sector stakeholders to develop methodologies and collect country specific data that will drive the determination on the use of specific index to monitor and forecast drought event (**please reference Chapter 5.2: "Strategic Objectives and Performance Indicators"**). Such future exercise will result in the provision of quantitative information to decision makers about drought characteristics in Liberia. For the purpose of this plan, we have therefore temporarily

recommended the use of those indices generally used in Sub-Saharan Africa and that specifically apply to our ecoregion while developing our indices.

Palmer Drought Severity Index (PDSI)

The PDSI is a meteorological drought index which provides a standardized measurement of moisture conditions to compare between locations and over time (Palmer, 1965). This Index estimates duration and intensity of drought events by measuring departure of the moisture supply based on a supply-and-demand concept of the water balance equation. The PDSI also incorporates precipitation and temperature data, and local Available Water Content of the soil from an unspecified period that best corresponds to past 9-12 months. The PDSI is a soil moisture algorithm calibrated for relatively homogeneous regions and was the first comprehensive drought index developed in the United States. However, the Palmer values may not identify droughts as early as the other indices and is less well suited for mountainous land or areas of frequent climatic extremes.

Rainfall Deciles-Based Drought Index (RDDI)

The RDDI was originally suggested for investigating rainfall deficiency as per criteria set by the Australian Bureau of Meteorology (Gibbs and Maher (1967). Deciles are calculated from actual rainfall series (Jain *et al*., 2015). First, rainfall values of each calendar month (or sum of rainfall values for a group of months for multiple time step) are ranked from lowest to highest and a cumulative frequency distribution is constructed. The distribution is then split into 10 deciles (10% slices). The first decile that has the top rainfall values indicates wettest months in the series whilst the last decile indicates driest months in the series. The use of decile is advantageous due to simplicity in its computation.

Standardized Precipitation Index (SPI)

The SPI is considered the most popularly used drought index developed to identify and monitor drought events using monthly rainfall data. It is intended to identify drought periods as well as the severity of droughts at multiple time steps. It is calculated based on the long-term precipitation record for a desired period. The available long-term rainfall data is fitted to gamma probability distribution, which is then transformed to a normal distribution so that the mean SPI for the location and desired period is zero (Mckee *et al.*, 1993). This transformed probability is

the SPI value, which varies between +2.0 and −2.0, with extremes outside this range occurring at 5% of the time (Edwards and Mckee, 1997). However, the objective choice on the best time step may depend on the purpose of drought analysis. Due to its reliability, and ability to address drought at multiple time steps for a variety of climatic regions, SPI has been used extensively in various parts of the world.

Effective Drought Index (EDI)

The EDI was proposed by Byun and Wilhite (1999) to monitor the duration and severity of drought. They used a new concept of effective precipitation (EP) which is a function of current month's rainfall and weighted rainfall over a defined preceding period computed using a time dependent reduction function. Byun and Wilhite (1999) computed EDI as a function of the amount of precipitation required to return to normal (PRN). Originally, it was developed to monitor drought condition on daily time step (Lee *et al.,* 2012) but was subsequently extended for monthly drought monitoring (Deo and Byun, 2014). The EDI is based on the concept of effective precipitation (EP) that is calculated by a time dependent reduction function on daily/monthly precipitation and requires specifying at least 30-years data for calculation of mean effective precipitation (Jain *et al.*, 2015).

The government of Liberia also considers using the African Flood and Drought Monitoring (AFDM), which produces several common individual and composite drought indices for monitoring and forecasting drought in sub-Saharan Africa (Sheffield *et al.,* 2013). The AFDM uses numerous remotely sensed datasets and stream flow data to calculate high resolution spatially continuous indicators describing meteorological, agricultural, ecological and hydrological drought for use in real-time monitoring and seasonal forecasting.

