REPUBLIC OF LIBERIA

National Policy and Response Strategy on Climate Change

August 2018

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Acronyms

AF	Adaptation Fund
AFDB	African Development Bank
AFT	Agenda for Transformation
APF	Adaptation Policy Framework
BNF	Bureau of National Fisheries
CARI	Central Agricultural Research Institute
CBO	Community Based Organization
CC	Climate Change
CCAAP	Climate Change Agriculture Adaptation Project
CDM	Clean Development Mechanism
CIF	Climate Investment Funds
ECOWAS	Economic Community of West African States
EEZ	Exclusive Economic Zones
EPA	Environmental Protection Agency
ESP	Education Sector Plan
EU	European Union
EVD	Ebola Virus Disease
FCPF	Forest Carbon Partnership Facility
FDA	Forest Development Authority
GCF	Green Climate Fund
GDP	Gross Domestic Product
GEF	Global Environment Facility
GHG	Greenhouse Gas
GoL	Government of Liberia
IBRD	International Bank for Reconstruction and Development
IDA	International Development Association
IFC	International Finance Corporation
INDC	Intended Nationally Determined Contributions
IPCC	Intergovernmental Panel on Climate Change
LASIP	Liberia Agriculture Sector Investment Program
LDCF	Least Developed Countries Fund
LDCs	Least Developed Countries
LEC	Liberia Electric Corporation
LEDS	Low Emissions Development Strategies
LHS	Liberia Hydrological Services
LISGIS.	Liberia Institute for Statistics & Geo-Information Services
LLA	Liberia Land Authority
LNP	Liberia National Police
LRA	Liberia Revenue Authority
LSA	Living shorelines Approach
LWSC	Liberia Water & Sewer Corporation
MDG	Millennium Development Goal
MEAs	Multilateral Environmental Agreements

MoA	Ministry of Agriculture
MoCI	Ministry of Commerce & Industry
MoD	Ministry of Defense
MoE	Ministry of Education
MoFA	Ministry of Foreign Affairs
MoFDP	Ministry of Finance & Development Planning
MoGCSP	Ministry of Gender, Children and Social Protection
MoH	Ministry of Health
MoIA	Ministry of Internal Affairs
MICAT	Ministry of Information Culture Affairs & Tourism
MoJ	Ministry of Justice
MoLME	Ministry of Land, Mines and Energy
MoT	Ministry of Transport
MoPW	Ministry of Public Works
MoYS	Ministry of Youth and Sports.
MRV	Monitoring, Reporting and Verification Systems
NAMA	Nationally Appropriate Mitigation Action
NAP	National Adaptation Plan
NAPA	National Adaptation Plan of Action
NBSAP	National Biodiversity Strategic Action Plan
NCCS	National Climate Change Secretariat
NDMA	National Disaster Management Agency
NEPAD	New Partnership for African Development
NHA	National Housing Authority
NIC	National Investment Commission
NPA	National Port Authority
NRDP	National Reconstruction and Development Plan
NTA	National Transport Authority
PES	Payment for Ecosystem Services
PPP	Public Private Partnership
REDD	Reduction of Emission from Deforestation and Land Degradation
RREA	Rural Renewable Energy Agency
SCCF	Special Climate Chang Fund
SDGs	Sustainable Development Goals
UL	University of Liberia
UNCBD	United Nations Convention on Bio-diversity
UNCCD	United Nations Convention on Combating Desertification
UNDP	United Nations Development Program
UNECA	United Nations Economic Commission for Africa
UNEP	United Nations Environment Program
UNFCCC	United Nations Framework Convention on Climate Change
USDA	United States Department of Agriculture
3Cs	Corporatization, Commercialization, and Certification.

Forward

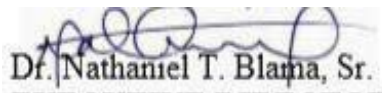
The impacts of climate change are even more evident and pervasive with increased occurrences of flooding across the country, changes in climatic conditions, as well as low agricultural yields in Liberia and other parts of the world. Undeniably, climate change is a major environmental threat facing the social and economic development of Less Developed Countries like ours being more vulnerable to the impacts due to their low capacity to adapt to the impact of Climate Change. Climate change has been recognized globally as having far reaching sociological, economical, political, and environmental consequences particularly amongst vulnerable communities and people, Liberia being of no exception. The impacts of Climate Change in Liberia does not only undermine development gains but also poses serious risk to food security and adaptive capacity and therefore needs urgent and concerted national efforts are not taken. The National Climate Change Policy and Response Strategy is a framework which will establish specific provisions for dealing with climate change issues, understanding the extent of the threat and putting in place specific actions to mitigate potential impacts.

The impacts of climate change in Liberia require the widest cooperation and participation in an effective and appropriate national response comprising mitigation and adaptation measures that are efficient, concrete and targeted. Cognizant of the impacts of climate change and the dire need for adequate national response, the Government of Liberia through the Environmental Protection Agency of Liberia (EPA) has developed a National Climate Change Policy and Response Strategy to guide national response measures in addressing menace. The strategy further provides guidance on integrating climate change issues into national development planning processes at national, county, district and local levels for effective coordination. The Government's commitment to develop a climate-resilient economy has also been demonstrated by many strategic short and medium term actions including implementation of key activities under our National Adaption Action Plan (NAPA), the establishment of the National Climate Change Secretariat, development of the Green Climate Fund (GCF) funded Monrovia Metropolitan Climate Resilient Project, etc.

Liberia's vulnerability to the adverse effects of climate change makes adaptation a national priority issue, demanding policy direction at the highest level, with full commitment attached. The country's mitigation potential due to the presence of the largest portion of the Upper Guinea Forest, must be harnessed to ensure that it participates in the global efforts for continuous reduction in emissions. Therefore, the National Climate Change Policy and Response Strategy articulates the government visions and aspirations for establishing a framework through which concrete actions are directed towards addressing climate change issues across the country. It also sets a bold mandate and strategy for the government engagement with local and international stakeholders and partners.

Considering the huge challenge that Climate Change poses to national growth and human development, it is my ardent hope that the policy and response strategy will lead to the building of a firm foundation for mainstreaming climate change actions into all key socio-economic programs in order to bring about an integrated response across all sectors.

It is my sincere hope that this policy will drive the opening of funding windows that would address issues related to climate Change and the environment. Finally, I am optimistic that national decision and policy makers will take more pragmatic approaches to climate change interventions and issues related to the environment.



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Executive Summary

1. Description of Country Profile

Liberia is located on the West Coast of Africa. It is bordered by Sierra Leone on the west, Guinea on the north, Côte d'Ivoire on the east, and the Atlantic Ocean on the south. It lies between the longitudes of $7^0$30` and $11^0$30` west and latitudes of 4^0 18` and $8^0$ 30` north. Liberia was founded in 1822 by Liberian people transported to Africa from America and got its independence on July 26, 1847 as a unitary constitutional republic and representative democracy. The executive branch of Liberia is divided into 15 functional sub-national administrative governance institutions called 'counties' and headed by superintendents who are appointed by the president. Other levels of local administration are the chiefdoms, headed by paramount and clan chiefs.

The new government, established in 2005 after 14 years of civil war, has incontrovertibly work towards maintaining the peace, accelerating economic development and provision of social services, promoting the rule of law and integrity of the justice system, supporting freedom of expression and rights to assembly, and striving to create an enabling environment for citizens' participation in the governance process of the country. The Agenda for Transformation (AfT), which articulates the country's vision for achieving middle income status by 2030 through inclusive and sustained economic development, was also adopted as a framework for meeting the country's expectation. It also considers climate change as a strategic objective. Although the economy was projected to maintain the GDP growth rate of 8.3% for two decades considering 2012 as the base year (Republic of Liberia, 2012), assessments show that GDP growth for 2014 declined from 2.5% to 0.7% due to Ebola Virus Disease (EVD) (Republic of Liberia, 2015[a]).

Topographically Liberia is diverse, ranging from features of coastal plains, lagoons and mangrove marshlands, to rain forests and plateaus rolling towards the interior. The Northern Highlands mark the highest elevation, which includes Mount Wutivi (1350 meter). Six major rivers traverse the northern and southern boundaries of the country, of which the Cavalla River is the longest (515 km). Two major lakes are found in the country also. Liberia has a tropical climate with heavy rainfall from May to October and a short interlude in mid-July to August. The dry season extends from November to April.

Liberia is endowed with several explored and unexplored natural resources. Currently, however, the main economic sectors of Liberia's economy are mining, agriculture, and forestry, while the main natural resources are iron ore, rubber, timber, diamonds, and gold. The rain forest occupies roughly 45% of Liberia's land and is the source of its timber resources. Liberia is home to many rare and endemic species and is listed as one of 34 global biodiversity hotspots. The forest resources are severely pressurized by logging, road building, agriculture, and human settlement. Scant studies show that there are 167 species of freshwater fish and 464 saltwater fish known for Liberia, three of which are endemic to Liberia. 54 of Liberia's fish species are listed in the Red List of IUCN, 14 as critically endangered, 18 as endangered and 22 as vulnerable.

Liberia's population was put at 3.5 million in 2008 (LISGIS, 2008) and it is projected to increase to 10.3 million by 2058 (World Bank, 2016), with more than 70% of the population living in coastal cities including Monrovia, the country's capital. The population grew at an average rate of 3.3% annually between 1962 and 1974 and 3.4% during 1974 and 1984, which was very high. Between 1984 and 2008, average growth was 2.1% (LISGIS, 2008), reflecting the population exodus and losses during the civil war. In 2014 the economy was hit by the outbreak of EVD. In 2015

agriculture constituted around 46 percent of the labor force with about 70 percent of rural households involved in the sector and contributing 23.9% to the real GDP.

Fifty per cent of the total 3.5 million population of Liberia is youth. Out of this number 33.2% have no education, 31.1% have attended primary education while 35.75% have attended secondary and tertiary education. To improve this condition Liberia launched an ambitious Education Sector Plan (ESP) covering the period 2010-2020 (LISGIS, 2008).

2. Climate Change Challenges on Development

In Liberia, because of low level of adaptive capacity in different sectors, emanated from low level of human and institutional capacity, technology, infrastructure, economy, etc., the impact exerted by climate change is severe. The impacted sectors identified as priority sectors through stakeholders' consultation and document review are:

- Economic sectors: Forestry and Wildlife, Agriculture, Coastal Area, Water, Fishery, Energy, Mining, Industry, Transport and Tourism;
- Infrastructure;
- Urbanization; and
- Social sector: Health and Settlement

These sectors, therefore, have been impacted by climate change seriously over the past few decades given that the physical, the human, the financial and the natural capitals are low to build resilience to the chocks. For instance, in forest dependent communities, climate change induced extreme events are limiting the ability of communities to meet their basic requirements for food due to a reduction in the amount of productive land and pest infestation of crops, lack of access to clean water, medicinal products, and fuel wood among other things, which they get from the forest. The disruption to the agricultural system resulting from climate change induced changes in patterns of rainfall. The temperature has direct consequences for the country, where more than 70% (Republic of Liberia 2010) of the population engage in agriculture as their main livelihood activity, with rice (which is the nation's staple) covering a majority of the area under production (rubber and cassava coming in at second and third place respectively). Intense precipitation could affect the water infrastructure, which could also lead to an increase in the amount of runoff into rivers and lakes, washing sediment, nutrients, pollutants, trash, animal waste, and other materials into water supplies.

Sea-level rise, induced flooding in Liberia is also an obvious and immediate threat to economic growth by affecting energy supply, disrupting roads and transport infrastructure as well as settlement as, the case was in 2007 and 2009 (USDA, 2013). It also affects food and agricultural activities, education, health, water and sanitation and social protection. For example, it is projected that about 95 km^2 of land in the coastal zone of Liberia will be inundated as a result of one-meter sea level rise, with about 50% (48 km^2) of the total land loss due to inundation been the sheltered coast, with Inundation followed by shoreline retreat (Wiles, 2005). Although detail study has not been done on inland, coastal and marine aquatic resources, scanty studies made revels that this situation in turn have had effect on the inland, coastal and marine fishing in terms of quantity and quality as well as by affecting the endangered aquatic species (Giorgio and Mohammed, 2006); EPA, 2006). Similarly, the adverse effect of climate change has been exerting pressure on energy accessibility and efficiency, industrial activity, transport infrastructure, wildlife, tourism, health and settlement and, urbanization.

3. Rationale for Climate Change Policy and Strategy

Liberia faces challenge with the impact of climate change coupled with many socio-economic problems like poverty, poor infrastructure, lack of information technology and access to finance, and weak institutions and resource competition, among others challenges. Several anthropogenic impacts have also worsened the climate change impact at the local level. For instance, 45 % of the total land area of Liberia is classified as dense forest. Shifting cultivation which uses slash and burn, increase mechanized cultivation which uses chainsaw, indiscriminate clearing of forest for industrial and artisanal mining, increasing exploitation of mangrove forest, small-scale plantation development and small-scale alluvial mining, which are occurring at the expense of natural forest (USDA, 2013), etc. Unless they are managed soon, poverty will be aggravate, which will cause serious current and inter-generational impact related to climate change. Other climate change impacts explained in Section 2 above will become worsened for generations to come, unless we take informed decisions and actions supported by policy and strategy interventions.

In order to tackle the impact of climate change, which will effect a worsening situation on the development endeavor of the country, it has become vital that a climate change policy and response strategies, which address key sectorial and cross-sectorial issues, be put in place.

4. Methodology

The preparation of Liberian Climate Change Policy and Strategy is based on national demand emanated from the climate-exerted pressure on social, economic and environmental assets. Consultations with key governmental and non-government organizations, community representatives and development partners were conducted. The consultation process, among other things, has revealed that its preparation and implementation of the climate change policy and response strategy are timely and urgent.

Guided by methodological tools prepared (work plan, bench marking templates, policy and strategy review matrixes), 9 countries' climate change policy and strategy documents were reviewed as a benchmarking and lessons, and best practices were taken. In addition, to ensure alignment and integrity with the National Policies and Strategies, 27 different sectorial and cross-sectorial Liberian national policy and strategy documents (including the countries NDC vision 2030 and Agenda 2063) were reviewed; and the outcome of the review process was used in the Policy and strategy formulation. The draft document produced was then reviewed by review groups and finally by national validation workshops, conducted to validate the draft. The outcome of this validation is incorporated in this final Liberian Climate Change Policy and Response Strategy produced.

5. Key Elements of the Policy and Strategy on Adaptation and Mitigation

a) Adaptation Policy Statements and Strategies

Adaptation Policy Framework recognizes that there are four major principles that provide a basis from which integrated actions to adapt to climate change can be developed. These are:

- Adaptation to short-term climate variability and extreme events to serve as a starting point for reducing vulnerability to longer-term climate change;
- Adaptation at different levels in society, including the local level;
- Adaptation policy and measures assessed in a development context; and
- The adaptation strategy and the stakeholder process by which it is implemented given equal importance.

Based on this framework and elements of adaptation strategy (see Figure 3 in section 6), key sectors were identified and their corresponding adaptation policy and strategies formulated.

The Policy and Response Strategy has recognized forestry and wildlife, agriculture, coastal areas, water resources, fishery, energy, mining, industry, transport, tourism, Infrastructure, urbanization and settlement, and health as priority sectors for adaptation. The policy statements for adaptation to climate change are hereunder in the summary, while their corresponding strategy elements can be referred in section 8.1 in the main body of the policy and strategy document.

I. **Forestry and Wildlife Policy Statement:** Using the '3Cs[1] approach' as the basis for sustainable forest management, ensures that forests and wildlife be considered when planning adaptation policies and practices in areas of the economy beyond forestry and wildlife, and define and implement measures for reducing the negative impact of climate change on the forest and wildlife.
II. **Agriculture Policy Statement:** Reduce the vulnerability of agricultural systems to risks related to climate change through direct and indirect support to farmers, including the setting up of a robust monitoring system to detect early changes that will affect agriculture production.
III. **Coastal Areas Policy Statement:** Ensure the protection of Liberia's 350 miles coastline.
IV. **Water Resources Policy Statement:** Ensure the continuous availability of critical water resources that are important for domestic, agricultural, energy, and recreational purposes.

V. **Fishery Policy statement:** Recognizing the importance of fishery as a major contributor to food supply, food security and livelihoods, adopt policies that maintain and protect the integrity of Liberia's fishery sector.
VI. **Energy Policy Statement**: moving Liberia's economy and social sectors forward on the basis of universal access to affordable, sustainable, and environmentally friendly modern energy services.
VII. **Mining Policy Statement**: Ensure that climate change adaptation principles are integrated in the mining sector so that climate stressor scenarios on mining as well as its exacerbation effect on climate change will be minimized. In doing so sustainable mining which contributes to the sustainable development of the country will be promoted.
VIII. **Industry Policy Statement**: Incorporate climate change considerations in industrial sector planning so that the manufacturing industries sector will be resilient to climate chocks emanated from energy, resources, and infrastructure needs as well as physical damage.
IX. **Transport Policy Statement**: Ensure the development of efficient, effective and affordable transportation system that is resilient to the possible shocks of climate change and which contributes to the sustainable development of the country.
X. **Tourism Policy Statement**: Develop and implement culture and tourism development programs that are resilient and responsive to the challenges of climate change.
XI. **Infrastructure Policy Statement:** Ensure that our infrastructure is 'climate-proof'.
XII. **Urbanization and Settlement Policy Statement:** Develop a comprehensive land-use plan to achieve sustainability in urbanization and settlement developments in order to adapt to climate change. .

[1] 3Cs means Corporatization, Commercialization, and Certification. It is an approach to help sustainable forest management. See for additional reference on:
http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.163.8482&rep=rep1&type=pdf#page=33

XIII. Health Policy statement: Strengthen the capacity of the health infrastructure and systems to achieve the objectives of the National Health and Social Welfare Policy and Plan, the Public Health Law and the SDGs 3 (good health) in the face of climate change and its risks.

b) Mitigation policy statements and Strategies

Even though Liberia's contribution to the pool of global emissions is relatively negligible, the country has committed over the years to ensuring that its potential as carbon sink is utilized adequately. The Government has also been committed, through several national programs, towards reducing emissions levels. Liberia's emission sources include Agriculture (swidden farming practice, large concessions within forested areas), waste disposal activities, energy sources (fuel wood, charcoal, & fossil fuel), and transportation system. In this policy and response strategy, hence, sectors included under mitigation are forestry and wildlife, agriculture, energy, mining, industry, transport, tourism, and waste management. Under this summary the policy statement of the sectors are identified while their corresponding strategies can be referred in section 4.2 of the document body.

I. Forestry and Wildlife Policy statement: Significantly enhance Liberia's potential for carbon sequestration by promoting conservation, sustainable forest management, community forestry and curbing key drivers of deforestation and forest degradation, which in turn will contribute to sustainable wildlife management.

II. Agriculture Policy statement: Move towards a sustainable agriculture system by encouraging lowland farming, investing in smallholder agriculture and allowing large-scale concessions on degraded land to avoid and reduce national emissions levels.

III. Energy Policy statement: Improve Liberia's economy and social sectors towards universal access to affordable, sustainable, and environmentally friendly low carbon energy services.

IV. Mining Policy statement: Ensure that mining sector in Liberia develops in an environmentally sustainable manner by gradually mixing the use of low emission energy sources and technologies.

V. Industry Policy statement: Ensure that the future of Liberian industrial base will not be locked into carbon emitting technologies but rather develop on environment friendly, economically viable and socially acceptable basis so that it will be competitive in domestic and world market.

VI. Transport Policy statement: Build the future of Liberia's transport system and associated infrastructure on low carbon emitting bases.

VII. Tourism Policy statement: Ensure the development of environment friendly tourism management system that contributes to the sustainable development vision of the country.

VIII. Waste management Policy statement: Pursue the development and implementation of a comprehensive waste management strategy that includes the development of environmentally sustainable landfills, recovery and use of methane emissions for energy generation and institute programs at the community and national level for recycling, reduce and reuse of waste.

c) Cross-cutting Themes Policy and Strategies

The cross-cutting issues are those topics which, by their nature, have a strong impact across all specific sectors and need to receive special attention. The cross-sectorial themes identified as critical in this policy and strategy document are communication, education, and awareness, capacity building and training, research and development, technology transfer, gender, HIV and AIDS. The Policy statement of these cross-cutting issues are presented below. The corresponding strategies can be referred in the body of the document (section 8.3).

I. Communication, Education and Awareness Policy Statement: Promote communication, education and awareness programs to incorporate climate change issues so that a society resilient to climate change and contributing to the reduction of the global GHG will be created.

II. Capacity Development and Training Policy Statement: Ensure that capacity development, training and capacity enhancement activities at systemic, institutional and individual level are prepared and continuously implemented to build adaptation and mitigation capacity to climate change.

III. Research and Development Policy Statement: Promote research and development aimed at addressing climate change issues at the national level; encourage cooperation and networking at the regional and international level to promote climate change research.

IV. Technology Transfer Policy Statement: Promote the transfer of technology that is proven to be locally adaptable, environmentally friendly, appropriate to user, culturally friendly, and manageable in a sustainable way for use in Liberia.

V. Gender, HIV and AIDS Policy Statement: Ensure that issues of gender, HIV and AIDS are mainstreamed in all climate change mitigation and adaptation interventions across the country as a means of promoting inclusiveness, equity and adequate participation of all.