3.2 Drought Monitoring and Forecasting

Drought monitoring and forecasting remains a challenge in Liberia due to limited technical and resource capacities to undertake such dedicated tasks. Successfully predicting drought events requires forecasting of both temperature and precipitation, knowledge of the current state of drought, and the ability to accurately model related changes in drought-relevant moisture stores such as soil moisture, groundwater, etc. (Crossman, 2018). Forecasting depends on the

availability of highly skilled expertise and judgement to combine temperature and precipitation seasonal outlooks, short-term weather outlooks and information on initial drought-related hydrological, water resources and soil moisture conditions (Crossman, 2018). In Liberia, the Department of Meteorology situated at the Ministry of Transport (MoT) is responsible for establishing and maintaining a weather observation network in Liberia while the Department of Hydrological Services of the Ministry of Mines and Energy (MME) is responsible for establishing and maintaining a hydrological observation network along Liberia's major river basins in order to collect meteorological data to inform hydrological planning. There are very low capacities within these departments which challenges the collection of accurate and standardized data as required.

The National Drought Plan of Liberia is intended to ensure that issues of drought are integrated or mainstreamed into national development plans as well as regional and cross-sectorial plans following the national planning processes. The Environmental Protection Agency as the Agency leading the Drought Initiative in Liberia, will work closely with the MoT and MME to undertake drought monitoring and forecasting activities in the country. These institutions will also rely on functioning satellite receiving stations located around Liberia to collect weather and other related data for analysis by the MoT and MME in collaboration with the EPA. The EPA is expected to design detailed drought mainstreaming and monitoring tools and guidelines in close coordination with these two government ministries for forecasting of future drought and other extreme weather-related events. These institutions will also work with other line ministries and agencies responsible for land and biodiversity in Liberia as well as multilateral/bilateral and development partners including the United Nations Development Program (UNDP) and the Food and Agriculture Organization of the United Nations (FAO). The EPA will develop institutional drought monitoring protocols and share with selected member institutions of the National Drought Initiative and Land Degradation Neutrality Technical Working Group to enable them conduct internal sector monitoring exercises during the implementation of this National Drought Plan. These institutions will conduct and prepare periodic drought monitoring reports which will be submitted to the EPA for collation and finalization into a periodic national drought monitoring report. The EPA will organize and provide technical back up and capacity building to those selected institutions on the drought monitoring process. Perimeters expected to be considered in

the drought forecasting and monitoring processes include: rainfall forecasts; seasonal duration of rainfall; rainfall distributions; weather and climate observation data; weather and climate projections; weather and climate change data and information on various socio-economic sectors; gender; etc.

3.3 Drought Impact Assessment

Liberia remains the hotspot for biodiversity in the region and hosts a significant proportion of the remaining Upper Guinean Tropical Rainforest of West Africa. As indicated earlier, Liberia is endowed with abundance of rainfall and has never experienced any incidence of drought event. However, evidences of changing climate on the socioeconomic livelihoods of people, especially rural poor farmers and fishermen, is alarming and demands immediate actions and planning to tackle the events of worse occurrences. Any occurrence of drought event has the propensity to directly impact key sectors including agriculture and food security, health and nutrition, forestry, etc. as well as the livelihoods of poor resources dependent communities. During periods of drought, impacts can be far-reaching and cut across economic sectors and the various levels of government. It is therefore important to assess the potential impacts of drought on these sectors since it is a new phenomenon with high potentials to occur in Liberia as a result of unsustainable land use practices couple with natural climate change events. The NDP considers drought impacts assessment as key to achieving its overall goal.

The assessment of drought impact is a government-led process with expected technical support from development and civil society partners as well as the involvement of would-be affected population. The assessment will evaluate the effects of drought, gather information on the physical damages to be caused and the overall impact the potential disaster will have on sustainable development of the country. The drought impact assessment will be driven by the EPA in close collaboration with selected member institutions of the National Drought Initiative and Land Degradation Neutrality Technical Working Group. Crossman (2018) proposes two approaches for assessing the magnitude and diversity of impacts that are likely to result from drought occurrence. The first approach calls for an organized technical team like the LDN and Drought Initiative Technical Working Group to be charged with the responsibility of determining impacts whilst the second approach proposes the establishment of a series of working groups

responsible for anticipating and identifying drought-related impacts in all economic sectors deemed to be important.