6. Enabling Pillars

Five enabling pillars that help the materialization of the policies and strategies are identified. These are:

Pillar I: Institutional Arrangement in CC Governance: The National Climate Change Steering Committee (NCCSC) is the high-level policy coordination body for the overall climate change activities in Liberia. The EPA as government designated entity coordinates, along with other ministries and agencies, the full implementation of major activities under the policy. The National Climate Change Secretariat (NCCS), housed at the EPA facilitates and spearheads climate change related activities including access to information and monitoring of program activities. It promotes inter-agency cooperation, provides coordination, monitors and evaluates the operational arm of the NCCSC. The environmental sector working group to be established in key sectors will serve as a multi-stakeholder forum for the exchange of ideas, including for the provision of updates on ongoing and planned climate change initiatives. To ensure sectors & cross-sectors coverage, sub-working group will be created.

Pillar II: Financing Mechanism: Liberia will establish the "*Liberia Climate Change Trust Fund*" for the purpose of collecting, blending, and managing all the incoming revenue streams – both international and national – that are related to climate change into one, centralized fund. Further, it will explored the available funding sources and ensure the access and effective use of international funding available for adaptation and mitigation efforts, as well as explore the possibilities for creating domestic and international carbon market opportunities.

Pillar III: Capacity Building and Knowledge Management: A study made by EPA (2013[a]) recognized that there is capacity deficit. This accounts for low individual and institutional capacity, both at the local and national level, for implementing climate-change related activities including adaptation and mitigation. To overcome the capacity barriers and gaps and to meet the challenge of climate change, the policy will also focus on harnessing opportunities for capacity building and knowledge management.

Pillar IV: Technology Innovation and Infrastructure: Under this pillar, Liberia needs to engage in application and investment in technology innovation. It also needs to engage in different sectors, including infrastructure,

to gradually leapfrog old, destructive and polluting technologies which are both energy and resource inefficient. This will also deal with climate-smart standards in adaptation technologies in order to cope with the current and foreseeable climate change hazards.

Pillar V: Integrated Planning and Data Management: Because of the cross-cutting nature of climate change, integrated planning helps the government of Liberia to invest in the most critical and efficient way so that the economic and environmental returns on the investment will be maximized while at the same time addressing sectors' priorities. Equally important also is the availability of robust data and information across the sectors for decision making. Therefore, the policy will harness the development of this pillar as part of the key aspect of policy and strategy implementation.

7. The Structure of the Policy and Strategy Document

The document is divided into Eleven (11) main chapters. Chapter 1 is the introductory part which, includes the context and rational for the climate change policy and strategy. Chapter 2 discusses the methodology used in the preparation of the policy and strategy document. Chapter 3 mainly deals with the national circumstances which contain geographical description, natural resources, population dynamics and settlement, economy, and education. Chapter 4 is a section in which climate trends and projections are discussed. Climate change impacts, vulnerabilities and response undertaken are discussed in Chapter 5 and 6 respectively. Vision, Mission and Objectives of the Policy and Strategy are covered in section 7. Section 8 discusses the adaptation, mitigation policies and Strategies under sectors identified as key to the climate change setting of the Republic of Liberia. Enabling pillars or building blocks, which are critical for the realization of the policies and strategies implementation, are presented in section 9. In Chapter 10, action plan and resource mobilization plan are discussed. Chapter 11 is all about the monitoring and evaluation framework which is a critical tracking tool for the achievement of the desired objectives.

Definition of key terms and terminologies

Adaptation: Adaptation to global warming refers to actions aimed at coping with climatic changes that cannot be avoided and aimed at reducing their negative effects. Adaptation measures include the prevention, tolerance, sharing of losses, changes in land use or activities, changes of location and restoration.

Adaptive Capacity: The ability of a system to adjust to climate change (including climate variability and extremes) to moderate potential damages, to take advantage of opportunities, or to cope with the consequences.

Afforestation: Planting of new forests on lands that historically have not contained forests.

Capacity Building: Capacity building and capacity development for climate change refers to the development or strengthening of personnel skills, expertise, and relevant institutions and organizations to reduce GHG emissions and/or to reduce vulnerability and adapt to climate-related impacts.

Climate: Climate encompasses the statistics of meteorological conditions; that is, temperature, humidity, atmospheric pressure, wind, rainfall, atmospheric particle count and other meteorological elements in a given region over long periods of time (usually 30 years).

Climate Change: Climate change refers to any significant change in measures of climate (such as temperature, precipitation, or wind) lasting for an extended period (decades or longer). Climate change may result from:

- Natural factors, such as changes in the sun's intensity or slow changes in the Earth's orbit around the sun;
- Natural processes within the climate system, such as changes in ocean circulation, human activities that change the atmosphere's composition through burning fossil fuels and land surface through deforestation, reforestation, urbanization, desertification, etc.

Climate Resilience: Climate Resilience can be used to describe a broader agenda than adaptation, as defined above. It captures activities which build the ability to deal with climate variability – both today and in the future. Climate resilience building activities include many existing development investments, including those in the agriculture, food security, health, land management and infrastructure sectors.

Climate Shocks: Climate shocks can be thought of as the realization of risks. 'Shocks' has a very specific connotation that encompasses: i) unexpectedness ii) size iii) high damage due to concentration on persons with high vulnerability and low resilience iv) exogenousness in the source and v) physical or psychological strain to one or more individuals or community due to that stress.

Climate-Smart: Climate-smart is an approach that helps to guide actions needed to transform and reorient sector's (agriculture, infrastructure, etc.) systems to effectively support development and security in a changing climate.

Climate Variability: Variations in the mean state and other statistics (such as standard deviations, the occurrences of extremes, etc.) of the climate on temporal and spatial scales beyond that of individual weather events.

Variability may be due to natural internal processes within the climate system (internal variability), or to variations in natural or anthropogenic external forcing (external variability). In simple terms climate variability refers to changes in patterns, such as precipitation patterns, in the weather and climate.

Deforestation: Those practices or processes that result in the conversion of forested lands for non-forest uses. This is often cited as one of the major causes of the enhanced greenhouse effect for two reasons: 1) the burning or decomposition of the wood releases carbon dioxide and 2) trees that once removed carbon dioxide from the atmosphere in the process of photosynthesis are no longer present.

Ecosystem: Any natural unit or entity including living and non-living parts that interact to produce a stable system through a cyclical exchange of materials.

Emission: The release of a substance, usually a gas, when referring to the subject of climate change in the atmosphere.

Exposure: Exposure refers to the nature and degree to which a system is exposed to significant climatic variations.

Extreme Weather: Includes un-expectable, unusual, unpredictable severe or unseasonal weather such as floods, heat-waves, cold-waves, heavy and devastating rainfall, tropical cyclones, etc.

Global Warming: Global warming is an average increase in the temperature of the atmosphere near the Earth's surface and in the troposphere, which can contribute to changes in global climate patterns. Global warming can occur from a variety of causes, induced naturally or by humans. In common usage, "global warming" often refers to the warming that can occur as a result of increased emissions of greenhouse gases from human activities.

Greenhouse Gases (GHGs): Any gas that absorbs infrared radiation in the atmosphere. Greenhouse gases include, but are not limited to, water vapor, carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), chlorofluorocarbons (CFCs), hydro-chlorofluorocarbons (HCFCs), ozone (O_3), hydro-fluorocarbons (HFCs), perfluorocarbons (PFCs), and sulphur hexafluoride (SF_6).

Intergovernmental Panel on Climate Change (IPCC): The IPCC was established jointly by the United Nations Environment Program (UNEP) and the World Meteorological Organization in 1988. The purpose of the IPCC is to assess information in the scientific and technical literature related to all significant components of the issue of climate change.

Low Carbon Development: This is distinct from mitigation. Mitigation is about cutting emissions. Low carbon development reframes this challenge and argues that in some cases, the low carbon option is also the best development option for low income countries. Climate resilience and low carbon development can be combined into the term ‘climate compatible development’.

Climate Mainstreaming: The informed inclusion of relevant climate concerns into the planning and decisions of institutions that drive national, local and sectorial objectives.

Mitigation: Mitigation refers to efforts that seek to prevent or slow down the increase of atmospheric GHG concentrations by limiting current and future emissions and enhancing potential sinks for greenhouse gases.

Payment for Ecosystem Services: Incentives offered to farmers or landowners in exchange for managing their land to provide some sort of ecological service. It has been defined as "a transparent system for the additional provision of environmental services through conditional payments to voluntary providers".

Reforestation: Replanting of forests on lands that have previously contained forests but that have been converted to some other use.

Renewable Energy: Energy that is collected from resources which are naturally replenished on a human timescale, such as sunlight, wind, rain, tides, waves, and geothermal heat.

Resilience: The ability of a system to adapt to climate change, whether by taking advantage of the opportunities, or by dealing with their consequences.

Sensitivity: This refers to the degree to which a system is affected, either adversely or beneficially, by climate-related stimuli, directly or indirectly.

Sink: Any process, activity or mechanism which removes a greenhouse gas, an aerosol, a precursor of a greenhouse gas or aerosol from the atmosphere.

Sustainable Development: Development which meets the needs of current generations without compromising the ability of the future generations to meet theirs.

Technology Transfer: A broad set of processes covering the flows of know-how, experience and equipment for mitigating and adapting to climate change amongst different stakeholders, such as governments, private sector entities, financial institutions, non-governmental organizations and research/education institutions.

Vulnerability: The degree of susceptibility to the negative effects of climate change. It is a function of the type, magnitude and frequency of climate events to which a system is exposed (exposure), as well as sensitivity and capacity for adaptation (adaptive capacity

1. Introduction

1.1 Context

Climate change is one of the most important environmental and developmental issues of our time. This concern reflects the reality that so much of human activity is sensitive to climate change, and that adapting to current and projected rates of climate change could be very challenging. It also reflects the understanding that human perturbation of the climate system is essentially irreversible, for many centuries at least. The extent to which future generations would be exposed to climate change will be determined by the actions that we take over the coming decades to reduce human impacts on the climate system. There is a very strong body of evidence, based on a wide range of indicators, that climate change is occurring and the climate system is warming. The evidence includes observed increases in global average air and ocean temperatures, widespread melting of snow and ice, and rising global sea level. It is rather the size of the impacts and their implications that remain uncertain. Plants and animals are responding to climate change in ways that are consistent with the observed warming with repercussions throughout natural and managed environments.

In developing countries, climate change continues to be a challenge that exerts constraints on livelihood. Poor communities heavily depend for their livelihood on a stable and hospitable climate. In Liberia, rain-fed agriculture is the mainstay of the economy. Rain-fed agriculture is dependent on climatic pattern, thus it is vulnerable to extreme weather events. Under such episodes, countries striving to meet basic developmental needs, such as those identified in the national development agendas and Sustainable Development Goals (SDGs), would hardly be able to achieve targets, thus leaving livelihood at stake.

Increased frequency of natural hazards such as coastal erosion, terrestrial flooding, loss of mangrove forest by sea intrusion and associated impact on fishery and wildlife are the most prominent impacts of climate change in Liberia. Other prominent impacts of climate change in Liberia are enhanced diseases on human health, loss of plant and animal biodiversity, destruction and or shorter life span of use of infrastructure and public facilities caused by flooding, sea level rise and overflow of wetlands, reduced renewable energy sources and loss of asset of particularly farming community.

Liberia is endowed with diverse natural resources and ecosystems as well as socio-cultural heritages. It has varied ecosystems which include mineral ores, forests, grasslands, mangroves, wetlands, rivers, lakes and the continental shelf, hosting approximately 600 bird species, 125 mammal species, 74 reptile species and 1,000 insect species (Giorgio and Mohammed , 2006; EPA, 2006). These resources, therefore, are in a critical condition due to the sustained climate change impacts mentioned above.

For the people and government of Liberia, recognizing the importance of addressing climate change in development planning, this climate change policy and strategy document is prepared in order to ensure that climate change adaptation and mitigation issues are mainstreamed at policy level and in key sectorial and cross-sectorial development efforts.

1.2 Rationale for the National Climate change Policy and Strategy

There is increasing evidence in the world that climate change is happening. Several consecutive reports prepared by the Intergovernmental Panel on Climate Change (IPCC) have shown that climate change is threatening our planet Earth. Directly or indirectly, the impact of climate change has been felt in Liberia over the past few decades. Although due to the previous war history and present reconstruction endeavor of Liberia coastal monitoring has never been conducted, there are visual indications of sea level rise along the coast which are ascertained by recession of beaches and loss of ocean front structures, or even whole villages. It is reported that during 1981 to 1997, about 100m of beaches were lost. Unsustainable human practice such as unregulated beach mining and coastal degradation caused by settlement pressure has worsened this situation (USDA, 2013).

Several climate disasters have already taken place in the country, displacing more than 2500 people in 2007, leaving various communities under water on several occasions, and causing a flash flood in 2009 and displacing 600 people, mostly women and children. Sea erosion has also made various parts of Liberia's coast uninhabitable by removing meters from the coast line, destroying important infrastructure and driving many civilians into homelessness. It is shown that nearly 58% of Liberian population lives within 40 miles of the coast (USDA, 2013) which indicates that coastal ecosystem degradation, including deforestation and the threat of sea level rise, is serious. Because of erratic rainfall, many local people, particularly the farming communities, have witnessed the shift in rain season by more than a month, affecting agricultural practice and livelihood. They have also frequently witnessed short duration intensive rainfall causing overflow of water on the road infrastructure and agricultural fields (field consultation, June 2015).

Liberia faces challenge with the impact of climate change coupled with many socio-economic problems like poverty, poor infrastructure, lack of information, technology and access to finance, weak institutions and resource competition, among others. Several anthropogenic impacts have also worsened the climate change impact at the local level. For instance, 45% of the total land area of Liberia is classified as dense forest. Shifting cultivation which uses slash and burn, increase mechanized cultivation which uses chainsaw, indiscriminate clearing of forest for industrial and artisanal mining, increasing exploitation of mangrove forest, small-scale plantation development and small-scale alluvial mining which are occurring at the expense of natural forest (USDA, 2013). Unless these issues are managed soon, they will aggravate poverty and pause serious current and inter-generational impact related to climate change.

In order to tackle the impact of climate change, which will have a worsening situation on the development endeavor of the country, it has become essential that climate change policy and associated response strategies be in place to integrate climate change considerations in key sectorial and cross-sectorial policies and interventions. The commitment made by the government of Liberia through its NDC is also a landmark which expresses the importance of this Policy and Response Strategy to be in place for its realization.

Among other umbrella policy level interventions, Vision 2030, which includes a range of Pillars, Sector Goals, Strategic Objectives and Outcome Indicators, which together supports adaptation, disaster risk management and mitigation capacity in Liberia, is an overarching vision to direct the country to a developed society. The National Climate Change Policy and Response Strategy, hence, is a vehicle to move this development effort in a climate smart and sustainable path.

Similarly, this Policy and Response Strategy is instrumental to the implementation of the universal Millennium Development Goals (SDGs), adopted by the UN General Assembly on 25 September 2015, and Agenda 2063 adopted in 2013. Particularly SDG 13, SDG 14 and SDG 15 are relevant to this context which refers to combating climate change and fostering sustainability. The Agenda 2063, which represents Africa's vision for promoting positive socio-economic transformation over the next 50 years recognizes climate change and natural disasters as a major threats to Africa's development now and in the future.

2. Methodology and Approaches

The preparation of the Liberian Climate Change Policy and Response Strategy is based on national demand emanated from the climate-exerted pressure on social, economic and environmental assets. In the process, consultations of key governmental and non-government organizations, community representatives and development partners (including a collection of relevant information) were made. This process, among other things, has revealed that the preparation of the national policy and response strategy was timely and urgent.

Guided by the methodological tools prepared – work plan, benchmarking and policy, and strategy review matrixes – the climate change policy and strategy documents of 9 countries were reviewed and lessons and best practices were taken. To ensure alignment with the National Policies and Strategies, 27 different sectorial and cross-sectorial national policy and strategy documents (including vision 2030, the Liberian NDC and Agenda 2063) were reviewed and the outcome was used as input for policy and strategy formulation. Finally, the input obtained from peer review and national stakeholders were incorporated to produce the final document.

3. The National Circumstances

3.1 Background

Liberia was founded in 1822 when groups of free men, women and children were transported to Africa from America based on the efforts of the American Colonization Society to settle freed American slaves in West Africa. Before the coming of the freed slaves Liberia was occupied by native tribes. The country gained its independence on July 26, 1847 after being a colony for more than 26 years. Liberia is the oldest independent nation on the west coast of Africa and consists of 16 tribes, including indigenous populations and descendants of repatriated freed American slaves (Sherman, 2011).

With Monrovia as its capital and seat of the central government, Liberia is a unitary constitutional republic and representative democracy with three branches: the legislative, executive, and judiciary. The centralized system within the executive branch is divided into functional sub-national administrative governance institutions. Each of its fifteen political subdivisions (counties) is headed by a superintendent who is appointed by the president. Other levels of local administration are the chiefdoms, headed by paramount and clan chiefs. Amongst the fifteen political subdivisions – Bomi, Bong, Gparbolu, Grand Bassa, Grand Cape Mount, Grand Gedeh, Grand Kru, Lofa, Margibi, Maryland, Montserrado, Nimba, River Cess, River Gee, and Sinoe – Montserrado (housing the capital) is by far the most populous, followed by Nimba, Lofa and Grand Bassa Counties.

In 2005, the country ushered in a democratically elected government after years of political rift, economic instability, civil devastation, and a complete breakdown in social services due to 14 years of bickering and infighting. The new government has, incontrovertibly, worked towards maintaining the peace, accelerating economic development, providing social services, promoting the rule of law and integrity of the justice system,

supporting freedom of expression and rights to assembly, and striving to create an enabling environment for citizens' participation into the governance process of the country. These measures and programs have continued over the last ten years unabated despite the enormous challenges inherited over the years.

Liberia adopted the Vision 2030 in 2012 as a major step in moving the country towards middle-income status. The Agenda for Transformation (AfT) was also adopted as a framework for meeting the country's expectation for social development, sustained and accelerated growth. Reflected in 5 pillars (Peace, Justice, Security and Rule of Law; Economic Transformation; Human Development; Governance and Public Institutions; Cross-Cutting Issues including environment and gender), the AfT articulates the country's visions and aspirations for achieving inclusive and sustained socioeconomic development towards the middle income status. It also considers climate change as a strategic objective.

As espoused in the AfT, to attain middle-income country status by 2030 the economy was projected to maintain the GDP growth rate of 8.3% for two decades considering 2012 as the base year (Republic of Liberia, 2012). However, an assessment of the economy revealed that the real GDP growth for 2014 declined from 2.5% to 0.7% as a result of the slow pace of economic activities in the traditional sectors, exacerbated by the outbreak of the Ebola Virus Disease (EVD) (Republic of Liberia, 2015[a]).

3.2 Geographic Description

Liberia is located on the West Coast of Africa, bordered by Sierra Leone on the west, Guinea on the north, Côte d'Ivoire on the east, and the Atlantic Ocean on the south. It covers an area of 111,369 square km (43,000 square miles), with 13.5% covered by water and the remaining 86.5% consisting of land. The coastline of Liberia is estimated to be 565-km in length. It is home to some of the country's largest cities and conducive to fishing and tourism. Liberia lies between the longitudes of $7^0 30`$ and $11^0 30`$ west and latitudes 4^0 18` and $8^0$ 30` north. (Republic of Liberia, 2004)

Figure 1: Map of Liberia

Liberia's topography features coastal lagoons and mangrove marshlands, rain forest and rolling plateaus. Along the Sea Coast is the Coastal Plain, which lies about 30m above sea level in elevation and runs up to 350 miles (560km), an almost unbroken sand strip with width varying from 16-40

km. It is marked by few promontories like Cape Mount (329 m elevation, at Robertsport, Grand Cape Mount County), Cape Mesurado (91 m, at Monrovia, Montserrado County), and Cape Palmas (31 m, at Harper, Maryland County)(Republic of Liberia, 2004).

Running parallel to the Coastal Plain is the belt of Rolling Hills. This belt lies at about 200-330 m elevation (average about 92 m). It is marked by several hills (including Bomi Hills, Mount Barclay, and Mount Gibi), valleys and water ways (Republic of Liberia, 2004).

The Northern Highlands mark the highest elevation, which includes Mount Wutivi (1,350 meter), the maximum elevation in Liberia, and Nimba Mountain range, in northeastern Nimba County, with maximum heights of 1,305 or 1,385 meter on the Liberian side. The range is shared by two other countries – Ivory Coast and Guinea. (Republic of Liberia, 2004)

The highest point wholly within Liberia is Mount Wutivi, which rises to 1,440 meters above sea level. It is located in northwestern Liberia and is part of the range of the West Africa Mountains and the Guinea Highlands. Mount Nimba, near Yekepa, is higher at 1,752 meters above sea level, but it is not wholly within Liberia. It shares a border with Guinea and Côte d'Ivoire (Republic of Liberia, 2004).

Six major rivers traverse the north and south boundaries of the country. The Mano River traverses the northwestern boundary while the southeast limits of the country are bounded by the Cavalla River. The St. Paul River exits near Monrovia while the St. John River exits at Buchanan. The Cestos River empties into the bay on the Atlantic Ocean within Rivercess County. The Lofa River traverses the north in Lofa County and empties in the Atlantic at Bomi County. Cavalla River is the longest river in the nation at 515 km (320 miles). Together these rivers drain approximately 66% of the country and take their sources from neighboring Sierra Leone, Guinea or Cote d'Ivoire. There are several smaller streams that rise in the interior and either join the major streams as effluent or flow directly to the sea. Almost without exception, the rivers are full of cataracts in their lower courses, mostly to within 30-40 km of the sea.

Two major lakes are found across the country. Lake Piso, located in Grand Cape Mount County and considered the largest, covers an area of approximately 40 square miles with potential of diamonds accumulations. Lake Shepard, on the other hand, is located in Mary Land County with part saltwater and part freshwater. The estimated terrain elevation above sea level is 4 meters.

The location of Liberia in West Africa allows for the country's climate to be described in terms of two separate climate regimes. The equatorial climate regime with rainfall occurring throughout the year in the southernmost part of Liberia, the tropical regime dominated by the interaction of the Inter-Tropical Convergence Zone (ITCZ), and the West African Monsoon. With variations over the last 10-15 years, Liberia has a tropical climate with heavy rainfall from May to October, with a short interlude in mid-July to August. The dry season extends from November to April. The coastal areas are wetter except for highland areas where air is forced to rise. Temperature ranges from 32°C in November to 28°C in June. Relative humidity is about 90-100% during the rainy season and 60-90% during the dry season.

3.3 Natural Resources

Richly endowed with water, mineral resources, forests, and a favorable climate, the main economic sectors of Liberia's economy are mining, agriculture, and forestry, while the main natural resources are iron ore, rubber, timber, diamonds, and gold.

The rain forest occupies roughly 45% of Liberia's land and is the source of its timber. Liberia has the largest remaining part of the Upper Guinean forest ecosystem, with an estimated 42% of the remaining forest. The rest of the Upper Guinean forest is located in Côte d'Ivoire (28% of the remaining forest), Ghana (16%), Guinea (8%), Sierra Leone (5%), and Togo (1%). Just an estimated 40-45% of Liberia's original forest cover remains, and less than 30% of its area is covered by natural forests. It is home to many rare and endemic species and listed as one of 34 global biodiversity hotspots. Its tracts of forest were once continuous but are now fragmented into blocks that are isolated from each other as a result of human pressure: logging, road-building, agriculture, and human settlements.

The plateaus are cultivated for agriculture (27% of land) and the mountains (including Mount Nimba and Putu Mountain) are home to mineral resources—especially iron ore, gold, and diamonds. The mining and quarrying sector contributed 7% of GDP and employed around 2% in 2011, with an increasing rate expereined over the last 5 years.

Liberia also has significant hydraulic resources including the Cavalla River, the St John River and the St Paul River, conducive for the development of hydro-electricity. It is noted as one of the African countries with the highest per capita renewable water resources with approximately 71,000 m^3/per person per year. The total renewable water resource is estimated at 232 km^3/year. In 2000 it was estimated that the total water withdrawal in Liberia was at C106.8 million m^3C, with agriculture accounting for 57%, followed by the domestic sector with 28% and the industry with 15% (FAO, 2005).

Marine biodiversity off the coast of Liberia has not been sufficiently studied. Apart from fisheries data from landing catches (including crustaceans and mollusks) (EPA, 2006), marine turtle coastal survey data and some sightings of larger marine animals such as cetaceans (whales and porpoises), little information on sub-surface flora and fauna exists.

There are 167 species of freshwater fish and 464 species of saltwater fish that are known for Liberia. Three of these species are endemic to Liberia. 54 of Liberia's fish species are listed in the Red List of IUCN, 14 as critically endangered, 18 as endangered and 22 as vulnerable.

3.4 Population Dynamics and Settlement

Liberia's population was put at 3.5 million in 2008 (LISGIS, 2008) while estimated at 4.503 million in 2015 (World Bank, 2016). The population is projected to increase to 10.3 million by 2058, with more than 70% of the population living in coastal cities including Monrovia, the country's capital. More than half of the country's population lacks access to basic social services and there is a high level of unemployment. Liberia's population has a number of notable features including 1) a high rate of fertility 2) an extremely high ratio of youth 3) a high degree of urbanization, and 4) compared to low income countries, relatively high literacy and education levels among the youth (Republic of Liberia, 2013).

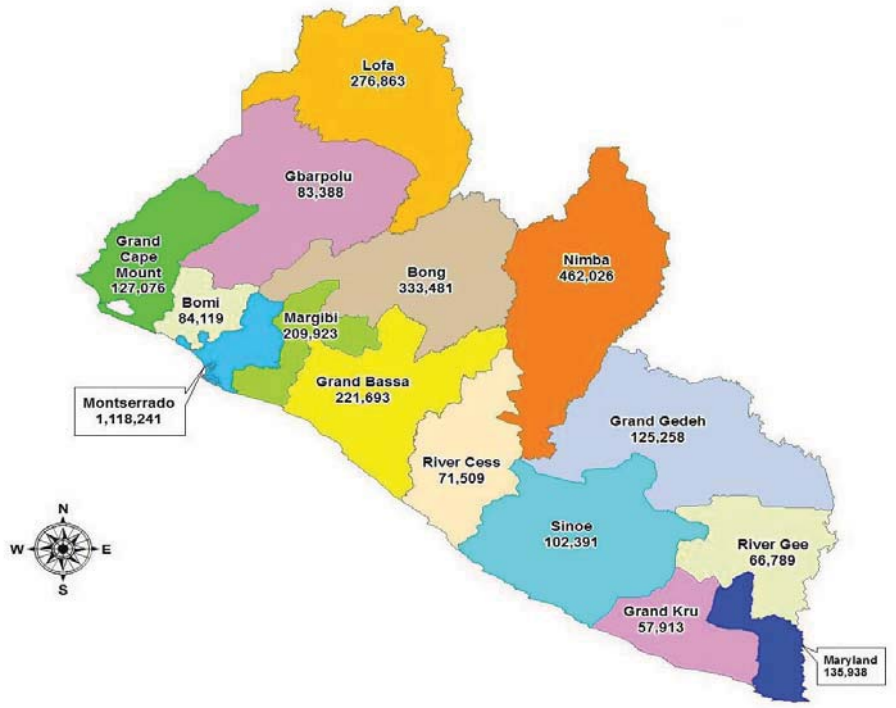

Figure 2: Population by county (Source: Agenda for Transformation (AfT)-Steps towards Liberia Rising 2030, 2013. Source: Population and Housing Census, LISGIS, 2008

While overall population density is still relatively low, population growth rates are high. The population grew at an average rate of 3.3% annually between 1962 and 1974 and 3.4% during 1974 and 1984. Between 1984 and 2008, average growth was 2.1%, reflecting the population exodus and losses during the civil war (Table 1) (LISGIS, 2008). The growth rate was estimated at 2.44% in 2016 (CIA , 2016).

Table 1: Population trend of Liberia, 1962 - 2008 (Census Statistics)

Population Characteristics	1962	1974	1984	2008
Population	1,016,443	1,503,368	2,101,628	3,489,072
Population Change		486,925	598,260	1,387,444
Average Annual Increase		40,577	59,826	57,810
Percentage Increase (total)		48	40	66
Average Annual Rate of Growth		3.3	3.4	2.1
Sex Ratio Male to Female			102.0	102.3

Source: Population and Housing Census, LISGIS, 2008

The population structure is characterized by very young with 42% below the age of 15. This puts increasing pressure on the provision of health care, education, housing, food, transportation and employment. Even if fertility levels decrease, the existing dynamic means that the dependency ratio will remain high for years to come and Liberia is unlikely to see a demographic dividend in the next several decades (Republic of Liberia, 2013).

Interestingly, Liberian urban population surged after the civil war as many migrants, from the rural parts of the country, adapted urban lifestyles and decided to remain within cities, mainly Monrovia. Thus, urbanization in Liberia is now much higher than other low-income countries. As of 2008, 48.7% of households lived in urban areas and 51.3% lived in rural areas. Despite the high urban density (especially Monrovia), people are reluctant

to return to rural areas where there is more poverty and fewer economic opportunities. Other demographic features by county, national, urban and rural are presented in Table 2.

Table 2: Selected demographic features of Liberia by County (Census Statistics)

	Fertility (Children/woman)	Population Growth Rate (average 1984-2008)	Mortality			Literacy Rate (adults)	Total Population
			Infant (per 1000 births)	Maternal (per 100,000 births)	Under-5 (per 1000 children)		
Bomi	6.6	0.9	109	967	171	45.8	82,036
Bong	5.9	1.0	76	909	115	39.1	328.919
Gbarpolu	6.7	2.3	74	586	117	40.7	83,758
G. Bassa	6.1	1.4	101	854	160	35.6	224,839
G. Cape Mount	6.1	2.0	100	1,679	154	40.5	129,055
G.Gedeh	6.3	2.9	65	744	81	42.8	126,146
G.Kru	7.9	0.4	92	923	132	50.6	57,106
Lofa	6.2	1.3	93	1,114	136	40.4	270,114
Margibi	5.5	1.1	78	633	117	54.2	199,689
Maryland	6.5	2.8	72	1,934	81	58.9	136,404
Montserrasdo	4.8	3.5	70	615	98	72.6	1,144,856
Nimba	6.2	1.7	64	1,052	95	56.3	468,088
Rivercess	6.4	2.3	72	681	108	38.0	65,862
Rivergee	7.8	2.2	62	435	86	53.8	67,318
Sinoe	6.9	2.1	70	1,274	99	49.7	104,932
Liberia	5.8	2.1	78	890	119	55.9	3,476,608
Urban	4.9	-	68	686	95	70.4	1,633,824
Rural	6.5	-	84	1,057	125	57.9	1,842,889

Source: Population and Housing Census, LISGIS, 2008.

3.5 Economy

Liberia is richly endowed with natural resources such as water, forests, minerals (gold, diamond, iron ore, etc.) and a climate favorable to agriculture. Like most Sub-Saharan African economies, the majority of the Liberian population relies on subsistence agriculture, while exports are dominated by raw commodities such as rubber and iron ore. Local manufacturing, such as it exists, is mainly foreign owned.

The fourteen year civil war (1989-2003) in Liberia destroyed government institutions, decimated infrastructure, forced the flight of thousands, and left approximately 250,000 dead. It destroyed critical industries such as manufacturing, iron mining, rice, and rubber and reduced Liberia's gross domestic product by 50 percent (Republic of Liberia, 2013; GoL, 2012).

Due to post war reconstruction, started in 2003, Liberia's economy has experienced high growth since 2006 despite a decline from 2008 to 2010 largely attributed to the global financial crisis. In 2011, the services industry, led by hotels and trades, government services, real estate, transport, construction and communication contributed the largest to GDP at an stimated 44%. This sector, supported by the huge donor presence, employed about 45% of the labor force. The agriculture, forestry and fisheries sectors combined, contributed 41% of GDP, providing employment for 47% of the labor force. This sector was driven by exports in forestry and

rubber, followed by subsistence production of cassava and rice. The mining and quarring sector contributed 7% of GDP and employed around 2%.

In 2012 the country witnessed a growth of 8.9%, which was driven by exports of iron ore, timber, rubber, construction, and services sector growth. In 2014, the economy was hit by the Ebola Virus Disease (EVD) outbreak which paralyzed economic activities in all sectors of the economy. The impact of the EVD on the economy was escalated by decline in global commodity prices of Liberia's major exports – iron ore and rubber. Before the outbreak in 2014, the economy grew at approximately 8 percent on average. The EVD epidemic impacted all sectors of the economy, resulting to a shy real GDP growth of 0.7 percent in 2014 to 0.3 percent in 2015 (Republic of Liberia, 2015).

In 2015, agriculture constituted around 46 percent of the labor force with about 70 percent of rural households involved in the sector. The sector's contribution to real GDP was recorded at around 23.9 percent marginally down from 24.2 percent, recorded in 2014, despite its high contribution to the labor force employed. Rubber, which represents a major contributor to the sector, experienced a decline of 9.2 percent compared to the 2014 output. The service sector continued to be the major contributor to the GDP growth in 2015 with 46.6 percent of the monetary value of all goods and services produced. This represents a major increase from the previous level of 2.3 percent, recorded in 2014, as a result of the poor performance caused by the EVD crisis. Due to the sharp decline in the global price of iron ore, the mining and panning sector contributed an estimated negative 17.0 percent from a positive 3.3 percent in 2014.

According to the World Bank, GDP growth is projected to recover to about 3.9% in 2016 as a result of the opening of a new gold mining concession and improvements in services as rural and urban markets becomes viable.

In general, despite substantial recovery efforts since 2005, Liberia remains one of the poorest countries in the world. The UNDP (2015) Human Development Report puts the poverty rate in Liberia at 81.86% with vulnerable employment population (% of total employment) being 78.7%, while 94.4% of the country's workforce is considered 'working poor' as they live on less than $USD 2.00 a day.

3.6 Education

In Liberia 50% of the total 3.5 million population is youth, of which 33.2% have no formal education, 31.1% have attended primary education while 35.75% have attended secondary and tertiary education (LISGIS, 2008).

Pillar III of Liberia's Development Agenda (Agenda for Transformation) focuses on human development. It seeks to provide education opportunities for all. One of the goals of the Pillar also refers to improving quality of life by investing in more accessible and quality education. To achieve these goal the Government has introduced a couple of policies that include Free and Compulsory Basic Education, Girls Education, Education Governance and Teacher Professional Development. The Education Sector Plan (ESP), covering the period 2010-2020, aims at achieving this agenda and to fulfill the Government's commitment to the Dakar Framework for Action in 2000 This Framework seeks to promote better results in education and is to me mentioned. The progress monitoring report of 2015 indicates that some progress have been achieved thus far: Close to half of the previously out-of-school children and adolescents are now enrolled. There has been remarkable progress in gender parity, mostly at the primary level, although there is still great disparity when looking at the country's gross enrollment data.

The Government has also intensified the evaluation of learning outcomes through national and international assessments as a way of ensuring that all children benefit from the desired quality of education. However, there is a lot that needs to be accomplished by the Government and its partners, with more than 0.5 million kids not in school and approximately 21% of students not completing primary education. There is also a marked variation in education between children of poor/disadvantaged families and those of middle class or rich families. As a result of the poor quality of education at the primary level, a significant number of students leave school without acquiring sustainable skills. One of the key challenges to education in the country is the inadequacy of funding from the national budget. To this, Government has committed to increasing support in the national budget for education (Republic of Liberia, 2015[b]).

4. Climate Trends and Projection

4.1 Temperature

Based on historical records available from 2009 to 2012 at the Roberts International Airport weather station, the temperature typically varies from 23°C to 33°C and is rarely below 21°C or above 34°C over the course of the year. The records show that there is a warm season that runs from January 1 to May 8 with an average daily high temperature above 31°C. March 9 is recorded as the hottest day in 2012, with an average high of 33°C and low of 24°C. There is a cold season, which runs from July 6 to September 17 with an average daily high temperature below 28°C (USDA, 2013).

The projected climate of Liberia from 2010 – 2050 is based on an ensemble of Regional Climate Models (RCMs). Mean air temperature is unanimously projected to increase by 0.4°C to 1.3°C (Table 3). The average increase in the 2020s for temperature is estimated at 0.6°C. It appears that temperature will increase by 1.3°C in the middle of the 21st century (EPA, 2013[b]).

Table 3: Mean Temperature and Precipitation Scenarios in the 2020's and 2050's for Liberia using RCM ensemble simulation to downscale ECHAM5 and HadCM3 A1b scenarios

Horizon	Precipitation (%)	Mean precipitation (°C)
2010 – 2019	+2.0	+0.4
2020 – 2029	+1.6	+0.5
2030 – 2039	+5.0	+0.8
2040 – 2049	+2.6	+1.3

Source: Initial National Communication (EPA, 2013[b])

Similarly, other projections also reveal that Liberia's future climate for 2050 and 2080 will be marked by a warmer climate in most parts of the country with some areas drier than current. It is projected that most parts of the country will experience an increase in temperature at 1° to 2° during the hottest month (February) compared to current temperature. Using historical data from the World Meteorological Organization station of neighboring countries, the statistical downscaling scenario reveals that temperature change will be less than 2°C throughout the country but nighttime temperatures will increase by more than 2°C in the interior of the country. A comparison of current average maximum temperature with 2050 projections in February, which is the hottest month, reveals an increase in temperature for most part of the country at 1° to 2°, with the highest temperature of 36°C in the interior. Similar comparison for average low temperature reveals a 2°C increase in nighttime temperature along the coast in the west and the northeastern border area. All of the different types of scenario

used in a study conducted by the United States Department of Agriculture in 2013 predict an increase in temperature conditions across Liberia (USDA, 2013).

4.2 Rainfall

Liberia has a rainy season that runs from May to October due to the African monsoon and pretty frequent rains in other months, except in the short dry season that runs from December to February, which is more marked in the north. In the southern zone, the rains have a relative break from mid-July to late August. Rainfall along the coast exceeds 3,000 millimeters per year. In Monrovia, the northern part of the coast, rainfall reaches even 5000 mm per year with a maximum in June and July, when nearly 1000 mm of rain per month fall, and a relative decrease in August. Here the rains are abundant already in April, and still in November. In the interior precipitation it is less abundant, and it drops even below 2,000 mm per year (EPA, 2013).

The projected climate of Liberia based on an ensemble of Regional Climate Models (RCMs) shows that average increase in rainfall from 2010–2050 will be between 2.0% and 5.0% (Table 3). The average increase in the 2020's for rainfall is estimated at 3% (EPA, 2013[b]).

Comparing current to 2050 spatial pattern of average annual precipitation, other projection also shows that there will be a slight increase in total rainfall towards the inland in the future, with the greatest average annual precipitation (5,000 mm) projected along the western coast in 2050. It is also projected that there will be an increase in rainfall along the coast during the wet season while the inland regions will see normal to slightly reduced rainfall. As a result of increase temperature in the ocean by 2050 the northern parts of Liberia will experience drier conditions, while rainfall along the southern coast will increase in May. June is reported to also have increase rainfall along the coast with the stronger monsoon pushing rainfall farther in the interior; and the northern interior will experience pockets of dry conditions. In July, which is the start of the mid-dry season period, there will be a dramatically expanded area of dryness to the east, while rainfall along the coast will continue to increase. In August there will be little change in rainfall pattern but with drier conditions for northern Liberia, reflecting a shift in the pattern of the rain season.

These projections show a spatial variability in precipitation with a warmer Atlantic Ocean and reduced inland temperature that result to less rainfall in the interior. The Liberia Climate Change Assessment report asserts that projections of rainfall by climate models are mixed and uncertain due to the complexity of correctly reproducing a number of key features of the atmospheric circulation patterns over West Africa. The USDA ensemble modeling projections of rainfall among three representative meteorological stations also gave mixed and inconclusive results, lacking consistency and predicting decreases and increases in rainfall across stations. With the warming projected, an increase in rainfall is the most likely outcome from a dynamics perspective. In general, abundant monsoonal rainfall is consistent with warmer tropical Atlantic sea surface temperatures as they enhance latent heat fluxes from the ocean to the atmosphere (USDA, 2013).

5. Climate Change Impacts, Risks and Vulnerabilities

In its fifth assessment report, the Intergovernmental Panel on Climate Change (IPCC, 2014) states that continued emission of greenhouse gases will cause further warming and long-lasting changes in all components of the climate system, increasing the likelihood of severe, pervasive and irreversible impacts for people and ecosystems. For example projected regional warming in West Africa is estimated at 1–1.5 °C by 2099, threatening the stability of current ecosystems (IPCC, 2013).

Limiting climate change would require substantial and sustained reductions in greenhouse gas emissions (i.e. mitigation), which, together with adaptation, can limit climate change risks.

Vulnerability to climate change is currently a concept that is now fully ingrained in the language relating to policies that are aimed at helping society to adapt to and or mitigate the impact of climate change. Vulnerability to climate change impact can be defined as a function of exposure, sensitivity and adaptive capacity.

Actions to address climate change have to, therefore, be informed by sectorial needs within the national/local circumstances, which are constantly changing. Below, we provide information on the adverse impact of climate change observed on the key sectors; that is, on forestry and wildlife, agriculture, coastal areas, water, fisheries, energy, mining, industry, transport, tourism, infrastructure, urbanization and settlement, and health.

5.1 Forestry and Wildlife

Of the total land area of Liberia (9.58 million hectares), forests cover about 4.30 million hectares or 45 percent of the land area. In recent years, the forest area has decreased somewhat, largely due to uncontrolled logging and an expansion of land used for agriculture. The average annual rate of deforestation since 2001 and over a reference period of 2005 to 2014 is 0.46% (FDA, 2016). The recorded planting of new forests to date has amounted to only about 11,000 hectares in total. Despite Liberia's small size, it contains a significant amount of biodiversity (flora and fauna), including: over 2,900 different vascular plants (including 225 tree species); 600 bird species, 150 mammal species, and 75 reptile species. The threat of deforestation due to shifting cultivation, though not accurately measured, is a major contributor to forest loss. This is in association to the loss of wildlife, particularly associated with subsistence agriculture and the expansion of commercial agriculture to meet national food requirement for market, particularly with the tendency of increasing the price of rice and palm oil in the domestic and world market (FDA, 2006). In relation to this, to be mentioned is the pressure created by climate change (unreliability of rainfall, over-flooding of settlement and farmlands and disparity in weather pattern) resulting in low agricultural productivity and the need for massive clearing of forest for agricultural production and settlement, which exerts a big impact on wildlife resources.