The drought impact assessment will be conducted nationwide covering key sectors expected to be affected in the events of a drought occurrence namely: the agriculture, forestry, health, environment, gender, transport and energy sectors. To ensure the conduct of a successful impact assessment, it is important that the capacities of those institutions to be involved in the exercise are built in the technical aspects of drought impact assessment. The technical team will also be expected to develop data collection methodology and tools as well as data analysis tools.

As previously indicated, the role of gender has traditionally been focused on the vulnerable women and children population in Liberia which is now shifting paradigm to include both men and women. There exist limited data on the role of gender in the implementation of development programs in Liberia. It is therefore prudent that this plan recommends the use of a systematic and standardized national process to collect, assess and share data, maps and trends on drought and vulnerability as well as for the effective monitoring and warning service that considers the abilities and needs of women and men. Such assessment will incorporate key concerns on women organizations involvement, women and men tradition knowledge in drought and other disaster forecasting, their perception on the characteristics of drought, their capacity to respond to incidence of drought, their level of involvement in decision making in their communities and their potential roles in the implementation of the Plan, etc.

4.0 DROUGHT RISK AND VULNERABILITY PROFILE

Climate change hazards is impacting Liberia and posing threats to both economic and social development. Risk is defined as vulnerability x hazards whilst Vulnerability (V) can be defined as Exposure (E) plus sensitivity (S) minus adaptive capacity (AC), thus: V=E+S-AC. The following narrative presents a synopsis of vulnerability to climate variability for selected key sectors over the last 10 years.

4.1 Agriculture

The agriculture sector of Liberia is labor intensive and characterized by low technologies and productivity with accompanying high food deficits. Agriculture-related imported products account for over half of total national imports since 2005 (EPA, 2018). Majority of the rural population of Liberia depend almost entirely on food crop production as an important source of livelihood. The system of production is rain-fed, indicating heavy dependence on rainfall. Increasing tendency of changes in rainfall pattern, and temperature have significantly impacted the sector. In the absence of regular supply of water, all metabolic processes are stopped apparently causing extensive damage and loss to the farmers and food insecurity in the nation. Moreover, drought can destroy flowers and flowering processes. In addition, climate change induced hazards, such as animal diseases and disease vectors could affect the productivity of the livestock sub-sector.

Hazard: Changing rainfall patterns.

Exposure: Loss of crops and livestock; low crops yields

Vulnerability: Increase in poverty incidence due to failure in crop productivity and livestock diseases.

4.2 Forestry

The natural forests cover about 4.3 million hectares or 45 percent of the land area, and the artificial forests cover about 11,000 hectares. The forest areas have continued to decline mainly due to unstainable agriculture and inappropriate commercial logging. According to EPA (2016), additional pressure is being created by climate change (unreliability of rainfall, over-flooding of settlement and farmlands and disparity in weather pattern) resulting in the need for massive clearing of forest for agricultural production and settlement. A changing climate influences the structure and function of forest ecosystems and plays an essential role in forest health. In fact, increased temperature as a result of climate change has started to expand the ranges and to enhance the survival rates of forest pests such as the case of the armyworm caterpillars' outbreak which occurred in rural Liberia in 2009.

Hazard: Changing rainfall patterns and increased temperatures

Exposure: Forest ecosystem diminished or destroyed due to expanding agriculture occasioned by decline in farming, and extreme temperature.

Vulnerability: Economic activities hampered as national foreign exchange earning relies substantially on export of forest products.

4.3 Fisheries

Although there have been no recent stock assessment conducted in Liberia, fisheries continue to provide a significant proportion of the animal protein needs of the country. Climate change variability can adversely impact aquatic bodies and subsequent destruction of water organisms, thereby seriously threatening fishery production. It has been estimated from several studies that the combined effect of changing temperature and rainfall patterns has markedly affected fish stock in terms of declining levels of certain species. It has been predicted that climate induced changes in the biophysical characteristics of Liberia, along with extreme events, will have significant effects on the ecosystems which support especially inland fish production (EPA, 2018).

Hazard: Changing temperature and rainfall patterns.

Exposure: Decline in fish stock, and disappearance of some species of high economic significance.

Vulnerability: Household protein may decline, and livelihood of fishing community destroyed in near term.

4.4 Health

Considering the poor state of the country's health care delivery system, and low health standards, increasing temperature is likely to exacerbate disease incidence to the extent to overwhelm the system. Climate-sensitive diseases could also be on the rise. Moreover, the impact of rise in average temperature and heat stress can cause serious skin irritation and rash. This can impair human health and productivity.

Hazard: Increasing temperature.

Exposure: Increase in climate-sensitive diseases posing danger to already impoverished populations.

Vulnerability: Health infrastructure is severely fragile to cope with such challenges.

4.5 Gender

The impact of gender disparity is glaringly visible in Sub- Saharan Africa and across all sectors of government and the private sector. While women and children are recognized to be striving for equality and integration, their men counterparts are equally facing various levels of inequality and marginalization in the society. Men and women in Liberia are traditionally involved in the labor-intensive agricultural practices, although at varying levels, without any forms of protection against diseases, extreme weather and other climatic conditions. An incidence of drought will have far reaching consequences on their health, livelihoods and survivability. Gender considerations at all levels and spheres of the society is therefore important to reducing existing disparity and bridge the gaps to ensure equality for all.

Hazard: Changing temperature and precipitation and sea level rise.

Exposure: Men, women and youths may be impacted at varying scales

Vulnerability: In the absence of proper gender mainstreaming in disaster management, the situation may persist.

The NDP commends the adoption of the "gender-responsive risk assessment", based on a gender-based vulnerability analysis, considering the practices of gender inequality in political, social, cultural and economic areas as well as the different roles that men and women play at national and local levels. This risks assessment that will be achieved through the consideration of gender during the planning and implementation of the drought risks and vulnerability assessments and will enable the identification of the nature, location, intensity, and probability of drought, determining the existence and degree of vulnerabilities and exposure to risks; whilst also identifying the capacities and resources available to address or manage droughts, and determining acceptable levels of risk.

5.0 STRATEGY FOR DROUGHT MANAGEMENT

5.1 Overall Vision

The National Drought Plan of Liberia is developed in adherence to the SDGs and consistent with the National Environmental Policy of Liberia which ultimate aim is to ensure the improvement of the physical environment, the quality of life of the people and of their economic and social living conditions. The overarching vision of the NDP is the establishment of a comprehensive

plan where systems are put in place to regularly assess and monitor the adverse impact of drought and the effects of actions being employed to mitigate same, ensure effective communication with all stakeholders and populations about drought in order to deal with whatever signs that may appear, and maintain a drought recovery program.

5.2 Strategic Objectives and Performance Indicators

Strategic Objective 1: Identify the capacity needs of national institutions for early warning and drought monitoring.

Indicator 1.1: The capacity needs for 60% of national institutions for drought monitoring identified, and their capacities assessed by 2020;

Indicator 1.2: The human capacity of staff within the assessed institutions raised to optimal level by 2021;

Indicator 1.3: Meteorological facilities for measuring temperature, humidity, soil moisture, etc. secured and installed by 2023;

Strategic Objective 2: Identification of national and regional hubs for the setting up of National Meteorological Stations.

Indicator 1.1: Five (5) National and regional meteorological stations set up by 2023;

Indicator 1.2: Meteorological databases established within the five meteorological stations by 2025.

Strategic Objective 3: Establish processes and methodologies for the collection of data on drought.

Indicator 3.1: Manuals for the approaches and methods of data collection on drought developed by 2020.