A changing climate influences the structure and function of forest ecosystems and plays an essential role in forest health. It may worsen many of the threats to forests, such as pest outbreaks, fires, human development, and drought. Evidence also suggests that climate-induced changes on the ability of forest ecosystem to provide basic goods and services will impact negatively the economic and social well-being of forest-dependent communities. This might include limiting the ability of communities to meet their basic requirements for food due to a reduction in the amount of productive land and pest infestation of crops, access to clean water, medicinal products, wildlife products, and fuel wood among other things which they get from the forest. 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. The FAO speculated the abnormal behaviour of the armyworms to reach in the foliage of the tall Dahoma trees where they tend to congregate due to climate change.

This could lead to deepening poverty, deteriorating public health, a breakdown of traditional institutions and social conflict as people seek to migrate to more productive areas locally or even to already overcrowded urban centers like Monrovia. In addition, the accumulated impact of the above factors will in the long term result in depletion of forest and wildlife resources and the loss of national income. Rough estimates show that in 2002 timber export accounted for 60% of Liberia's export revenue (FDA, 2006).

5.2 Agriculture

Liberia's agriculture sector is forest based, dominated by traditional subsistence farming systems, mainly in the uplands, and characterized by labour intensity, shifting cultivation, low technologies and productivity. Although rice, cassava and vegetable production accounts for about 87% of cultivated land, the output of the staple foods remains below national requirements. Agriculture-related imported products, of which food and live animals account for over a third, amounted to well over half (50%) of total imports in the post-war period, second only to petroleum products (MoA, 2015).

While food crop production represents the most important source of livelihood for the majority of Liberia's rural population, with approximately forty-one percent (41%) of the population engaged in the activity, tree crops have represented the highest income – generating sub-sector, providing formal employment to the greatest number of workers in the agriculture sector and contributing significantly to the country's GDP (MOA, 2015). Tree crop commonly grown in Liberia include rubber, oil palm, cocoa, coffee, and coconut.

The livestock sub-sector was one of those sectors degraded due to the civil war. Currently, livestock population is below 10% of national requirements. The Food and Agriculture Policy and Strategy for the sector is focused on restocking, focusing on small ruminants short-cycled animals, reduced production costs and revitalizing the value chains in livestock production. It is estimated that 26,000 heads of live cattle, 15,000-16,000 heads of live sheep and goats (estimated to equate to respectively, 3000 metric tons and 312 metric tons) were imported from neighboring countries in 2005/2006. The fisheries sub-sector is also underdeveloped but has good potential for growth, since only about 6.8% of sustainable yield is harvested annually (MoA, 2015).

The production system of agriculture in Liberia is nature-dependent as the production activity that transforms inputs into agricultural outputs involves direct use of weather inputs (precipitation, temperature, and solar radiation available to the plant.), with various studies of the impacts of climate change on agriculture reporting substantial differences in outcomes such as prices and production. As climate predictions indicated in Chapter 4, the increasing tendency of temperature and the high variability, but increasing tendency for rainfall pattern, show that climate change continuous to exert significant pressure on the agriculture sector. Similarly, the livestock sector, which contributes 14% of food and agricultural GDP (MoA, 2006), pressure is expected as climate change hazards, as well as animal diseases and vectors could affect the productivity of the sub-sector.

Agronomic studies suggest that yields could fall quite dramatically in the absence of costly adaptation measures, as current farming technology is basic and incomes low, suggesting that farmers will have few options to adapt. Without adaptation, climate change is generally problematic for agricultural production and for agricultural economies and communities, although vulnerability can be reduced with adaptation-related activities. In Liberia where more than 70% of the population engage in agriculture as their main livelihood activity, rice is the nation's staple covering majority of the area under production (rubber and cassava coming in at second and third respectively). The disruption to the agricultural system resulting from climate change will seemingly have direct consequences for the country.

In 2008 a three year sustainable Land Management (SLM) initiative was started with funding from the Global Environmental Fund (GEF), the United Nations Development Program (UNDP) and the Government of the Republic of Liberia. The project was designed to contribute to the mitigation of land degradation and to promote ecosystem integrity and stability with enhanced ecological functions and services. The project sought to strengthen the enabling environment for SLM through mainstreaming and capacity development for sustainable agriculture through a broad based participatory process. The project was completed in 2013. It achieved the

following outcomes: integration of SLM into the curriculum of the University and into the extension training systems of the Ministry of Agriculture and the NGOs sector, and establishing a knowledge management system for facilitating information and experience sharing among stakeholders (EPA, 2013).

5.3 Coastal Area

A rise in seawater level along the coast in Liberia could cause saltwater intrusion into freshwater areas. Flooding is an obvious and immediate threat to economic growth, energy supply, roads and transport, food and agriculture, education, health, water and sanitation and social protection.

Settlements in coastal lowlands of Liberia are especially vulnerable to risks resulting from climate change; yet these lowlands are densely settled and growing rapidly (McGranahan *et al.,* 2007). For example, it is projected that about 95 km^2 of land in the coastal zone of Liberia will be inundated as a result of one-meter sea level rise, with about 50% (48 km^2) of the total land loss due to inundation being the sheltered coast. The Inundation will be followed by shoreline retreat (Wiles, 2005); yet the population of Monrovia continues to grow. The potential rise in sea levels could add to existing trends of coastal erosion in areas like Buchanan and Monrovia, with a loss in infrastructure and land of around $250 million apart from the social and psychological stress on the population (Tumbey, 2015; Wiles, 2005).

5.4 Water Resources

The bulk of the major hydrologic features of Liberia are constituted by several large lakes and six main rivers (Mano, St. Paul, Lofa, St. John, Cestos and Cavalla), which drain the country with north-south pattern. They drain 66% of the country. The short coastal watercourses drain about 3% of the country and include but not limited to the Po, Du, Timbo, Farmington, and Sinoe rivers. All of the six major rivers have considerable potential for hydroelectric power (Republic of Liberia, 2004). Prior to the civil war there were three operational hydroelectric power plants in Liberia: Harbel (Firestone), 4MW; Mount Coffee (LEC), 64MW; and Yandahun (a community micro hydro in Lofa County), 30KW. The Mount Coffee and Yandahun plants were destroyed during the war, but have both been made operational recently. A number of feasibility studies carried out over the period 1976-1983 identified at least 14 large scale schemes in over six rivers in the country (IBRD, 2012). It is highly likely that climate change could have impact on the realization of these schemes.

It is predicted that water will be the main channel through which people, ecosystems and economies, will feel the impacts of climate change although, predicting impacts on the availability and quality of freshwater resources, and water-dependent services and sanitation, remain difficult. This is due to the fact that while there is a high level of confidence in the processes linking emissions to warming, much less is known about how warming will manifest itself at the local level through changes in rainfall, runoff, groundwater recharge and climate extremes.

Intense precipitation could affect the water infrastructure, as the increased volumes of water overwhelm sewer systems and water treatment plants. This could also lead to an increase in the amount of runoff into rivers and lakes, washing sediment, nutrients, pollutants, trash, animal waste, and other materials into water supplies making them unusable, unsafe, or in need of water treatment, hence increasing cost for water purification to supply potable water to communities.

5.5 Fishery

Fishing provides 65% of the animal protein needs of the country and contributes around 3.2% to Liberia's GDP. In 1984, the last period for which any data is available, an acoustic survey of the country‘s marine resources indicated a total biomass (total fish resources) of about 800,000 metric tons consisting of pelagic 12 and

demersal 13 species. There have been no stock assessment surveys conducted in more than twenty years to determine the level of exploitation of the fisheries resources. However, Liberia‘s Bureau of National Fisheries (BNF) believes that the demersal species are under threat from over exploitation of both commercial and artisanal fisheries (USDA, 2013).

A study conducted to project climate change impacts in countries with different dependencies on marine fisheries, which included Liberia, linked models of physical, biological and human responses to climate change in 67 marine national exclusive economic zones (EEZ). This yield approximately 60% of global fish catches have projected that West African nations, including Liberia, may see increased production in their exclusive economic zones (EEZs) by 2050. However, they warned that if people living along the coast are to benefit from this increase in production, a key task would be to ensure that fisheries governance improves and that distant water fishing nations do not jeopardise local opportunities to benefit from increased productivity and the value of their fisheries. This does not translate to a lack of overall potentially negative impact on fisheries (Barange et al., 2014).

Climate induced changes in the biophysical characteristics in Liberia, along with extreme events, will have significant effects on the ecosystems which support fish (especially inland). This will affect food security in multiple ways. These include loss of some fish species due to extinction and low productivity to support local consumption, migration of many fish species to aquatic environments with optimal climatic condition beyond Liberian waters (those that are inaccessible to fishers), lower earnings from fish export due to reduced fish production, consequently reduced capacity to import food and exacerbation of food insecurity locally, and fisheries productivity and supplies (Barange et al., 2014; MoA, 2015). Hence, with the predicted increase in the demand for fish products, efforts to support food and livelihood security need to be informed by predictions of climate change impact in fish production and its associated social and economic consequences.

5.6 Energy

In 2004 it was estimated that 95% of the Liberian population depends on biomass, particularly on firewood and charcoal, for cooking and heating needs and on palm oil for lighting (MoLME, 2009[a]). Only 2% of the rural and 10% of the urban population have access to electricity through diesel generation (GoL, 2012). The use of modern energy sources like petroleum products and electricity generated through diesel is mainly limited to the economic sectors and transportation. Assessments have shown that despite the current domination of biomass for generation of energy and fossil fuel for electricity generation, Liberia has the potential to diversify its energy potential using its abundant renewable energy resources such as hydro power, biomass and solar power. For instance Liberia's six rivers (Mano, Saint Paul, Lofa, Saint John, Cestos and Cavalla) drain over 60% of the country’s area having potential for hydropower. That means Liberia needs to look into its abundant hydro sources for energy generation to increase resilience and mitigate emissions. However, having all this potential for modern and renewable source of energy, fuel wood and charcoal remain by far the most important energy source in the country (USDA, 2013).

The threat of climate change on the energy sector in Liberia can be explained in terms of its potential for infrastructural damage on power stations and power transmissions, as well as barrier to access biomass fuel sources which can be caused by sea level rise and flooding. This can also be explained in terms or the rise in temperature, particularly given that energy source in Liberia is less diversified and dominated by fossil fuel, charcoal and wood.

The Initial National Communication study conducted in 2013 demonstrated that there has been an average 14% annual growth in diesel and gasoline consumption since 2004. However, a 10.3% growth up to 2020 and a 3.4% growth between 2020 and 2028 are considered in this study. Hence, the current fossil fuel dominated energy generation in the country, though not considerable, is a source of GHG emission. The 2000 inventory showed that a total of 5,414 Gg CO_2e (67.5%) is emitted from the energy sector (not including LULUCF). That is why the Government of Liberia has taken the energy sector in its INDC as strategic option for mitigation together with the waste sector (Republic of Liberia, 2015). The unsustainable and dominant biomass use for fuel, particularly at household level, effects health through indoor pollution. The massive tropical rainforest clearing for making charcoal and for fire wood has also a great potential for the release of increasing GHG to the atmosphere although the fact shows that the LULUCF sector is a net sink (-96,811) (EPA, 2013[b]).

Therefore, the energy sector in Liberia is highly sensitive to and contributes to the changing climate. As a result, in order for the energy sector to be climate smart and, based on the long-term vision set in the Energy Policy "Make Liberia a carbon neutral country by 2050" and a vision for moving "Liberia's economy and social sectors forward on the basis of universal access to affordable, sustainable, and environmentally friendly modern energy services", it is vital to have adaptation, mitigation policy and strategy implemented.

5.7 Mining

Liberia's geological formation is dominated by Precambrian rock formations of the West African Craton, a rock formation from 2.7 to 3.4 billion years old. Metamorphosed rocks of the Liberian Province underlie the western two-thirds of Liberia. Metamorphites and granites of the Paleoproterozoic Eburnian Province, which constitutes the West African Shield that is made of granite, schist and gneiss, dominate the eastern part of Liberia. In Liberia this shield has been intensely folded and faulted and is interspersed with iron-bearing formations known as itabirites. The iron ore deposits of the Bong Range occur in the Liberian Province. Unmetamorphosed Paleozoic recent sediments occur along the coast (Hurley et al. 1971; Hadden, 2006).

Mining activities are widely distributed in geographic location although some minerals can occur in association with the others. Due to their widespread nature, climate change explained in terms of shift in rainfall and temperature and extreme events in weather and climate-like flood, affects the effectiveness and stability of the sector. It disrupts infrastructure, transport routes, environmental protection, site closure as well as water and energy supply (Julia N. & Ryan S., n.dD). The discovery of iron ore in Liberia in the late 1950s gave major boost to the country's economic growth. In the 1960s and 1970s, Liberia was one of the major largest exporters of iron ore. Several other types of unexplored minerals are also available in the country (http://www.focusafrica.gov.in/Sector_Profile_Liberia.html).

Mining activity in Liberia can be grouped into two major groups, and the challenges associated with it in relation to climate change aggravation are: 1) Industrial mining: which has major overlaps with protected areas/forest reserves causing siltation of dams and rivers, indiscriminate deforestation, ground and surface water pollution, dust pollution, water table depression, habitat fragmentation, depletion of wild resources, and land degradation; 2) Artisanal mining: which typically involve the digging of pits within alluvial river channels and excavating black sands that are associated with diamond-bearing gravels. MoLME estimates that there are over 100,000 artisanal miners operating in Liberia. FDA estimates that in Sapo National Park alone, there are over 6000 illegal artisanal miners. FDA also reports that illegal artisanal mining is taking place in nearly all of Liberia's protected areas. These miners have similar impact to the one indicated above under industrial mining (USAID, 2008).

Beach Sand mining is also one of the most serious threats to the coastline and marine environment in the country because of its unsustainable practice (UNDP, 2008). Nearly every coastal community has a sand pit but there are no estimates of the actual amount of sand being taken from the pits. At the beach mining site it is reported that the site was open (and busy) 24 hours per day. This situation is causing coastal erosion, shoreline recession and associated loss of land and shorefront properties (USAID, 2008).

Before 1990, the mineral sector contributed greater than 65 per cent of export earnings and approximately 25 per cent of GDP of the country. Following the civil war all the major mining fields were closed. The post-war reconstruction effort, however, put mining as one of the means to leap-frog the development effort of the New Liberia (MoLME, 2010). This effort, to be realistic, needs to consider the possible impact of climate change on the mining sector and the corresponding adaptation and mitigation strategies to be taken. The mining sector, to be climate-change smart, is important because, a) the critical inputs like energy and water can be easily affected by climate change, b) employees health can be at risk due to disease like malaria and extreme weathers, c) climate change exacerbated vulnerability will bring the mining sector in conflict with the local communities due to competition for resources such as water, d) increased risk will bring project financing to be less secured, and e) climate change will also cause physical damage on mining and communication infrastructure useful for transporting input to the mining plant and the products of the mining industry to the market (supply chain) (Julia and Ryan, n.d).

5.8 Industry

According to analysis made by Economy Watch, before the outbreak of the civil war, the country had an evolving rubber industry, which accounted for almost US $100 million in exports annually. The rubber and iron ore industries were the most exploited since they used to generate foreign currency. After the restoration of a democratic set up in 1997, the government took measures to reinstate the major industrial sectors. Even today the Liberian economy largely depends on agricultural productivity and the industrial sectors which contribute 5.4% to the country's GDP and employ almost 8% of the working population. The major Liberian industry sectors include mining and is agriculture based. (http://www.economywatch.com/world_economy/liberia/industry-sector-industries.html).

As in many agriculture-dominated developing countries, agro-industries and industries dependent on climate sensitive resources such as rain-fed agriculture, which are likely to be relatively of greater significance in Liberia as it constitutes the bulk of the economy. The current trend of climate change, which can be explained in terms of erratic rainfall and temperature condition linked with the interconnected nature of agro-industries and agriculture sector, will imply that industries whose input depends up on agriculture will continue to be severely affected by climate change.

In addition, the threat in sea level rise and overflow of water, which is currently affecting Liberia, is a big threat to the industrial sector by devastating industrial infrastructure, raw material supply and market routs. Adaptation strategies to the industrial sector in Liberia are therefore critical in this era of changing climate. In addition, Liberia in the long-term doesn't want to be locked into a carbon-based industrial economy. The country's contribution to GHG emission is currently inconsiderable. This is a good opportunity to design and grow the country's industrial base with low carbon emission and sustainable future in terms of energy use and technology.

5.9 Transport

A predicted rise in sea level, associated flooding and storm surges at a global scale is the most worrying phenomena particularly along the coast. The Intergovernmental Panel on Climate Change (IPCC) noted that in African coastal states “climate variability and change could result in low-lying lands being inundated, with resultant impacts on coastal settlements (high confidence)” (Center for Climate and Security, n.d).).

It is evident that a large portion of the road infrastructure, which is the dominant surface for transport network for Liberia is located in the populous area, located 40 miles of the coast. In this situation it is apparent that climate change is a big threat to the infrastructure, including the road network. The climate disasters occurred in 2007 and 2009 in Liberia and displaced thousands of people; and sea erosion, which resulted in devastation of several infrastructures including roads and airports, is to be mentioned (https://climateandsecurity.org/2014/08/19/liberias-rising-waters/). In turn, the transport sector is considered as one of the source of GHG emissions with regard to its energy use; and it is one of the key strategic intervention sector considered in the Liberian INDC, including using 5% palm oil biodiesel with gasoline and diesel which is expected to have 40% reduction in GHG emission (Republic of Liberia, 2015).

The Government of Liberia has put several initiatives in the transport sector through its National Transport Master Plan. In the Master Plan there is a recommendation of a roads rehabilitation and maintenance, road development and upgrading, expansion of public transport, enhancement of rail transport, the potential for coastal shipping, and the means to develop the air transport (Ministry of Transport and Ministry of Public Works, 2012).

Therefore, by integrating climate-smart principles together with the National Transport Master Plan, it becomes critical to lift the adaptation capacity of the existing road and other transport infrastructures from the current high level of vulnerability so that the new transport designs and the rehabilitation and maintenance effort become climate smart, which will efficiently contribute to the development vision of the country.

5.10 Tourism

Climate is a principal source of tourism as it codetermines the suitability of locations for wide range of touristic activities (UNEP, 2008). On the other hand extreme weather conditions like flood, heat wave, storms, and tropical cyclones will affect the tourism industry through infrastructural damage, additional emergency preparedness requirements, climate induced vector-borne diseases, business interruptions, etc. It is also possible to mitigate the carbon emission from the tourism sector through mainly change in behavior of tourists, e.g., using non-motorized transport such as bicycles and change in technology and market mechanism.

Tourism industry is one of the untapped sector in Liberia although there are many tourist attractions which vary from pleasing natural tropical rainforest and the mangrove forest in which we find unique and diverse species of fauna and flora endemic to Liberia. The country can also multiply scenes like the Sapo National Park for attraction of domestic and international tourism. Liberia has also immense potential of tourism including but not limited to game hunting, boat riding, watching waterfalls (like the one at Kpatawee Waterfalls), fishing on the rivers as well as a beautiful scene, the possibility of expanding beach resort along the 350 miles coastal length, and the beautiful islands. In general, the diverse physical and cultural landscapes of the country can serve as a means to boost sustainable development of the country.

In the face of all these opportunities, climate change has been an obstacle for the development of the tourism sector through degradation of ecosystems and infrastructure, which results in change in tourists' preference as a holiday destination (Maria B. et. al, 2006). Therefore, building resilience to climate change in the tourism sector enables maximized benefits to be obtained from the sector (UNEP, 2008).

5.11 Infrastructure

Currently Liberia's infrastructure capacity for basic social services is low and highly vulnerable to climate change. In 2005, it was projected that a rise in sea level by 1 m, would cause a loss of about 95 km^2 of the estimated 565-km long coastline (due to inundation); and 50% of the area inundated (48km^2) will be areas with settlement such as parts of the capital city of Monrovia, West Point, New Kru Town, River Cess, Buchanan, and Robertsport, which are less than 1 m above mean sea level (Wiles, 2005). This was projected to result in a loss in infrastructure and land of around $250 million apart from the social and psychological stress to the population, with women and children being particularly vulnerable. The sea level rise could also inundate the seaward portions of the remaining mangrove wetlands which provide critical ecosystem services along the coast (WILES, 2005). Currently, sea level rise and coastal erosion has heavily impacted on communities like West Point, New Kru Town, Sinkor and Virginia, putting major infrastructures such as the JFK Kennedy Hospital, D. Tweh High School and the Hotel Africa at risk.

5.12 Urbanization and Settlement

Liberia's population, with growth rate of 2.1% (LISGIS, 2008) and economy coupled with a high level of urbanization has the potential to exert pressure on available resources (basic services, infrastructure, and jobs). In 2015 Liberia's urban population was projected at 49.7%. Between 2010-2015, the urban population growth rate (average annual %) for Liberia was put at 3.4% (UNDATA, 2016). The environmental and social conditions resulting from the country's growth, together with increased competition over resources, may intensify the country's vulnerability to climate risks. Sea level rise has resulted in increased rates of inundation, storm surges, erosion and other coastal hazards that are threatening coastal settlement, resulting in loss in infrastructure and involuntary migration in communities like West Point and Buchanan. This involuntary settlement in Liberia has also aggravated abrupt urban slum settlements along the coastal zones by people whose previous settlement is inundated by seawater or coastal degradation (Personal interview and visual observation). This situation has in turn aggravated urban problems such as problem of waste management, shortage of social services such as water, sanitation, education, health, etc. as the case is in West Point, Buchanan and other areas.