Indicator 3.2: Nation-wide meteorological data collection commenced by 2024;

Indicator 3.3: Improved quality data on drought available and disseminated to relevant end users, experts and decision makers by 2026.

Strategic Objective 4: Identify vulnerable landscapes, population, sectors and build their resilience to drought

Indicator 4.1: Areas susceptible and vulnerable to drought nationwide identified, and mapped out by 2026.

Indicator 4.2: Develop and implement drought response programs in priority five locations by 2027;

Indicator 4.3: The agricultural, forestry, fisheries, mining, and health sectors strengthened to ameliorate the adverse impact of drought by 2027.

Strategic Objective 5: Develop and operationalize drought recovery programs.

Indicator 5.1: Two (2) national water reservoir constructed by 2027;

Indicator 5.2: Promulgate legislations and enforce mandatory water use restrictions by 2027;

Indicator 5.3: National capacity for aid, contingency and other assistant packages developed by 2026.

Strategic Objective 6: Build knowledge management network to ensure that food production practices and systems are climate proof.

Indicator 6.1: Extension packages for knowledge sharing in climate proof agriculture production systems developed and implemented by 2025;

Indicator 6.2: Capacity in sustainable agriculture enhanced in 150 farming communities by 2025;

Indicator 6.3: Farmers in 150 communities introduced to and trained in drought coping measures by 2025.

Indicator 6.4: Priority sector agencies commence technical assistance to farmers by 2024.

Strategic Objective 7: Design public education and awareness strategy and communicate with all populations about drought.

Indicator 7.1: Drought risk communication strategy developed and implemented by 2020;

Indicator 7.2: People's perception about drought are improved and appreciable by 2022;

Indicator 7.3: Understanding of the people on how to respond to drought is enhanced by 2023;

Indicator 7.4: Cooperation and adjustments in living patterns improved by 2026.

Strategic Objective 8: Mobilization of resources financial and human for the implementation of the drought plan.

Indicator 8.1: Diverse sources of funding for the implementation of the drought plan identified by 2019;

Indicator 8.2: Increased in national budgetary allocation for drought management by 2020;

Indicator 8.3: Increased public-private-community partnerships for the financing of the drought Plan by 2020.

5.3 Priority Interventions

Based on findings from the analyses of Liberia national drought circumstances, the NDP envisions prioritizing the following key areas of intervention which substantial efforts are required in order to achieve the goals and objectives as outlined in the national plan.

5.3.1 Early Warning

Early warning is a practical and cost-effective tool for implementing timely and appropriate responses to drought. In the case of Liberia, it will focus on strengthening specific national institutions to enable them to generate, record, store and share weather related information and data that will improve planning of various interventions in a timely and effective manner. It will not only explore ways of information sharing, but also ensure the improved and sustained collection of extreme weather-related data. This will allow for appropriate actions to be taken to avoid or reduce their risk and prepare for effective response. Early warning involves forecasts based on climate projections and the area's drought history, possible outcomes of developing drought events, and deducing the duration of the drought, its severity and impact. The early warning systems will also involve both technology and all interested parties in drought planning and response. The effectiveness of mitigation and emergency response actions will depend on the accuracy, timely assessments, recording and dissemination of weather data.

5.3.2 Preparedness and Mitigation (*Please see 5.2: "Strategic Objectives and Performance Indicators" above for specific short- and long-term actions to mitigate potential risks in Liberia*).

A National Drought Task Force will be established comprising key stakeholders as specified in the stakeholder's involvement plan to coordinate and supervise the implementation of the drought plan at all levels of government. This Team will be tasked with the activation of the various elements of the plan during times of need and will specifically undertake the following task in short- and long term: (a) carry out regular monitoring, and conduct public information, education and awareness, (b) analyze trends and catalogue persisting conditions, (c) make the case for risk assessment, (d) recommend mandatory restrictions, and (e) enforce actions and implement mitigation and response programs. The Task force will work in close coordination with the EPA, MME and MOT which are the key institutions expected to feed them with empirical quantitative data for decision making.