5.13 Health

The Climate Change and Gender Action Plan notes that average temperature across the country has been rising and will continue to do so, creating incidence of pests. It also notes that with low health standards the correlation between temperature and waterborne diseases and the spread of malaria is an issue for concern. The population of disease-carrying mosquitoes will be boosted and will result in increased malaria epidemics, which already accounts for more than 30% of Liberian deaths (UNICEF, 2013).

Climate change could alter or disrupt natural systems, making it possible for diseases to spread. This includes those caused by water-borne pathogens (such as cholera) as well as those caused by vector-borne diseases (such as malaria, onchocerciasis and schistosomiasis). In addition, vector-borne diseases which have aquatic phases and changes in the pattern of rainfall – and subsequent habitat change – will therefore also affect their epidemiology. Other climate-sensitive diseases of concern to the country include respiratory disease (such as tuberculosis) and disease associated with, or exacerbated by, malnutrition (such as HIV/AIDS) (EPA, 2013[b]).

Liberia has set a target of becoming a middle-income country by 2030 (Republic of Liberia, 2012), and the health and social welfare of the population is critically important in achieving that goal (Ministry of Health and Social Welfare, 2007).

6. Response Measures Being Undertaken

The EPA is the institution responsible for the implementation of international environment treaties to which Liberia is a Part (including UNFCCC). Representatives of EPA also perform the function of the GEF Political and Operational Focal Points, as well as UNFCCC Focal Point. Within the EPA there is a Climate Change Enabling Unit, which is responsible for activities related to preparation of National Communications, Biennial Update Reports, and National Inventory Reports of the Republic of Liberia under the UNFCCC. The Unit is also responsible for monitoring climate-change related activities/projects and their execution on behalf of the EPA.

In 2008, Liberia completed its National Adaptation Programme of Action (NAPA) with technical support and funding from the GEF and UNDP. The preparation of NAPA was guided by existing national development plans such as the National Reconstruction and Development Plan (NRDP), the National Biodiversity and Strategy Action Plan (NBSAP) and the Millennium Development Goals (MDGs). The findings of the NAPA studies revealed that Liberia was faced with the issues of climate variability and extreme events which were having a negative impact on agriculture and socio-economic development, leaving the rural poor (particularly women) at high risk. Several adaptation measures were formulated by the stakeholders as adaptation measures to reduce the impact of climate change variability and extreme climate events in Liberia. The key adaptation needs of the NAPA were aligned along the sectors of agriculture, forest and wetland ecosystem, health, energy, meteorology/hydrology and fisheries.

The NAPA process identified several projects and urgent adaptation needs using multi-criteria analysis, which were validated at a stakeholder's forum. Based on multi-criteria analysis, three projects were selected as the most urgent priority needs of the country. These projects, given by priority rank within the NAPA, are described below:

- *Agriculture adaptation:* enhancing resilience to increasing rainfall variability through the diversification of crop cultivation and small ruminants rearing;
- *A National Meteorological and Hydrological Monitoring System:* enhance adaptive capacity through the rebuilding of the national hydro-meteorological monitoring system and improved networking for the measurement of climate parameters;
- *Coastal Defence:* reducing the vulnerability of coastal urban areas (Monrovia, Buchanan, and Robertsport) to erosion, floods, siltation, and degraded landscapes.

The Climate Change Agriculture Adaptation Project (CCAAP), with the intention of introducing climate smart agriculture, was executed by the Ministry of Agriculture from September 2011-2015 with support and funding from the GEF, UNDP, and Government of Liberia's in-kind contribution. The project was intended to increase resilience and enhance adaptive capacity to address the additional risks posed by climate change in the agriculture sector and provide the conduit through which agriculture adaptation can be implemented in Liberia. The project was designed to achieve the following expected outcomes:

- Integrating concerns into relevant policies and planning processes at the state and national levels;

- Comprehensive capacity development for individuals in national agencies, focusing on agriculture in pilot counties and farmers;
- Demonstration of risk reduction strategies and measures at pilot sites;
- Strengthening of technical capacity to integrate climate change risk management into farmer level agricultural capacity, and
  Capturing and disseminating lessons learned to key stakeholders

The Government of Liberia also developed the Liberia Agriculture Sector Investment Program (LASIP). This program expresses Liberia's strategic choices for the growth and development of agricultural in an environmentally friendly and sustainable manner over a period of 10 years (beginning 2011). LASIP is geared toward food security, public and private sector investment in the agriculture sector, promoting the use of technology and innovation by local farmers. It has 5 priority programs:

- Food and Nutrition Security;
- Competitive Value Chains and Market Linkages;
- Institutional Development;
- Land and Water Development; and
- Cross-Cutting Issues (Gender & Environment).

The National Meteorological Monitoring System (Early Warning System) project of Liberia is being executed by the Ministry of Transport with funding from the GEF under the Least Developed Countries Fund. The project was launched on January 22, 2014 and its installation is expected to be completed by 2017. This system will provide farmers and extension officers in the pilot project sites with real time climate information (rainfall, temperature, sunshine etc.) that can assist them in planning agricultural activities and measures intended to adapt to climate variability and extreme events like flooding or drought.

The coastal defence project, executed by the Ministry of Lands, Mines & Energy was designed with the objective to strengthen national capacities in reducing the incidence of floods, erosion, siltation and degraded landscape in the cities of Monrovia and Buchanan. Though ranked 3rd under the NAPA, the project was given priority due to the increasing threat of sea erosion to the shorelines of coastal cities. It was implemented with funding from the GEF, under the Least Developed Countries Fund. The coastal defence project was launched for the Construction of a Break Water System in Buchanan (Walvis Bay, Robert Street and Port of Buchanan) in January 2012 and due for completion by 2016. At the moment the project has realize the consolidation of 500m of coastline in the coastal city of Buchanan and put in place a mechanism for the establishment of an Integrated Coastal Zone Management Unit at the Ministry of Lands, Mines & Energy (MLME). The climate change agriculture adaptation project has also been concluded pending a terminal evaluation of its outcome. The early warning project at the Ministry of Transport is due to be completed in 2017. It is expected to increase the capacity of hydro-meteorological services and associated networks to monitor and predict extreme weather, climate-related hazards and climate trends, efficient and effective use of tailored climate, environmental and socio-economic data. This will produce appropriate information which can be communicated to government entities and communities to enable informed decision-making, increase awareness in government, private sector and local communities of the major risks associated with climate change, and use of available information when formulating development policies and strategies.

A National Adaptation Plan (NAP) is currently being developed as a means of identifying Liberia's medium and long-term adaptation needs. Additionally, the Government of Liberia (GoL) through the Environmental Protection Agency is working in collaboration with UNDP to develop a climate change adaptation Project proposal. A team comprising of staff from UNDP, GoL and experts are leading the project formulation process. This proposal aims to build/strengthen national and community-level structure capacities in the Greater Monrovia Metropolitan Area for Disaster Risk and climate change impacts in the wake of the potential threat of increasingly intense extreme events like drought, windstorm, flooding and heavy rainfall etc. This will also determine the social and economic costs of these impacts and their impediments to the country's development now and in the future.

Moreover, the government also developed an Integrated Water Resource Management Policy in 2007 to ensure the supply of adequate quantity and quality of water for domestic water use, food production and for other uses.

In view of this effort, for future adaptation effort to be effective it should consider the implementation of 8 elements in combination, which are also considered in the design of this policy and Response Strategy (Figure 3).

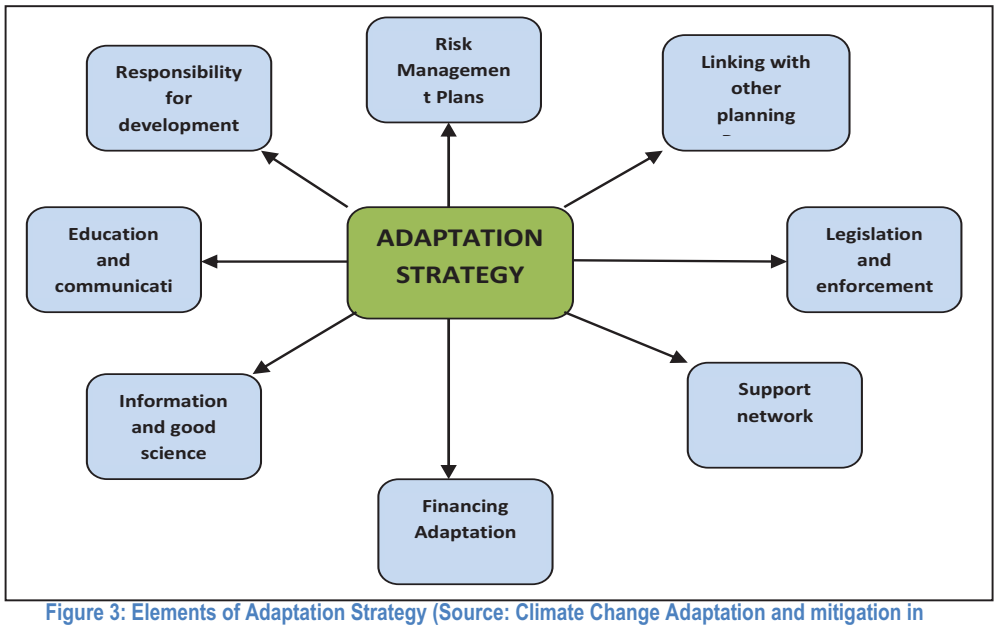

Figure 3: Elements of Adaptation Strategy (Source: Climate Change Adaptation and mitigation in Tourism Sector, UNEP 2008)

7. Strategic Focus

In view of Liberia's position as a Least Developed Country with high vulnerability to adverse impacts of climate change, adaptation effort is the main focus of this policy document. Accordingly, the vulnerabilities of various sectors to climate change have been highlighted and appropriate adaptation measures have been spelled out. Notwithstanding the policy and response strategy recognizes the Principle of Common but Differentiated Responsibilities in the context of the UNFCCC and Liberia's INDC commitments toward mitigation. To this end, there is also a focus on mitigation that seeks to reduce emissions, particularly from forests (REDD+), and the

development of alternative clean energy sources and fuels at the lowest cost to reduce greenhouse gas emissions.

This policy highlights the need for international cooperation and support, enhancing awareness and understanding, promoting technology development and innovation, promoting partnership between government, communities and the private sector, and encouraging sustainable development in the key sectors such as agricultural, forestry, power, and transportation.

7.1 Vision

A climate resilient low carbon nation that responds to climate change while equally addressing its national development priorities in a sustainable and equitable way.

7.2 Mission

The strengthening of national institutions, communities and initiatives so that they have strong capacity for adaptation, disaster risk reduction and mitigation, which can contribute to increased resilience and achievement of national development agenda and sustainable development goals of Liberia.

7.3 Objectives

The Climate Change Policy and Response Strategy seek:

- To strengthen coordination for the implementation of the national policy between the government and all stakeholders;
- To create an overarching framework for the integration of climate considerations and to support the implementation of Liberia's national development strategy as well as other regional and international policies and frameworks;
- To enhance pro-poor and gender sensitive adaptation while also promoting mitigation at the national and local levels, to the extent possible in a cost-effective manner amidst the challenges and constraints posed by climate change;
- To provide guidance to the efforts of government in ensuring that the country achieves benefits from clean and renewable energy, energy efficiency and mitigation technologies that enhances the livelihoods of the people and promotes the national economy, while contributing to the global efforts to reduce GHG emissions and global warming;
- To ensure that development at the national and local levels are environmentally sustainable;
- To promote awareness on climate change and its impact on the country and to enhance the skill and institutional capacity of relevant stakeholders; and
- To promote the conservation of the nation's rich biodiversity and natural resources so that they benefit the present and future generations.

8. Interventions

8.1 Adaptation

Analysis of the adaptation strategies uses the Adaptation Policy Framework (APF). Under the APF, there are four major principles that provide the basis from which integrated actions to adapt to climate change can be developed.

- Adaptation to short-term climate variability and extreme events to serve as a starting point for reducing vulnerability to longer-term climate change;
- Adaptation at different levels in society, including the local level;
- Adaptation policy and measures have been assessed in a development context; and
- The adaptation strategy and the stakeholder process by which it is implemented are given equal importance.

Based on this framework and the eight elements of adaptation strategy shown in Figure 3 section 6, the key sectors identified and their corresponding adaptation policy and strategies formulated are explained below:

8.1.1 Forestry and Wildlife

Policy Statement: Using the '3 Cs' approach' as the basis for sustainable forest management ensures that forests and wildlife be considered when planning adaptation policies and practices in areas of the economy beyond forestry and wildlife. It also defines and implement measures for reducing the negative impact of climate change on the forest and wildlife. To realize this the following strategies are put in place.

Strategies:

- Implement sustainable and, where applicable, alternative livelihood initiatives for forest-dependent communities, to enable them to become less reliant on forest resources or to be able to use them in a sustainable way.
- Promote community forests activities beyond timber extraction as a management tool for sustainable forest management, using indigenous species and knowledge.
- Establish a comprehensive monitoring system for forest resources by building on existing system (including non-timber forest products) to detect changes in the conditions of the ecosystem that might affect these resources and other ecosystem services provided by forests.
- Implement reforestation and afforestation activities to increase vegetation cover, to improve ecosystem services in degraded areas, to increase rural income, and to improve biodiversity richness including wild fauna.
- Enhance the management and conservation of forest biodiversity, focused on preventing perturbations such as fire, invasive species, insects and diseases through including the adoption of a strategic approach to communication that clearly outlines the cost and benefits of various actions affecting forests.
- Strengthen and/or implement reforestation and afforestation activities to increase vegetation cover, improve ecosystem services in degraded areas, increase rural income, and improve biodiversity richness, Identify and map for proper management water catchment areas, valuable to communities, in the forests.
- Promote consolidation of the protected area network by considering landscape approach and ensuring that it consists of a large spectrum of forest types across various environmental gradients to enhance connectivity between habitats and support species migration.
- Establish and/or strengthen coordination mechanisms with other line ministries and agencies that might be implementing activities that affect forest and wildlife and to ensure that the principle of sustainable forest and wildlife management is mainstreamed in national and sectorial policies and programs.
- Enforce regulations related to illicit hunting, eliminate poaching and developing and implementing an environmental 'Code of Ethics' in the wildlife sector.

- Put in place health facilities for wildlife in hotspot areas[2].
- Develop and implement a communication strategy to increase the awareness of relevant stakeholders, particularly forest dependent communities, about the impact of climate change and how they can take action to adapt to these changes.

8.1.2 Agriculture

Policy Statement: Reduce the vulnerability of agricultural systems to risks related to climate change through direct and indirect support to farmers, including the setting up of a robust monitoring system to detect early changes that will affect agriculture production.

Strategies:

- Improve the effectiveness of pest, disease and weed management practices through the wider use of integrated pest and pathogen management, development, and the use of varieties and species resistant to pests and diseases, and improving quarantine capabilities and monitoring programs.
- Assess crops vulnerability and suitability (cropping pattern) for different Agro-ecological zones.
- Enhance climate proof agro-infrastructural systems (input, output, marketing, post- harvest technologies and infrastructure including storage) that strengthen the capacity of farmers to increase resilience and productivity.
- Build and strengthen the capacity of extension officers in new sustainable farming and livestock raising technologies, in order to enhance their support for farmers.
- Support communities in livestock and crop sectors through inventory and dissemination of indigenous knowledge, establishing and/or strengthening insurance scheme, early warning and early action system, vaccination campaign, disease control, etc., to cope with the stress based on climate variability.
- Set up seed banks to collect different varieties of crops in order to preserve local diversity and provide farmers with the opportunity of making informed choices based on suitability.
- Develop and introduce a diverse range of integrated soil fertility management (IFSM) techniques to farmers as a sustainable means of improving soil fertility, and intensifying agricultural production.
- Promote wider use of appropriate technologies and work with communities to harvest water and discourage the burning of organic residues on the soil surface, in order to prevent soil erosion, water logging and nutrients leaching in increased rainfall scenarios; and to preserve soil moisture in drier rainfall scenarios.
- Support farmers to diversify their income through integrating farming activities with other income generation activities such as sustainable livestock raising, bee harvesting, rabbit, poultry, guinea fowl, etc.
- Encourage farmers to engage adaptation measures as well as coping strategies such as intercropping, irrigation, aquaculture, and the use of climate resilient plant varieties so as to create resilience to the shocks of climate change.
- Ensure technologies and methodologies promoted to farmers through agricultural programs are cognizant of different socio-economic levels (e.g., pro-poor) and are gender sensitive.

[2] Intervention to be implemented in integration with 'health' sector.

- Develop a communication strategy to increase farmers' awareness of climate change and strengthen the coordination of existing structures and institutions that are available to help them adapt to its impact and ensuring the mainstreaming of climate change in their sectorial planning.

8.1.3 Coastal Area

Policy Statement: Ensure the protection of Liberia's 350 miles coastline

Strategies:

- Develop management plan for coastal areas to ensure their continuous functioning and availability.
- Set up early warning systems and educational program, especially for people living along the coast.
- Promote disaster risk management in general (especially disaster preparedness) and protective infrastructure (e.g. seawalls and flood reservoirs) to protect against rising sea level.
- Support the rehabilitation and protection of wetlands and mangroves or manage retreat where it occurs for the primary purpose of buffering coastal communities from storm surge and coastal erosion.
- Establish mechanisms for coastal erosion control and promoting alternative sources and technologies to enhance water availability.
- Climate proofing and enhancing of infrastructures (roads, sewers, water supplies and other infrastructure) in coastal settlements (particularly from Robertsport to Harper) and rural areas to protect continuous access to livelihoods, health care and education.
- Engage with communities along the coast to participate in actions aimed at protecting the coast and ensuring its continuous viability.
- Investigate the suitability and, where possible, implement the living shorelines approach (LSA), which uses natural vegetation, sand and some rocks to protect shorelines and habitat.
- Design and implement a strategic communication action plan to inform and educate people about changes and challenges associated with coastal areas related to climate change and how they can adapt to cope with these changes and challenges.

8.1.4 Water Resources

Policy Statement: Ensure the continuous availability of critical water resources that are important for domestic, agricultural, energy, and recreational purposes.

Strategies:

- Develop a management plan for water resources to ensure their continuous functioning and availability.
- Support the protection of river catchments and other sources of freshwater, including aquifers, to secure a steady supply of freshwater across all sectors and communities; and to facilitate and promote water recycling, reuse and efficiency for the same purpose.
- Conduct water resources, vulnerability assessment, mapping, documentation and dissemination of necessary information to stakeholders.
- Increase urban and rural domestic water supplies and urban sewage services to help combat water-borne diseases and their social and economic impacts.

- Mainstream climate change in all water resources (coastal water, fresh water sources including aquifers) management plans and programs to secure environmental safety and sustainable fresh water supply.
- Design and implement a strategic communication action plan to inform and educate people about changes and challenges associated with water resources which relate to climate change and how they can adapt to cope with these changes and challenges.

8.1.5 Fishery

Policy Statement: Recognizing the importance of fishery as a major contributor to food supply, food security and livelihoods, adopt policies and programmes that maintain and protect the integrity of Liberia's fishery sector.

Strategies:

- Investment and support for artisanal fishery communities, including training, fishing gears and alternative livelihood.
- Set up a robust monitoring, reporting and verification system that captures and reports in a timely and accurate manner changes in the stock, productivity, and pressure on fisheries.
- Use the precautionary principle as a cue, use information from monitoring to implement adaptive management practices that set catch limits based on changes in recruitment, growth, survival and reproductive success.
- Conduct research to fully understand fishing pressures and adjust quotas to sustainable levels, as well as into predicting where fish populations will move; finding species resistance to salinity and temperature fluctuations for aquaculture and, where necessary, support selective breeding for increased resilience in aquaculture.
- Support the protection and restoration of mangroves, recognizing their role as an important habitat for aquatic species, which contributes to biodiversity and increased food product availability for household consumption and resources for local markets, as well as providing water filtration services[3].
- Identify and protect areas valuable for fisheries (e.g. deep pools in river systems that serve as spawning areas), including the setting up of marine protected areas and encouraging native aquaculture species to reduce impacts.
- Put in place or strengthen a system to reduce external stressors on fisheries by instituting changes in vessel or gear types in order to reduce pressure on fishery and to contribute to their sustainable harvesting, as well as instituting actions and regulatory measures to reduce land-based sources of pollution (e.g. agricultural and urban runoff) and destructive fishing practices (e.g. fishing with explosives and poisons).
- Integrate fisheries fully into climate change adaptation and food security policies at the national level (draft and enact where non-existent) to ensure incorporation into broader development planning.
- Support the diversification of the livelihood portfolio of communities that are fishery dependent.

[3] Intervention addressed under "coastal and water" sector

- Establish improved information and communication networks for decision making and planning, as well as between fishing communities, to support information sharing about potential shocks in the system.

8.1.6 Energy

Policy Statement: moving Liberia's economy and social sectors forward on the basis of universal access to affordable, sustainable, and environmentally friendly modern energy services.

Strategies:

- Promote diversification of energy sources including renewable energy sources.
- Promote the development and use of affordable energy-efficient technologies.
- Promote and implement energy plantation schemes to minimize pressure on natural forest and reduce energy stress.
- Introduce and promote a system for sustainable use of biomass energy.
- Promote and support the development and utilization of community-based off-grids/ mini-grids.
- Conserve water catchments for sustainable production of hydropower sources.
- Ensure the incorporation of renewable and low carbon energy technology promotion in sectorial and national development planning.

8.1.7 Mining

Policy Statement: Ensure that climate change adaptation principles are integrated in the mining sector so that climate stressor scenarios on mining, as well as its exacerbation effect on climate change, will be minimized. In doing so sustainable mining which contributes to the sustainable development of the country will be promoted. To realize this the following strategies are identified.

Strategies:

- Put in place a mechanism to ensure new designs and engineering standards to consider the current and future changing climate and periodic review of the design basis for updated climate compatible designs to be in place.
- Design and implement a procedure to reinforce assets or amend design standards or the frequency of maintenance and monitoring of assets to withstand current and future climate conditions (e. g., storm surge, sea level rise, higher temperatures, and heavy rainfall incidents).
- Design a procedure to relocate or raise assets and operations outside of high-risk areas (e. g., flood plains, and coastal areas).
- Incorporate biodiversity management programs in mining sector during mining planning so as to enhance ecosystem services like water, which are critical for mining sector.
- Retain or restore natural buffers in coastal and river environments to increase resilience against flooding, erosion, storm surge and other extreme weather events that may cause damage on infrastructure and assets useful for the mining sector.[4]
- Put in place a procedure to ensure community engagement, from planning to implementation, of mining sector to overcome and meet growing community concerns over climate change and

[4] Its Strategic intervention is integrated with "ocean and water" sector.

environmental issues due to the establishment of mining projects (e. g., the use of polluting energy sources, conflict over water usage particularly in metal mining which needs abundant water).

- Design and implement environmental health and safety programs in the mining sector.
- Introduce disaster management and disease prevention policies, procedures and assessment at national and corporate level.
- Ensure the incorporation of climate change-related considerations into existing mining sector policies and programs, and monitoring of system components in mining sector (e.g: tracking maintenance and repair records to assess the impacts from historical extreme events or more gradual effects).

8.1.8 Industry

Policy Statement: Incorporate climate change considerations in industrial sector planning so that the manufacturing industries sector will be resilient to climate chocks emanated from energy, resources and infrastructure needs as well as physical damage.

Strategies:

- Promote a policy on the use of diversified and integrated energy sources for industrial use.
- Incorporate a procedure for the establishment of energy management systems in industry sector.
- Promote appropriate spatial planning for industrial locations and zoning in the context of climate change.
- Introduce and promoting climate insurance schemes in industrial establishments.
  Promote sustainable small-scale energy installations in rural areas.
- Put in place a system to regularly assess vulnerability of industrial sector.
- Put in place integrated water resource management and planning[5].

8.1.9 Transport

Policy Statement: Ensure the development of a efficient, effective and affordable transportation system that is resilient to the possible shocks of climate change and which contributes to the sustainable development of the country.

Strategies:

- Ensure the mainstreaming of climate change considerations in the national transport policies and programs.
- Establish and gradually improving systems for rapid transportation.
- Promote the use of mass transport facilities.
- Put in place a system for proper urban transport planning to facilitate efficient and low GHG modes of transportation.
- Promote multiple modes in public transport to include water and rail.
- Promote the use of non-motorized transport like bicycle.
- Promote fuel switch in transport facilities.

[5] Its strategic intervention is addressed with “ocean and water sector”.

8.1.10 Tourism

Policy Statement: Develop and implement culture and tourism development programs that are resilient and responsive to the challenges caused by climate change.

Strategies:

- Promote ecotourism, conservation and payment for Ecosystem Services (PES) that involve local communities targeted at biodiversity conservation, community benefit (pro-poor and gender sensitive), and that minimize illegal poaching.
- Promote awareness creation to build knowledge of the impact of culture and tourism, and simple procedures to adopt for adaptation (ecotourism).
- Develop and implementing an environmental 'Code of Ethics' in the tourism sector.
- Enhance vegetal cover in tourist sites through afforestation and ecosystem enrichment[6].
- Establish capacity building scheme in analyzing and using weather and weather-related information as well as monitoring the effectiveness of climate change responses in the sector.
- Establish a system and standard to ensure that tourist infrastructures (sittings, buildings, etc) are adaptable to extreme weather events (e.g., for hurricane force winds).
- Design and implementing efficient and effective disaster management and preparedness plan for tourist sites as well as redirecting clients away from impacted destinations.
- Put in place health facilities for human in touristic areas[7].

8.1.11 Infrastructure

Policy Statement: Ensure that our infrastructure is 'climate-proof'

Strategies:

- Ensure climate resilience in the infrastructure sector, including improved use of weather and climate information in infrastructure planning and development, and research to identify and designs materials that enhance the resilience of infrastructure.
- Amidst the increasing wave of sea erosion along the coast, higher tides and more frequent storm surge events, there is a need to redesign the coastal highways, bridges, sewer and water infrastructure so that they are made resilient.
- Regulations and codes should be revised or developed where necessary to account for climate change impacts. Major infrastructure projects such as roads, airports and sea ports should be subjected to climate risk screening as part of the planning process.
- Reduce damage to infrastructure and the environment, and lessen the risk to human health and wellbeing by developing land-use policies and emergency response measures that account for sea-level rise when planning and building infrastructure.
- Regulate development in coastal areas; prevent construction in areas of known vulnerability, and protect coastlines at critical sites in order to mitigate the risk to coastal communities.
- Employ significant investment in building coastal protection including eco-based solutions (planting of trees) and hard structures (grooynes, revetments, etc) in coastal cities like Monrovia, Buchanan, Robertsport, Greenville, Harper, Cestos and Grandcess.

[6] Intervention to be implemented in integration with 'forest' sector.

[7] Intervention to be implemented in integration with 'health' sector.

- As a last resort, relocate communities that are at extreme risks due to flooding and coastal erosion.

8.1.12 Urbanization and settlement

Policy Statement: Develop a comprehensive land-use plan to achieve sustainability in urbanization and settlement developments in order to adapt to climate.

Strategies:

- Conduct assessment for hazard mapping, risk reduction and vulnerability of urban settlements in erosion and flood-prone areas and sites of national economic priority. Plan and implement adaptation actions in those areas.
- Incorporate nationally appropriate low emission strategies and technologies having adaptation co-benefits and appropriate adaptive strategies in human settlement, land use planning, and urban development.
- Promote incentives for commercial and public buildings to use energy efficient lighting and appliances such as solar water where water heating is necessary.
- Develop and support for improved water supply and waste management systems for cities that include recycling facilities and landfills with methane recovery for electricity generation.
- Make installations of wastewater treatment plants an integral part of all sewerage schemes. Ensure separate collection, disposal and re-use of recyclable, composite and biodegradable waste preferably at source.
- Monitor rural-to-urban migration and develop infrastructure and support facilities in smaller agro-based towns and periphery urban areas in order to reverse rural-urban migration[8].
- Develop and implement proper "spatial Land Use Planning" which considers existing and predictions of climate change, and which encourages vertical instead of horizontal expansion of urban housing projects.
- Regulate industrial development in urban designated areas through land use planning.
- Improve the management of coastal zones including the rehabilitation and conservation of vital coastal ecosystems such as wetlands and the mangroves they support through the development of an Integrated Coastal Zone Management Plan, a National Disaster Risk Management Response Plan and implement the National Environment Action Plan.[9]

8.1.13 Health

Policy Statement: Strengthen the capacity of the health infrastructure and systems to achieve the objectives of the National Health and Social Welfare Policy and Plan, the Public Health Law and the SDGs 3 (good health) in the face of climate change and its risks.

Strategies:

- Integrate climate change considerations into existing health policies and strategies, taking into account gender-differentiated impacts and responses.

[8]Intervention to be implemented in integration with' infrastructure' sector..

[9] Intervention to be implemented in integration with "coastal, water and fishery" sector.

- Strengthen the integrated disease surveillance response systems and the emergency preparedness to prevent, mitigate, and respond to climate induced epidemics.
- Strengthen preventive measures to restrict preventable disease transmission.
- Develop early warning systems for climate-driven infectious diseases.
- Improved community-level health care and the dissemination of information on changing health risks to enhance the response to climate-related diseases.
- Increased access to safe water in order to improve disease vector control[10].
- Conduct research on health vulnerability and impact, and develop scenarios to facilitate adequate planning.
- In a low carbon action, promote the use of water filters that provide access to clean water while reducing demand for firewood used to boil water and therefore slowing deforestation.
- Conduct periodic health Impact assessments on proposed mitigation and adaptation strategies to determine impacts on vulnerable populations and cumulative health impacts.

8.2 Mitigation

While Liberia's contribution to the pool of global emissions is relatively negligible, the country has committed over the years to ensuring that its potential as carbon sink is utilized adequately. This is evident in the National *Forest* Reform Law of *Liberia* which requires *setting aside* at least *30%* of *Liberia's* total *forest* area for conservation. Liberia's emission sources include Agriculture (swidden farming practice, large concessions within forested areas), waste disposal activities, energy sources (fuel wood, charcoal, & fossil fuel), and the transportation system. The Government has also committed, through several national programs, towards reducing emission levels. The national readiness program under REDD+, the sustainable agriculture programs to discourage the use of more forest land (shifting cultivation), commissioning of a low carbon economy study, etc. are national initiatives that demonstrate the government's desire and aspiration towards mitigating climate change. This section provides the policy directions and the corresponding strategies in the identified sectors through which the government will engage its partners and citizens in mitigating the impacts of climate change. The sectors identified below in the mitigation interventions are forestry and wildlife, agriculture, energy, mining, industry, transport, tourism, and waste.

8.2.1 Forestry and Wildlife

Policy Statement: Significantly enhance Liberia's potential for carbon sequestration by promoting conservation, sustainable forest management, community forestry and curbing, key drivers of deforestation and forest degradation, which in turn will contribute to sustainable wildlife management.

Strategies:

- Promote the development of REDD+ activities across Liberian forest landscapes.
- Provide adequate and sustainable support for conservation and engage nationally for increment in the number of areas set aside as protected areas within forested landscape.
- Build a national carbon registry and accounting system as well as clarify the issues of carbon rights, ownerships, and tenure.

[10] Intervention to be implemented in integration with water sector.

- Provide adequate regulation and enforcement of current and future national forest management law and policies which address drivers deforestation and forest degradation as well as wildlife degradation.
- Adopt fiscal and regulatory measures to reduce unsustainable wood utilization, particularly in constructions and charcoal production.
- Promote activities which enhance carbon density, such as reforestation, afforestation and agroforestry initiatives across the country, which also brings benefits to reduce the stress and pressure on natural forest and ecosystems.
- Develop and facilitate the adequate management of community forests by strengthening forest governance and institutions, including wildlife, to ensure better stewardship.
- Increase capacity building programs and monitoring capabilities to minimize degradation or impacts to forest areas and wildlife by nearby communities and other external economic agents.
- Ensure the sustainable use of forest and wildlife resources to contribute to the livelihoods of the rural communities as they adapt to climate change, and to contribute also to mitigation.

8.2.2 Agriculture

Policy Statement: Move towards a sustainable agricultural system by encouraging lowland farming, investing in smallholder agriculture and allowing large-scale concessions on degraded land to avoid and reduce national emissions levels.

Strategies:

- Support and encourage farmers towards lowland farming by providing tools, training on soil management, integrated pest management and production of organic fertilizer, and seeds adapted for lowland framing to farmers.
- Reduce the traditional approach of shifting cultivation or swidden agriculture by the introduction of diverse Integrated Soil Fertility Management (IFSM) practices, inclusive of Conservation Agriculture, agroforestry, Integrated Pest Management (IPM), organic fertilizer preparation that maximize returns on labor and/or inputs (e.g. fertilizers, seeds, pesticides).
- Provide support and enhance farmer field school groups to ensure adequate coordination and learning of sustainable agriculture which can later be used as a base to form cooperatives.
- Develop measures and policies for use of degraded land by agricultural concessionaires in order to reduce impacts and pressure on forest lands, which in turns will increase the country's carbon sink potential and reduce emission level.
- Enhance and properly coordinate the management of agricultural wastes.
- Reduce the contribution of agriculture to GHG emission while improving its role as a carbon sink.

8.2.3 Energy

Policy Statement: Improve Liberia's economy and social sectors toward universal access to affordable, sustainable, and environmentally friendly low carbon energy services.

Strategies:

- Promote exploration of renewable energy sources and enhance the mix of renewable energy share in the national grid and off-grid.
- Put in place a system to enhance off-grid power supply to rural areas with additional objective of reducing deforestation.

- Promote diversification of energy sources.
- Identify, promote and support the use of energy-efficient and low carbon as well as green energy technologies and practices, including the efficient use of domestic appliances.
- Put in place an incentive mechanism to strengthen the participation of private the sector in the production and use of clean energy through including public private partnership (PPP).
- Introduce affordable waste-to-energy technologies such as methane captured from urban waste dumps.
- Introduce and encourage energy conservation practices in various sectors.

8.2.4 Mining

Policy Statement: Ensure that mining the sector in Liberia develops in an environmentally sustainable manner by gradually mixing the use of low emission energy sources and technologies.

Strategies:

- Put a system for introducing and enhancing cleaner production practices and technologies by gradually incorporating clean power business model in the sector.
- Promote diversification and integration of energy sources and hybrid technologies.
- Promoting the establishment of environmental and energy management systems in the sector.
- Explore mechanisms and affordable technologies for capture and storage of GHG so that the mining sector in Liberia will incorporate carbon management policy to be competitive in the world market.
- Explore and enhance adoption of appropriate and affordable energy-efficient technologies.
- Explore and promote best practices for methane recovery.
- Promote low carbon mix of power generation for local and national grid[11].
- Establish a system for promoting green mining in private sector investment.
- Consider a safeguard policy in mining activities around national parks and biodiversity hotspots[12].
- Ensure the use of environmentally friendly chemicals in the mining sector so as to avoid pollutions and the release of toxic chemicals that are dangerous to human health and the environment.

8.2.5 Industry

Policy Statement: Ensure that the future of Liberian industrial base will not be locked into carbon emitting technologies but rather develop on environment-friendly, economically viable and socially acceptable basis, so that it will be competitive in domestic and world markets.

Strategies:

- Explore, adopt and enhance cleaner and efficient production practices and technologies.
- Promoting diversification of energy sources and fuel switching technologies.
- Put in place a system for the establishment of environmental and energy management systems.
- Adopt clean and energy efficient technologies.
- Promote low carbon mix of power generation for local and national grid[13].
- Establish a system for promoting green industry in private sector investment.

[11] Intervention to be implemented in integration with 'energy' sector.
[12] Intervention to be implemented in integration with "wildlife and tourism" sector.
[13] Intervention to be implemented in integration with 'energy' sector.

- Establish a system to gradually increase a share of biomass and bio-fuels in the mix of energy-potential decreasing costs, foreign expenditure and emissions.

8.2.6 Transport

Policy Statement: Build the future of Liberia's transport system and associated infrastructure on a low carbon emitting bases.

Strategies:

- Enhance and promote the use of mass transport systems in major cities using, for example, buses.
- Promote the use of non-motorized transport means such as bicycles.
- Construct new road infrastructure and rehabilitate the existing ones to gradually avoid traffic congestion.
- Integrate urban and regional planning approach to the national planning in order to optimize location of facilities, so as to reduce travel time and cost.
- Introduce and gradually enhance the blending of domestically produced biofuels with fossil fuel to substitute imported fossil fuels for cars with domestically produced biodiesel and bioethanol.
- Introduce and strengthen control on the importation of used cars and stricter fuel efficiency standards.
- Provide fiscal and regulatory investment incentives to make water, rail and air transport in Liberia gradually develop and become safer and more accessible.
- Avail or put in place a system to encourage the availability of public transport for tourist destinations[14].

8.2.7 Tourism

Policy Statement: Ensure the development of an environment-friendly tourism management system that contributes to the sustainable development vision of the country.

Strategies:

- Put in place a system to enable investment in energy-efficient and renewable technologies in tourism.
- Promote programs for enhancing vegetation cover in tourist sites through afforestation and ecosystem enrichment[15].
- Establish a system to incorporate energy saving techniques in tourist accommodation facilities (e.g., limiting water heating temperatures, introducing energy saving light bulbs, switch cards in rooms, etc.).

8.2.8 Waste Management

Policy Statement: Pursue the development and implementation of a comprehensive waste management strategy that includes the development of environmentally sustainable landfills, recovery and use of methane emissions for energy generation and instituting programs at the community and national level for recycling, reduce and reuse of waste.

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[14] Intervention to be implemented in integration with 'transport' sector.

[15] Intervention to be implemented in integration with "forest sector".

Strategies:

- Strengthen capacity at the community and institutional level for integrated waste management.
- Identify and promote the use of energy-efficient technologies and measures in the waste sector.
- Develop an integrated waste management strategy and system for all types of waste, assigning priority for prevention of waste generation with nationally appropriate and low greenhouse gas emission technologies that are well managed and compatible with methane recovery, capture and use for power generation.
- Promote private public partnership and other ventures that attract financing for infrastructure investments in the waste sector.
- Design and implement a system to turn urban waste to inputs for agricultural production through composting of waste for use in food security programs in urban (urban agriculture) and rural areas.
- Identify and develop CDM and NAMA projects in the solid waste and waste water sector.
- Expand equitable access to environmentally-friendly and sustainable waste management and sewerage systems – including for the poorest and most vulnerable communities.

8.3 Cross-cutting themes

The cross-cutting issues are those topics which, by their nature, have a strong impact across all specific sectors and need to receive special attention. The cross-cutting themes are treated separately in this document as they are applicable and essential to all sectors specified in the adaptation and mitigation intervention sections. The cross-cutting issues identified as critical in this policy and strategy document are communication, education, awareness, capacity building, research and development; technology transfer, gender, HIV and AIDS. The Policy statement and corresponding strategies of these cross-cutting issues are presented below.

8.3.1 Communication, education and Awareness

Policy Statement: Promote communication, education and awareness programs to incorporate climate change issues so that a society resilient to climate change and contributing to the reduction of the global GHG can be created.

Strategies:

- Develop communication, education and public awareness strategies on climate change
- Integrate climate change and environmental education in formal, informal and non-formal education programs.
- Establish a system to regularly promote public awareness on climate change.
- Design and implement sensitization programs for decision makers on climate change.
- Establish mechanisms to engage stakeholders and to promote awareness on climate change issues.
- Use mass media (radio, television, newsletter, magazines, pamphlets, mobile phones, etc.) to disseminate climate change information to the public.
- Harmonize sectorial communication strategies in relation to climate change

8.3.2 Capacity Development and Training

Policy Statement: Ensure that capacity development, training and capacity enhancement activities at systemic, institutional and individual level are prepared and continuously implemented to build adaptation and mitigation capacity to climate change.

Strategies:

- Update national capacity assessment report on climate change capacity.
- Design and implement capacity building programs and projects (trainings, workshops, experience exchange visit, etc.) at community, government (including the climate change focal points) and non-government organizations level to enhance climate change governance and adaptation capacity at different level.
- Identify, design and implement adaptation and resilience building physical projects and programs at grass root level, particularly around the vulnerable communities.
- Establish a system and mechanism for access to appropriate technologies and finance (including the establishment of Liberia Climate Change Trust Fund" for adaptation and mitigation to climate change.
- Design a system to monitor, evaluate and draw lessons from capacity building programs targeted at climate change resilience building.
- Establish knowledge management and research unit (as a center of excellence) at appropriate government institution to enable Liberia's access to the latest idea and technologies on climate change.

8.3.3 Research and Development

Policy Statement: Promote research and development aimed at addressing climate change issues at the national level; and encourage cooperation and networking at the regional and international level to promote climate change research.

Strategies:

- Develop the research capacity of relevant organizations to make reliable predictions of climatic parameters and river flows at seasonal, inter-annual and inter-decadal levels; to assess the corresponding likely impacts on various sectors, and to develop appropriate adaptation measures.
- Develop climate change research and development capacities at higher institutions of learning
- Strengthen Environmental units in key sector institutions such as the Ministry of Agriculture; Forestry Development Authority; Rural Renewable Energy Agency; Ministry of Lands, Mines and Energy; Ministry of Public Works and the Liberia Water & Sewer Corporation to devise adaptive strategies in coordination with the Environmental Protection Agency for projected impacts of climate change on the sectors and identify opportunities for reducing emissions.
- Identify local/traditional knowledge, which enhances climate change adaptation and mitigation, and incorporate it into climate change adaption and mitigation efforts.
- Promote the integration of indigenous knowledge and latest technology with scientific research; and provide support to rural communities, schools and rural-based institutions through participatory training to acquire skills so as to conduct simple and appropriate methods of collecting and managing localized climate data and information.

- Harness and provide support to build the capacity of national institutions, NGOs and the private sector to undertake research in climate friendly technology development.

8.3.4 Technology Transfer

Policy Statement: Promote the transfer of technology that is proven to be locally adaptable, environmentally friendly, appropriate to users, culturally friendly, and manageable in a sustainable way for use in Liberia.

Strategies:

- Develop a technology policy that aligns with Liberia's Low Carbon Development Strategy and the long-term sustainable development vision, as well as its needs towards technology transfer for climate change mitigation and adaptation.
- Conduct a technology needs assessment in order to identify technology for adaptation and mitigation for various sectors.
- Explore technologies and best practice that are available globally; select nationally appropriate innovative technologies; disseminate and implement them to the extent possible with sound mechanisms for monitoring their effectiveness.
- Harness and patronize local technologies and traditional knowledge available in the relevant sectors with protection of the intellectual property rights of their sources.
- Establish and provide economic incentives to the private sector, including NGOs, to promote the use of technologies that address climate change.