5.3.3 Response

Drought response actions are designed to solve short term water supply deficits when drought occurs and meant to solve an emergency supply shortfall; thus, does not always need to be justified by avoided costs. It is important to prepare drought response plan before a drought occurs. This allows time for the plan to receive public review and comment while not in a crisis mode. A Drought Contingency Plan shall be developed as a short-term response before drought sets in, and such plan shall take into consideration areas that are inaccessible. Water supply and savings effects are directly related to: a) the public's belief that the emergency is real; b) the public clearly understanding the actions required to reduce water use; and c) the active enforcement of mandatory water use restrictions.

Priority actions to be considered include (a) periodic review of the preparedness and contingency plans focusing on the most vulnerable areas, populations and sectors, (b) strengthening institutional capacities at both local and national levels preparedness, (c) information dissemination and sharing and coordination among different elements of the plan and agencies (d) robust disaster preparedness exercises, including evacuation drills and the (e) establishment of emergency funding modalities.

5.3.4 Communication

It is straightforward to construct a message about drought risk; but ensuring that your message is understood by your audience and that its implications are accepted is most difficult. Communicating more effectively with members of the public and engaging the public around drought risk is important. There are several elements that ensure effective communication: (a) people's perception is partly shaped by timing; (b) communicating using a trusted messenger is advantageous; (c) scientific facts alone are not sufficient to engage people with drought risk – it is important to provide a compelling narrative, grounded in peoples' values; (d) connecting drought risk to health impacts can make it more personally relevant ; and (e) avoiding doom and gloom and focusing on opportunities and benefits for taking actions.

When communicating with the general public during drought awareness, it is important to consider the following key issues: (a) how drought relieve is expected to be affected; (b) what cooperation and adjustments in living patterns may be expected from communities; (c) enhancement of people understanding on how to respond to drought once it occurs; (d) what the cost will be; and (e) what funding modalities are available and accessible.

5.4 Institutional Arrangements

While it is true that there exists no recorded incidence of drought in Liberia, its potential impacts associated with climate change events are indicative of the level of threats to the socioeconomic, ecological, environmental and health systems of Liberia should any incidence of drought ever occur. An important step towards preparedness to tackle the impact of drought in Liberia involves having a functioning institutional structure to coordinate drought mitigation initiatives across related sectors at the national and sub-national levels.

As a new phenomenon not yet experienced in Liberia, current governance structure and institutional arrangements are inadequate to tackle any incidence of future drought events. It is therefore important to have an efficient and effective institutional arrangement that will seek to establish the political basis through which vulnerabilities associated with drought related risks

are addressed. This institutional arrangement seeks to support effective response to drought by creating a governance structure that will seek to undertake the following tasks:

i. Oversee the effective implementation of drought initiatives by providing leadership, coordination and political support;
ii. Identify requisite institutional policies, structures and processes currently in place to address drought associated issues and harmonize as appropriate;
iii. Create an information and knowledge base to identify, develop and implement effective responses to emerging drought related issues;
iv. Ensure that gender considerations are integrated and mainstreamed into the development of any response to drought;
v. Mainstream disaster management and climate change adaptation into long-term development planning; and
vi. Establish a process to effectively disseminate information on drought related activities.

The National Drought Initiative and Land Degradation Neutrality (LDN) Technical Working Group

The National Drought Initiative and Land Degradation Neutrality Technical Working Group is a multi-disciplinary technical group chaired by the Environmental Protection Agency (EPA) of Liberia and co-chaired by the Liberia Institute for Statistics and Geo-Information Studies (LISGIS). The Secretariat of this Technical Working Group shall be housed at the EPA and coordinated through a collaborative effort between the UNCCD and the UNFCCC National Focal Persons.

The Environmental Protection Agency (EPA) is the principal authority over all environmental programs and activities in the country. The agency recognizes the role of sectoral environmental units such as water, agriculture, maritime, energy and forestry. These units are to work in conjunction with the respective line ministries and autonomous agencies that are involved with the environment.

The Forestry Development Authority (FDA) is responsible to sustainably manage the forest and its related resources. It provides long and middle-range planning in the forestry sector as well as

preparing forestry policy, law and administration; supervises adherence to forest legislation and concession agreements; calculates and determines forestry fees; evaluates investment proposals; executes reforestation and forest research and training; monitors activities of timber companies and executes protected area programs and administers wildlife and national parks.

The Ministry of Mines and Energy has the statutory responsibility for the development of mineral, water and energy resources of the country and their administration; oversees land surveys in all parts of the country; coordinates the activities of miners of gold and diamonds, including granting of operation licenses; regulates beach sand mining.

The Liberia Land Authority is required to propose, advocate and coordinate reforms of land policy, laws and programs in Liberia with the ultimate aim of ensuring equitable and productive access to the nation's land, both public and private, security of tenure in land and the rule of law with respect to landholding and dealings in land, and effective land administration and management. The Authority's mandate covers all land and land based natural resources, including both urban and rural land, private and public land, and land devoted to residential, agricultural, industrial, commercial, forestry, conservation and any other purpose.

The Ministry of Agriculture is the central policy–making body of government for the agricultural sector and is responsible for promoting agricultural development and regulating the sector. It proposes to achieve its development objectives by focusing on applied research and extension services.

The Ministry of Internal Affairs is responsible to administer the affairs of all Government functionaries within local and urban areas of Liberia. The Ministry oversees the activities of local Government bodies such as chiefdoms and clans; supervises all County Superintendents; guided by the revised interior regulations of Liberia which give the Ministry custodianship over all private and public properties within territorial confines of the country.

The Central Agricultural Research Institute (CARI) is the only research organization in the country that has been carrying out applied and adaptive research covering food and tree crops,

livestock, aquaculture and related areas. CARI is striving to transfer new and improved technologies to farmers. Support from the central government to strengthen its capacity is limited, making it heavily dependent on external sources.

The Ministry of Public Works is the government agency with responsibilities to provide basic social and physical services such as feeder roads, improved sanitation and piped water as a means to improve livelihood of rural peoples. Before the war, this agency was actively involved in providing services to the rural areas with the support of donors.

5.5 Stakeholders Involvement Plan

A National Drought Management Initiative involves multiple stakeholders. It is therefore important to identify such stakeholders and clarify the specific roles each is expected to play, and the nature of collaboration and coordination required both in the development and implementation of the National Drought Plan. Below are the principal stakeholders groups which will be involved with the National Drought Plan.

1. Environment Coordination Unit (ECU)

The establishment of the ECU is provided for by the EPA Act of 2003. It is expected to be spearheaded by the Environmental Protection Agency where the environment units of each government ministry and agency collaborate.

2. Agricultural Coordination Committee (ACC)

The ACC is consistent with the Food and Agriculture Policy and Strategy (FAPS) of 2008. It comprises of government ministries and agencies, community-based organizations, local and international non-governmental organizations, agricultural cooperatives, research and training institutions, and donor partners.

3. National Coordinating Committee to Combat Desertification

As the implementation of the UNCCD became a high national priority, the NCCCD was established in October 2008 with the aim of coordinating national actions in meeting Liberia's obligations.

4. Society for the Conservation of Nature of Liberia (SCNL)

The Society for the Conservation of Nature of Liberia is Liberia's premium conservation organization that was established in 1986 with the mission of promoting nature conservation, supporting the establishment of a protected area network, encouraging good governance of natural resource management and increasing public participation in biodiversity conservation. The SCNL has over the years being involved in the sustainable management of Liberia's forests and associated biodiversity for the benefits of forest communities adjacent protected areas. The organization is also involved in the conduct of research on natural heritage, wildlife, forest and other key features and publishes reports for public consumption.