8.3.5 Gender, HIV and AIDS

Policy Statement: Ensure that issues of gender, HIV and AIDS are mainstreamed in all climate change mitigation and adaptation interventions across the country as a means of promoting inclusiveness, equity and adequate participation of all.

Strategies:

- Mainstream gender (including women, youth, children, and people with disabilities) in planning, decision making and implementation of climate change responses across the landscape of Liberia.
- Ensure that all climate change research data are disaggregated reflecting the significance of the impacts and response measures on gender, youth, people living with HIV/AIDS and children.
- Develop safeguards and other measures to ensure equity with respect to gender, people living with HIV/AIDS, youth and children towards benefit sharing related to climate change.
- Integrate issues relating to gender and people living with HIV/AIDS into climate change programs, interventions and actions.
- Assess and mitigate the impact of response measures on gender and on people with HIV and AIDS.

9. Enabling Pillars

9.1 Pillar I: Institutional Arrangement in CC Governance

While current impacts of climate change are indicative of how it might negatively affect Liberia, the general trend in the increase in climate-related natural disaster indicates that failing to take measures to prepare for and respond to climate change impacts will be costly in social, economic, ecological and environmental terms. An important step in being ready to address the impacts of climate change, either through adaptive or mitigative actions, involves having a functioning institutional structure to coordinate climate change initiatives across all sectors at the national and sub-national levels. However, current governance structures and institutional arrangements are inadequate for facing the inherent challenges faced with addressing climate change.

An effective institutional arrangement must, therefore, seek to establish the political basis through which social, economic, ecological and environmental vulnerabilities associated with climate-related risks are addressed. Consequently, the arrangement designed for implementation of the climate change policy focuses on enhancing risk management for extreme events such as coastal erosion, flood, pest infestation, disease outbreak, and reduced agricultural productivity. This done by considering the appropriate institutional arrangements and regulatory frameworks that might be effectively developed to meet the challenge associated with climate change.

This institutional arrangement seeks to support effective response to climate change by creating a governance structure that will seek to do the following:

I. Oversee the effective implementation of the climate change policy by providing leadership, coordination and political support;
II. Establish a centralized structure to coordinate climate change, which feeds from and into the policies of the relevant line ministries and agencies that are in sectors likely to be affected by climate change;
III. Clearly identify the requisite institutional policies, structures and processes that are currently in place to address climate change, creating and modifying as appropriate;
IV. Create an information and knowledge base to identify, develop and implement effective responses to emerging climate-related issues;
V. Coordinate the implementation of existing and future adaptation and mitigation projects (considering the conditions under which they will work) anticipated cost and benefits, and the resources required to implement them;
VI. Establish a process to document short, medium and long-term responses to climate change, to ensure that lessons are captured to inform the development of future projects and policies;
VII. Ensure that gender considerations are integrated into the development of any response to climate change;
VIII. Mainstream disaster management and adaptation into long-term development planning, especially at the macro level;
IX. Establish a process of effectively disseminating information on climate change related activities.

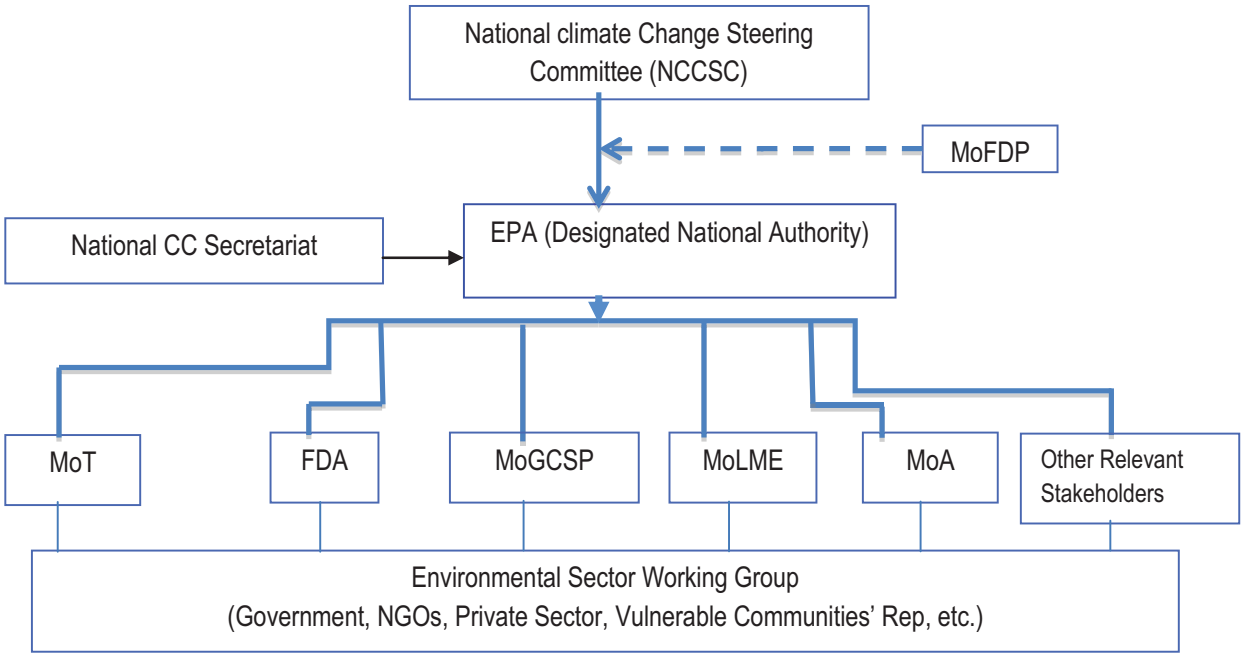

Figure 4: Proposed governance structure

National Climate Change Steering Committee (NCCSC)

The NCCSC, as the overarching institutional structure, has the mandate for coordinating and supervising the implementation of the climate change policy. Established by the President in October 2010, the NCCSC is a high-level policy coordination committee and is responsible for the overall climate change activities in Liberia. It comprises of the President of Liberia, Ministers of Government, Directors of Governmental Agencies, National Energy & Climate Change Advisers to the President, private sector, civil society and international partners.

The primary roles of the NCCSC are as follows:

- Validate and secure government support for the implementation of the climate change policy.
- Supervise and provide leadership for the overall coordination and programs of activities, which accelerate the policy implementation.
- Strengthen the capacity of the National Secretariat (NCCS) to be responsible for carrying out and coordinating the daily operations of the NCCSC;
- Adopt measures and take appropriate actions necessary for achieving the mandate and goals of the policy, including and in particular:
    - Report annually on progress made towards implementation of the climate change policy;
    - Authorize and/or approve the solicitation of external assistance for activities under the policy; and
    - Engage the cabinet and the legislature to secure adequate and accessible funding for the implementation of the policy.

Table 4: Current & Proposed Composition of the NCCSC

1. President of the Republic of Liberia – Ex-official
2. Energy, Environment and Climate Change Advisor to the President of Liberia
3. Heads of Standing Committees on Environment and Natural Resources of the Senate and the House
4. Minister of Planning and Economic Affairs (MoPEA)
5. Minister of Lands, Mines and Energy (MoLME)
6. Minister of Agriculture (MoA)
7. Minister of Finance (MoF)
8. Minister of Gender and Development
9. Minister of Transport
10. Minister of Finance & Development Planning
11. Managing Director of the FDA
12. Executive Director of the EPA
13. Chairman, National Investment Commission
14. Commissioner of Liberia Maritime Authority
15. World Bank
16. University of Liberia
17. Civil Society
18. Fauna & Flora International
19. NCCS Coordinator

The Environmental Protection Agency (EPA) of Liberia is the Designated National Authority (DNA) for the United Nations Framework Convention on Climate Change (UNFCCC/Kyoto Protocol) and has the mandate as the national regulatory agency for sustainable environmental management including climate change. The EPA is the Republic's regulatory Agency charged with the responsibility to ensure the sustainable use, management and protection of the environment and its natural resources. The Agency is also clothed with the statutory authority to integrate, harmonize and monitor the implementation of environmental policies and decisions of the Policy Council by line ministries and agencies. Based on its mandate, the Agency will coordinate, along with other ministries and agencies, the full implementation of major activities under the policy. As a key member of the NCCSC, the EPA will serve as the implementing agency of the policy in consultation with the Ministry of Transport (MoT), Forestry Development Authority (FDA), Ministry of Gender, Children and Social Protection (MoGCSP), Ministry of Lands, Mines and Energy (MoLME), Ministry of Agriculture (MoA), Ministry of Finance and Development Planning (MFDP) and other relevant Sectorial institutions indicated in the Action Plan (Table 5) through the NCCSC.

The National Climate Change Secretariat (NCCS) has been set up as a supportive component of the NCCSC. The NCCS provides coordination, monitoring and evaluation as the operational arm of the NCCSC. It has been housed at the EPA to facilitate better coordination of climate change related activities, access to information, monitoring of key programs and activities and promoting inter-agency cooperation. This will remain unchanged during the implementation of the climate change policy. The NCCS will continue to operate under the direct supervision of the EPA as DNA for climate change and lead agency in coordinating the implementation of the policy.

The roles of the NCCS will be as follows:

- Track progress on implementation and alignment of international climate change programs/policies with the national climate change policy.
- Serve as liaison between the NCCSC, the EPA, the various working groups, and other relevant national stakeholders on climate change.
- Engage in appropriate programs to strengthen national capacity in addressing climate change.
- Cooperate with international organizations, regional centers, institutions and experts in developing programs of action to mitigate and adapt to climate change in the region.
- Collate, document and store data and record, and disseminate climate change information to the public and the media.
- Maintain full records of the proceedings of the Climate Change Steering Committee, issue citations, serve as a clearing house on climate change, and inform all stakeholders on a regular basis on the progress of the policy implementation.

Environmental Sector Working Group. The Environmental Sector Working Group encompasses all sectors which are said to have stake in the policy implementation including, but not limited to, the sectors identified under Table 5 as well as civil societies, the private sector and community representatives. The Environmental Sector Working Group will serve as a multi-stakeholder forum for the exchange of ideas, including the provision of updates on ongoing and planned climate change initiatives. Issues proposed to be discussed by the working group will focus broadly on issues directly related to the environment and natural resources management, such as forestry, agriculture, biodiversity conservation, land and marine resources. The working group will also address the crosscutting aspects of climate change that impact livelihoods, food security, health, shelter, water, education, and gender. To facilitate the smooth operations of the working group, sub-working groups focusing on the issues listed above should be created, as not every member of the working group will have the expertise or interest in all the issues falling with the purview of the working group.

9.2 Pillar II: Financial Mechanism

The implementation of both mitigation and adaptation interventions in Liberia will require substantial, predictable, and sustainable financial resources. Liberia faces stack challenges in implementing climate change adaptation and mitigation activities given the national circumstances of the country and economic realities, which are due to the inadequate flow of financial resources. There is currently no direct budget line for climate change activities in the national budget due to the overwhelming and competing national priorities amidst resource challenges created by the war and, most recently, the recent economic shock the country experienced as a result of the Ebola Virus Disease. Currently, most funding for environmental initiatives relies extensively on international funding; even as such Liberia has not been able to adequately access international climate change mitigation financing such as those associated with NAMA, NAP etc. This is partly due to the limited capacity at the national level in developing and implementing projects in regards thereto.

Liberia, as a Party to the UNFCCC and a member of other multilateral institutions such as the World Bank is entitled to financial support to enable it meet its adaptation and mitigation obligations.

There are various articles relating to financial obligations in the Convention which make provisions for international support, from which Liberia can benefit, a necessity. For example Article 4.3 states that “The developed country Parties and other developed Parties included in Annex II shall provide new and additional financial resources to meet the agreed full costs incurred by developing country Parties in complying with

their obligations under Article 12, paragraph 1. Article 4.7 also states that "The extent to which developing country Parties will effectively implement their commitments under the Convention will depend on the effective implementation by developed country Parties of their commitments under the Convention related to financial resources and transfer of technology and will take fully into account that economic and social development and poverty eradication are the first and overriding priorities of the developing country Parties."

In recognition of these commitments and needs, governments gathered at the UNFCCC Climate Change Conference in Cancun where developed countries pledged $30 billion in "fast start" funding — climate funds pledged between 2010 and 2012 — and up to $100 billion annually by 2020. There has been a matching of these pledges by public and private funds outside of the UNFCCC process. These funding avenues offer countries new resource opportunities to undertake climate change mitigation and adaptation actions. According to estimates by the UNDP "taken together, there are already more than 50 international public funds, 45 carbon markets and 6,000 private equity funds providing climate change finance. Each of these public, private, bilateral and multilateral sources offers new opportunities for countries to address their climate and development needs" (UNDP, 2011).

In order for Liberia to secure an appropriate share of available and future funding resources needed to undertake its climate change interventions, the country needs to create the enabling environment that can facilitate the access of this funding.

Under this Pillar, Liberia will implement the following policy measures:

- Establish the "Liberia Climate Change Trust Fund". The fund will serve as a mechanism that allows the country to collect, blend, and manage all the incoming revenue streams, both international and national, related to climate, change into one centralized fund. The fund will mobilize national resources, including the national budget, to support climate change related activities such as disaster management, coastal protection, reforestation and afforestation; and will establish a system for tracking, monitoring and reporting on domestic and international financing directed at climate change adaptation and mitigation;
- Further explore the available funding sources and ensure the access and effective use of international funding available for adaptation and mitigation efforts such as Global Climate Fund (GCF), Clean Development Mechanism (CDM), Adaptation Fund (AF), Global Environmental Facility (GEF), World Bank's Forest Carbon Partnership Facility (FCPF), etc;
- Under the coordination of the NCCS, support specific sectors to develop proposals for the Adaptation Fund;
- Finalize the National Adaptation Plan which will further elaborate the strategies for financing adaptation in Liberia, including up scaling the implementation of the adaptation projects of the NAPA;
- Further engage and participate in the REDD+ (Emissions from Deforestation and Forest Degradation) system based on the outcome of the Strategic Environmental & Social Assessment, REDD+ Strategy and other relevant instruments;
- Explore the possibilities for creating domestic and international carbon market opportunities.

9.3 Pillar III: Capacity Building and Knowledge Management

Capacity Building:

Capacity building and knowledge management are critical components for ensuring the efficiency and effectiveness of this strategy. According to a study done by the EPA in 2013: Identification of Capacity Barriers, Gaps and Needs for Enabling Climate Change Mitigation Measures under the Project, Management of Environmental Services and Financing for Sustainable Development. There is a capacity deficit which accounts for low individual and institutional capacity both at the local and national level for implementing climate change related activities including adaptation and mitigation. The gaps and barriers identified to the development of Low Emission Development Strategies (LEDS), Nationally Appropriate Mitigation Actions (NAMAs) and Monitoring, Reporting and Verification Systems (MRV) include:

- Inadequate data and information about the natural, physical, socio-economic and political environment;
- Weak political will;
- Poor regulatory environment;
- Conflicting sectorial mandates;
- Lack of a monitoring systems and strategy that includes data collection, monitoring and the strengthening of the mandate of the M&E officers;
- Insufficient equipment for monitoring e.g. GIS instruments.
- A lack of standardization of MRV systems in the country;
- Weak inter-sectorial coordination;
- Lack of alignment and harmonization of regulations on monitoring, evaluation and reporting and lack of the tools in the key institution; and
- Poor frequency of reporting, data and information utilization.

In September 2010, the National Climate Change Steering Committee (NCCSC) was established as a high-level policy coordination committee to take charge of the overall climate change policy in Liberia. The embodiment of the NCCSC includes the Ministers, Directors of Governmental Agencies, the National Energy & Climate Change Adviser to the President, private sector, civil society and international partners. As an advisory body, the NCCSC should serve as the policy-clearing house for all climate change related issues, including policy formulation. While the NCCSC has been dormant over the last few years, its Secretariat – the National Climate Change Secretariat (NCCS) – has been revitalized. Working along with the EPA, the NCCSC is required to ensure the harmonization of climate change enabling activities under a single framework and to make Liberia compliant with all requirements of the United Nations Framework Convention on Climate Change (UNFCCC).

To overcome the capacity barriers and gaps and meet the challenge of climate change, the capacity of government institutions and experts, civil society and the private sector will be strengthened. The following actions will be pursued under this pillar:

- Reinstitute the NCCSC through high level cabinet endorsement and support as a pivot point for directing the implementation of the climate change policy;

- Conduct a review of institutional mandates for the purpose of harmonizing conflicting mandates and roles of climate change related institutions in order to ensure that there is a clear line of responsibility and authority for implementing specific roles;
- Review and revise all government policies across the different sectors, where appropriate, so as to ensure that these policies take into account climate change and its impact. This will include mainstreaming climate change in national, sectorial and spatial development planning to ensure that impacts on vulnerable sectors and groups including women are prioritized in the plans;
- Build the capacity of key government climate change frontline institutions to advance climate change adaptation (e.g. Ministry of Lands, Mines & Energy, Disaster Management Agency, Ministry of Public Works, Central Agricultural Research Institute, Ministry of Health, Ministry of Gender, Children and Social Protection). This capacity building effort will focus on material and technical support; staff training and restructuring, and budgetary support for adequate motivation and knowledge sharing;
- Establish and build the capacity of climate change focal points in relevant Government institutions including but not limited to MoA, FDA, MoLME, RREA, MoPW, MoGCSP, MoT, to incorporate climate change considerations in their planning processes;
- Develop a criteria and approach for mainstreaming gender consideration in all climate response activities and build the capacity of gender focal points in Government institutions, to enable them participate effectively in climate change response activities;
- Build the capacity of the NCCS and the EPA, including the Climate Change Enabling Unit to effectively lead international and regional climate change negotiations; and promote regional and international cooperation that is essential for attracting the needed support and means of implementation of the climate change policy;
- Build the capacity of the government (e.g EPA and FDA), private sector and civil society on carbon financing to access various global climate finance mechanisms available for implementing programs on adaptation and mitigation;

Knowledge Management:

In order to ensure that the strategy is effective and efficient there is a need to identify, build, dispense, and enable the adoption of insights and experiences held in individual experts or embedded in institutions as processes or practices. This policy will focus on harnessing opportunities to enhance continuity, optimize the performance of institutions, enhance the learning experience of professionals, improve communication amongst experts and institutions, promote synergy and maintain the institutional memory of government institutions involved in dealing with climate change and its impacts.

The following actions will be pursued under this pillar:

- Establish a unit for Research and Knowledge Management on Climate Change at LISGIS, which collaborates with the NCCS and MICAT to ensure Liberia has access to the latest ideas and technologies available globally, and ensure that data and information is widely and freely available to researchers and other end users;
- Develop the capacity of the entities (NCCS, LISGIS, and MICAT) to effectively lead the management of climate change knowledge, including the training and setting up of dedicated unit at MICAT for Climate Change Awareness and Knowledge Management;

- Develop training programs for high and mid-level Government official, NGOs/CBOs, private organizations and provide training in collaboration with research centers and universities;
- Develop and implement a mechanism for monitoring the application of climate change knowledge by policy makers and people at the frontline of climate change impacts;
- Maintain a robust and up-to-date climate change knowledge management system;
- Publish the Climate Change Policy and Response Strategy and ensure adequate awareness at all levels (ministries/sectors, professionals, academics, NGPs/CBOs, civil society leaders as well as the general public); and
- Enlist the support and participation of media agencies and networks in raising awareness and disseminating information on climate change.

To achieve this focus the National Climate Change Secretariat (NCCS), working along with the Liberia Institute for Statistics & Geo-Information Services (LISGIS), and the Ministry of Information Culture Affairs & Tourism (MICAT) will serve as the framework for comprehensive climate change information retention and management.

The NCCS will collaborate with government institutions (EPA, FDA, MoT, MoLME, MoA, CARI, RIA, UL, etc.) civil society, academic and research institutions, private sector and individual researchers/experts generating climate change research work in order to regularly access the information they generate for transmission to LISGIS.

LISGIS will set up an information system for the processing and archiving of information, including GHG emissions and inventory reports, climate data and future projections, forest cover, human resource development and special programs, impacts of climate change on physical infrastructure, data on environment water and sanitation, data on agriculture and rural development, human resource development and special programs, low carbon options and their benefits.

The Ministry of Information Cultural Affairs & Tourism (MICAT) will be responsible for the climate change information flow among the government, private citizens, civil society, private sector, research institutions, individual researchers and academic institutions. It will develop a framework in tandem with the NCCS and LISGIS for identifying the potential users of the climate change knowledge and the various media for information sharing, including websites, publications and bulletins, national and community radios, etc.

The tripartite collaboration amongst the NCCS, LISGIS and MICAT will allow for organizing, refining and disseminating of climate change knowledge products for the intended beneficiaries. It will also facilitate accountability for climate change knowledge management in Liberia.

9.4 Pillar IV: Technology Innovation and Infrastructure

It is inevitable that the pressure and extreme event caused by climate change will result in stress on existing infrastructure. This pressure will force change or replacement in some infrastructure programs. The existing infrastructures may need to be reinforced or modified to cope with the current and foreseeable climate change hazards. Such climate change hazards could be rise in sea-level, higher temperature, flood, storm, change in the rainfall regime, etc. There is also a need to establish new infrastructure to satisfy the growing and high living standard need of the future generation and for this climate smart standards to be considered starting from the design stage of such infrastructure. Such consideration will have an advantage of maximizing economic return on investment. In so doing investment in the adaptation and mitigation aspect

on infrastructures and human capacity building in sectors such as agriculture, energy, transport, forestry, etc. will become critical.