5. Liberian Universities

Several Universities in Liberia are expected to get involved with the implementation of the National Drought Plan. They include: University of Liberia, Cuttington University; William V.S. Tubman University; African Methodist Episcopal University; United Methodist University, and the Stella Maris Polytechnic. These institutions conduct undergraduate training in general agriculture, agronomy, forestry, wood science, home science and agriculture extension education, environmental science; agriculture engineering and food science.

6.0 SOURCES OF FINANCING

6.1 Internal

Sector Financing

In terms of sector financing, there are currently two (2) agencies of government; the Environmental Protection Agency and the National Disaster Management Agency through which direct sector financing could be channeled towards the implementation of the National Drought Plan. Additionally, the line ministries/agencies responsible for specific disaster shall make allocation every fiscal year during the national budgeting process. Several other sectoral ministries and agencies that have work plans supported by budgets should have an allocation devoted to the management of the environment operated through their Environmental Units. They also have the potential to raise their own funds from the public and private sector for the services that they perform and regulate and can support national drought management efforts.

There are three (3) separate funding schemes that could be used to contribute to the implementation of the National Drought Plan: (a) the National Environment Trust Fund; (b) the National Disaster Management Fund and; (c) Agency Fees.

Agency Fees are fees and fines charged by environmental regulatory agencies for the review of commercial projects, and fines for non-compliance and offences to deter private companies and others benefitting from Liberia's resources, to respect the natural resources and environmental laws of the country. It is a critical source of needed revenue to provide adequate funding for the implementation of the National Drought Plan.

NGOs funding

Several Non-Governmental Organizations have already shown interest in Liberia. It is expected that they will continue to source funds for the protection of the Liberian environment. Prominent among them are (a) Birdlife International working with the Society for the Conservation of Nature in Liberia since 1986 (b) International Union for the Conservation of Nature and Natural Resources(IUCN) - currently funding a number of projects and studies (c) Conservation International (CI) - worked in Liberia in the early years of post-conflict Liberia, and now actively engaged in conservation efforts (d) Flora and Fauna International (FFI) – currently working in protected areas, and particularly the Sapo National Park

Other - in - Country Financing

Internal private sector participants including local entrepreneurs, mineral mining industry, agro-industrial producers including small holders, agribusiness, etc. have the potential to finance some activities in the National Drought Plan. Training and research institutions in the country do access finance for research and capacity building, hence they could attract funds for research in drought.

6.2 External

A number of donors are known to have shown interest in the environment and natural resources management worldwide. Some of these donors are already involved with projects or programs in Liberia. Key among them are the World Bank; European Union; Forest Carbon Partnership Facility (FCPF); African Development Bank; the German Development Bank (KFW); Global Environment Facility; Global Mechanism; United States Agency for International Development; the United Nations Environment Program; United Nations Development Program; and Deutsche Gesellschaft für Internationale Zusammenarbeit or (GIZ).

7.0 RECOMMENDATIONS

Considering the overview of drought in Liberia as earlier described in this plan; and consistent with the draft outline for the preparation of the drought plan as presented by the UNCCD coupled with an elaboration of drought vulnerability profile, and other country specific circumstances, the following recommendations are proffered:

1. Commence the construction of minimum drought mitigation and preparedness infrastructures such as the development of alternative water sources in rural and urban areas; and water storage facilities;
2. Identify regional sites and/or institutions for monitoring water resources and assessing water deficit impacts on agriculture, fisheries, forestry and health;
3. Initiate national water quality monitoring including those of catchment areas, lakes, streams and rivers (whether perennial or seasonal), and aquifers;
4. Establish and activate all structures that are expected to lead the implementation of the National Drought Plan;
5. Commence public education, awareness, and outreach on drought and its implications on human health and survivability; and
6. Ensure the inclusion of women and men, particularly of marginalized socio-economic groups, in decision making processes and in action implementation.
7. Undertake pre and post drought and gender impact assessments to identify potential threats to the vulnerable rural population and enable an analysis of impacts for different classes of population, social and age groups, etc. in order to guide the development of national response protocols.

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