Liberia also needs to engage in application and investment in technology innovation of different sectors, including infrastructure, to gradually leapfrog old, destructive and polluting technologies which are both energy and resource inefficient. This approach, hence, will lead the country to follow the green path of development.

Therefore, under this pillar Liberia will:

- Rehabilitate and repair existing infrastructure (roads, coastal wall, river embankments, erosion control walls, drainage systems and flood shelters, etc). For this purpose It will also put in place effective maintenance and operation system;
- Put in place strategic planning of future infrastructure needs by taking into consideration future urbanization, socio-economic development as well as the predicted impact of climate change;
- Give due attention and invest in planning, designing and construction of urgently needed new infrastructure in various sectors to cope with the changing conditions with climate change;
- Conduct and periodically update technology need assessment (TNA) for Liberia and make use of every opportunity available for technology transfer through the Technology Mechanism agreed at COP 16, as well on COP 21 Agreement. This will help to boost the resilient and green technology access of Liberia through bilateral, multilateral as well as regional technology cooperation such as the South-South cooperation;
- Setup a system and incentive mechanism to encourage the private sector to engage in investing in green and environment friendly technologies through sole investment as well as public-private partnership;
- Establish/strengthen climate technology innovation center for Liberia to enable support small and medium enterprises and the private sector in providing services and support for climate resilient low carbon development;
- Perform local research and development for climate resilient low carbon technology and infrastructural development; and
- Establish a link and cooperation with regional and international center of excellences to access and exchange appropriate technologies.

9.5 Pillar V: Integrated Planning and Data Management

The nature of climate change being cross-cutting brings about planning and actions to be taken in an integrated way. Liberia is constrained with climate change impacts in various sectors such as agriculture, water, coastal, energy, forestry, settlements, etc. Integrated planning, hence, will help the government of Liberia to invest in the most critical and efficient way so that the economic and environmental return on the investment will be maximized while addressing sectors' priorities. Equally important is the availability of robust data and information across the sectors for decision making. As Liberia's previous war history has resulted to the devastation of historic data across the sectors, due attention should also be given to collect, analyze and avail sectorial data so that informed decision will be given at all levels. Integrated set of analysis and decision making need to be conducted to come up with the dynamic, complex and cross-sectorial issues involved in ecosystem services, energy, land use, water, etc.

To do this efficiently, handling and managing both spatial and non-spatial data in a systematic way in a central, regional, sub-regional and sectorial level is essential. This will enable to have a data set to manage resources such as land and water, other biological and physical resources, and to monitor the impact of climate change in these resources.

Therefore, under this pillar Liberia will:

- Put in place a system for recording and establishing integrated data sets based on the international standard particularly for priority sectors;
- Develop robust forecast of future vulnerability with appropriate indicators and resource demands for future climate shocks;
- Establish a system for integrated sectorial planning which addresses climate change adaptation and mitigation in an integrated manner;
- Ensure that national and sectorial planning processes are climate compatible based on climate information;
- Establish monitoring, reporting and evaluation system for ensuring integrated planning and data management relevant to climate change.

10. Action Plan and Resource Mobilization Plan

10.1 Action Plan and Cost

This action plan encapsulates strategic interventions that are earmarked for implementation across the key sectors over a period of 10 years (2017-2026). Key government implementing agencies (IAs) which have accountability to the implementation of their respective interventions are identified. These implementing agencies will implement the interventions based on their institutional mandates in collaboration with relevant stakeholders and actors including but not limited to local and international NGOs and Civil Societies, bilateral and multilateral development partners, community groups, the private sector and the grass root communities. The plan seeks to roll out initiatives to reduce vulnerability, build resilience and strengthen the capacity of Liberia to address the challenges posed by climate change. The implementation of this plan will require detail elaboration of specific activities with their indicators and milestone, which is expected to be done by respective implementing agencies during sector level planning in collaboration with key actors and relevant stakeholders during the implementation phase. In addition, detailed monitoring and evaluation plan need to be elaborated during sector level planning based on the monitoring and valuation framework of this Policy and Strategy (Chapter 11). The plan is programmed along 3 pillars of interventions (Adaptation, Mitigation and cross-cutting Issues). The total budget requirement estimated for the implementation of this Climate Change Policy and Response Strategy is USD **1,939,240,000** (Table 5).

Table 5: Action Plan for the Implementation of Strategic Interventions

Intervention Type (Adaptation/Mitigation)	Sectoral and Cross-Sectoral Intervention Areas	Strategic Interventions	Intervention Period (Years-2017 to 2026)			Estimated Cost (Million USD)	Implementing Agencies (IAs)[16]
			(1-3) Short-term	(4-5) Mid-term	(6-10) Long-term		
I. Adaptation Interventions	Forestry and Wildlife	• Strengthen the capacity of the FDA including training of experts and logistics for forest management.	√	√	√	2	FDA. EPA, MoFDP, Universities and colleges
		• Implement sustainable and where applicable alternative livelihood initiatives for forest-dependent communities, to enable them to become less reliant on forest resources.	√	√	√	5	MoA, FDA, MoIA, NGOs, EPA, MoFDP
		• Promote community forests activities beyond timber extraction as a management tool for sustainable forest	√	√	√	1	FDA, EPA, MoFDP

[16] IAs are government bodies which have accountability to the implementation of strategic interventions based on their institutional mandates. The IAs will bring together the efforts of relevant stakeholders and development partners such as local and international NGOs and CSOs, bilateral and multilateral development partners, community based organizations, communities, and the private sector and ensure their effective participation with in their roles and mandates.

Intervention Type (Adaptation/Mitigation)	Sectoral and Cross-Sectoral Intervention Areas	Strategic Interventions	Intervention Period (Years-2017 to 2026)			Estimated Cost (Million USD)	Implementing Agencies (IAs)[16]
			(1-3) Shor-term	(4-5) Mid-term	(6-10) Long-term		
		management, using indigenous species and knowledge.					
		• Establish a comprehensive monitoring system for forest resources by building on existing system (including non-timber forest products) to detect changes in the conditions of the ecosystem that might affect these resources and other ecosystem services provided by forests.	√	√		0.25	FDA, MoA. EPA, MoFDP,
		• Implement reforestation and afforestation activities to increase vegetation cover to improve ecosystem services in degraded areas, increase rural income, and improve biodiversity richness including wild fauna.	√	√	√	3	FDA, EPA, MoFDP
		• Identify and map, for proper management, water catchment areas in forests that are valuable to communities.		√	√	0.5	FDA, LWSC, LISGIS, MoIA, MoA, EPA, MoFDP,
		• Promote the consolidation of the protected area network by considering landscape approach, ensuring that it consists of a large spectrum of forest types across various environmental gradients and enhance connectivity between habitats.	√	√	√	1	FDA, MoA, MoIA, EPA, MoFDP
		• Establish and/or strengthen coordination mechanisms with other line ministries and agencies that might be implementing activities that affects forest and wildlife and ensure that the principle of sustainable forest and wildlife management is mainstreamed in national and sectorial policies and programs.	√	√	√	0.1	FDA, MoIA, MoA, MoJ, MoFDP, EPA,
		• Enforce regulations related to illicit hunting, eliminate poaching, develop and implement an environmental 'Code of Ethics' in the wildlife sector.	√	√	√	0.13	FDA, MoIA, MoFDP, EPA
		• Develop and implement a communication strategy to increase the awareness of relevant stakeholders, particularly forest dependent communities, about the impact of climate change and how they can take action to adapt to these changes	√			0.05	MICAT, EPA, MoFDP

Intervention Type (Adaptation/Mitigation)	Sectoral and Cross-Sectoral Intervention Areas	Strategic Interventions	Intervention Period (Years-2017 to 2026)			Estimated Cost (Million USD)	Implementing Agencies (IAs)[16]
			(1-3) Shor-term	(4-5) Mid-term	(6-10) Long-term		
	Agriculture	• Strengthen the capacity of the MOA including training of experts, logistics and use of technology for the management of the sector	√	√	√	2	MoA, CARI, EPA, MoFDP, Universities and Colleges.
		• Improve the effectiveness of pest, disease, and weed management practices through the wider use of integrated pest and pathogen management; development, and use of varieties and species resistant to pests and diseases and improving quarantine capabilities and monitoring programs.	√	√	√	1	MoA, CARI, EPA, MoFDP, Universities and Colleges
		• Assess crops vulnerability and suitability (cropping pattern) for different Agro-ecological zones.		√	√	0.25	MoA, CARI, EPA, MoFDP, Universities and Colleges
		• Enhance climate proof agro-infrastructural systems (input, output, marketing, post-harvest technologies and infrastructure including storage), that strengthen the capacity of local farmers to increase productivity	√	√	√	5	MoA, CARI, EPA, MoFDP, Universities and Colleges
		• Build and strengthen the capacity of extension officers in new sustainable farming technologies in order to enhance their support for farmers	√	√	√	0.25	MoA, CARI, EPA, MoFDP, Universities and Colleges
		• Build and strengthen capacity of local farmers to increase agricultural productivity including post-harvest techniques/technologies to minimize losses resulting from poor harvest.	√	√	√	2	MoA, CARI, MoFDP, EPA, Universities and Colleges
		• Support communities in livestock and crop sectors through inventory and dissemination of indigenous knowledge, establishing and/or strengthening insurance scheme, early warning and early action system, vaccination campaign, disease control, etc., to cope up with the stress based on climate variability	√	√	√	2	MoA, CARI, EPA, MoFDP, Universities and Colleges
		• Develop and introduce a diverse range of integrated soil fertility management (IFSM), water harvesting and conservation techniques to farmers as a sustainable means of improving soil fertility and intensifying agricultural production as well as cope with extreme	√	√	√	5	MoA, CARI, EPA, MoFDP, Universities and Colleges

Intervention Type (Adaptation/Mitigation)	Sectoral and Cross-Sectoral Intervention Areas	Strategic Interventions	Intervention Period (Years-2017 to 2026)			Estimated Cost (Million USD)	Implementing Agencies (IAs)[16]
			(1-3) Shor-term	(4-5) Mid-term	(6-10) Long-term		
		conditions (aridity, water-logging, flood, etc.)					
		• Strengthen the capacity of the Central Agricultural research Institute for research, development of climate smart agriculture initiates in Liberia including the setting up of seed banks, soil management, crop diversification, irrigation, improved livestock breeds, etc.	√	√	√	5	CARI, MoA, MoLME, EPA, MoFDP, Universities and Colleges
		• Develop and implement agriculture technologies and methodologies including hydrological technology models and scenarios for planning and ensure its promotion through agricultural programs by considering socio-economic and gender differences.		√	√	0.5	CARI, MoA, EPA, MoFDP, Universities and Colleges
		• Develop and support coping strategies such as irrigation infrastructure, intercropping, aquaculture, climate resilient plant varieties to support farming systems and encourage farmers to engage in them.		√	√	2	CARI, MoA, EPA, MoFDP, Universities and Colleges
		• Promote the development of sustainable livestock programs for farmers including grazing management systems, Livelihood diversification (bee harvesting, rabbit, guinea fowl, indigenous poultry) and breeding animals to adapt to climate change.	√	√	√	5	MoA, CARI, EPA, MoFDP, Universities and Colleges
		• Develop a communication strategy to increase farmers' awareness of climate change and strengthen the coordination of existing structures and institutions that are available to help them adapt to its impact.	√	√		0.1	MICAT, MoA, EPA, MoFDP
	Coastal areas	• Assess and build the capacity of agencies and managers responsible for the management of coastal adaptive capacity in the sector	√	√	√	2	LWSC, MoLME, MoA, MoIA, EPA, MoFDP, Universities and Colleges
		• Develop an integrated management plan for coastal zone management as well as early warning system that includes training and capacity development for coastal management and monitoring		√		5	MoLME, MOD, Maritime, EPA, MoFDP, Universities and Colleges

Intervention Type (Adaptation/Mitigation)	Sectoral and Cross-Sectoral Intervention Areas	Strategic Interventions	Intervention Period (Years-2017 to 2026)			Estimated Cost (Million USD)	Implementing Agencies (IAs)[16]
			(1-3) Shor-term	(4-5) Mid-term	(6-10) Long-term		
		• Promote and implement disaster risk management in general (especially disaster preparedness)	√	√	√	100	DMA, MoPW, MoLME, LISGIS, MoIA EPA, MoFDP
		• Support the rehabilitation and protection of wetlands and mangroves, including awareness and education of their host communities	√	√	√	3	MoA, MoPW EPA, MICAT, MoFDP
		• Develop and implement a program to climate proofing and enhancing infrastructures (roads, sewers, water supplies and other infrastructure) in coastal settlements and rural areas to protect continuous access to livelihoods, health care and education.		√	√	50	MoPW, MOA, LWSC, MOH, EPA, MoFDP,
		• Design and implement a strategic communication action plan to inform and educate people about changes and challenges associated with coastal areas related to climate change, and how they can adapt to cope with these changes and challenges.	√	√		2	MICAT, MoIA, MoLME, EPA, MoFDP
	Water Resources	• Develop an integrated management plan for water resources as well as early warning system that includes training and capacity development for coastal management and monitoring	√	√		5	MoLME, LWSC, MoT, EPA, MoFDP, Universities and Colleges.
		• Assess and build the capacity of agencies and managers responsible for the management of water sources to improve sanitation, hygiene and, in general, adaptive capacity in the sector	√	√	√	2	LWSC, MoH, MoCI, EPA, MoFDP
		• Conduct water resources and vulnerability assessment and mapping, document and disseminate necessary information to stakeholders		√	√	1	LWSC, EPA, MoLME, EPA, MoFDP
		• Develop and implement programs on increasing urban and rural domestic water supplies and urban sewage services to help combat water borne diseases and their social and economic impacts	√	√	√	20	MoPW, LWSC, MoH, EPA, MoFDP
		• Ensure the mainstream climate change into all water resource (coastal water, fresh water sources including aquifers) management plans and actions to secure	√	√	√	0.25	LWSC, MoLME, EPA, MoFDP

Intervention Type (Adaptation/Mitigation)	Sectoral and Cross-Sectoral Intervention Areas	Strategic Interventions	Intervention Period (Years-2017 to 2026)			Estimated Cost (Million USD)	Implementing Agencies (IAs)[16]
			(1-3) Shor-term	(4-5) Mid-term	(6-10) Long-term		
		environmental safety and steady supply of fresh water.					
		• Develop and implement programs on the protection of river catchments and other sources of freshwater, including aquifers, to secure a steady supply of freshwater across all sectors and communities, and facilitate and promote water recycling, reuse and efficiency.	√	√	√	5	LWSC, MoLME, EPA, MoFDP
		• Design and implement a strategic communication action plan to inform and educate people about changes and challenges associated with water related to climate change and how they can adapt to cope with these changes and challenges.	√	√		0.01	LWSC, MoLME, MICAT, EPA, MoFDP
	Fishery	• Strengthen the capacity of the Bureau of National Fisheries including manpower and logistic for research, monitoring and enforcement.	√	√	√	1	BNF, National Coast Guard, EPA, MoFDP, Universities and Colleges
		• Invest in and support artisanal fisher communities, including the provision of training, fishing gears and alternative livelihood	√	√	√	3	EPA, MICAT, BNF, MoGCSP, MoFDP
		• Set up a robust monitoring, reporting and verification system that captures and reports in a timely and accurate manner changes in the stock of productivity and pressure on fisheries; and implement adaptive management practices for managing the sector	√	√	√	0.5	BNF, EPA, MoFDP
		• Support research to fully understand pressures on fishery related to climate change impacts and identify appropriate measures including diversification of livelihood portfolio of fishery dependent communities	√			0.1	EPA, MICAT, BNF, MoGCSP, MoFDP, Universities and Colleges
		• Identify, map and protect areas valuable for fisheries (e.g. deep pools in river systems that serve as spawning areas), including the setting up of marine protected areas.	√	√	√	0.5	BNF, LISGIS, LHS, FDA, EPA, MoFDP
		• Support the establishment of a system to reduce external stressors on fisheries by instituting changes in	√	√		0.20	LISGIS, BNF, MoA, MoC, LHS, EPA,

Intervention Type (Adaptation/Mitigation)	Sectoral and Cross-Sectoral Intervention Areas	Strategic Interventions	Intervention Period (Years-2017 to 2026)			Estimated Cost (Million USD)	Implementing Agencies (IAs)[16]
			(1-3) Shor-term	(4-5) Mid-term	(6-10) Long-term		
		vessel or gear types as well as instituting actions and regulatory measures to reduce land-based sources of pollution (e.g. agricultural and urban runoff) and destructive fishing practices (e.g. fishing with explosives and poisons).					MoFDP
		• Integrate fisheries fully into climate change adaptation and food security policies at the national level (draft and enact where non-existent) to ensure incorporation into broader development planning.	√	√		0.25	BNF, MoA, EPA, MoFDP
		• Support the diversification of the livelihood portfolio of communities that are fishery dependent.	√	√	√	2	MoA, BNF, EPA, MoFDP
		• Support the establishment of early warning systems to identify probable threats and risks related to fisheries.	√	√		1	BNF, MoT, EPA, MoFDP,
		• Support the establishment of improved information and communication networks for decision making and planning as well as between fishing communities to support information sharing about potential shocks in the system	√	√	√	0.30	MoA, BNF, MICAT, EPA, MoFDP
	Energy	• Establish and promote a robust national program on solar energy (e.g. hybrid systems, installation of solar panel, promotion of solar street lighting, etc.) and other energy efficient lighting technologies	√	√	√	3	RREA, EPA, MoFDP
		• Support the provision of energy efficient technologies such as energy efficient bulbs to provide power and lighting for schools and other public institutions as well as for households, as a means of enhancing or introducing energy efficient technologies	X	X		1	RREA, LEC, MoPW, EPA, MoFDP,
		• Support the promotion and implementation of energy plantation schemes, targeted at minimizing the pressure on natural forest, and reduce energy stress	√	√		3	FDA, MoA, EPA, MoFDP
		• Develop a system to regulate sustainable use of biomass energy.	√	√		0.1	RREA, FDA, MoME, EPA, MoFDP
		• Promote and support the development and utilization of community-based off-grids/mini-grids.		√	√	12	RREA, LEC, EPA, MoFDP

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			(1-3) Shor-term	(4-5) Mid-term	(6-10) Long-term		
		• Conservation and protection of water catchments, including around hydro-power and municipal water supply sources.	√	√	√	11	FDA, MoLME, EPA, MoFDP
		• Ensure and support the incorporation of renewable and low carbon energy technology promotion in sectorial and national development planning.	√	√	√	0.01	MoLME, FDA, NIC EPA, MoFDP,
	Mining	• Mainstream climate change consideration into mining regulations and practices to promote the use of efficient, clean energy and the protection of biodiversity and other environmental resources.	√	√		0.25	MoLME, MoC, EPA, MoFDP
		• Put in place appropriate monitoring and evaluation system in the mining sector to ensure that climate considerations are incorporated from planning to implementation.	√			0.10	MoLME, EPA, MoFDP
	Industry	• Put in place a system and procedure to mainstream climate change considerations into industrial planning and practices including the promotion of diversified and integrated energy sources, establishment of energy and industrial waste management systems, spatial planning for industrial locations and zoning in the context of climate change, and the establishment of climate insurance scheme.	√	√		0.4	MoLME, MoPW, MoC, EPA, MoFDP
		• Promote cottage industries that utilize sustainable small-scale energy technologies/installations in rural areas	√	√	√	15	MoLME, MoC, RREA, EPA
	Transport	• Mainstream climate change considerations into transport sector planning to promote sustainable transportation system in the country	√	√	√	0.25	MoT, MoFDP, EPA
		• Establish and gradually Improve systems for mass and rapid transportation	√	√	√	3	MoT, MoPW, MoJ MoFDP, EPA
		• Put in place a system for proper urban transport planning to facilitate efficient and low GHG modes of transportation		√	√	0.5	MoT, MoPW, MoFDP, EPA

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			(1-3) Shor-term	(4-5) Mid-term	(6-10) Long-term		
		• Promote the expansion of multiple modes in public transport to include water and rail and non-motorized transport like bicycle.		√	√	50	MoT, MoPW, LMA MoFDP, EPA
	Tourism	• Develop infrastructures and systems that promote ecotourism conservation and Payment for Ecosystem Services (PES)	√	√	√	20	MICAT, FDA, MoIA, EPA, MoFDP
		• Develop sustainable tourism projects with full involvement of and distribution of equitable benefits to local communities and with pro-poor consideration	√	√	√	20	MICAT, FDA, MoIA, EPA, MoFDP
		• Promote ecotourism awareness to attract local and international tourist	√	√	√	0.12	MICAT, MoFA, MoFDP, EPA
		• Implement research, training and capacity building programs in tourism, including using weather-related information and its effectiveness to enhance climate resilience of the tourism sector	√	√	√	5	MICAT, FDA, NDMA, MoIA, MoFDP, EPA, Universities and Colleges.
		• Ensure climate change mainstreaming in the tourism sector, which involves adaptation of tourism infrastructure, disaster management and preparedness	√	√	√	0.1	MICAT, FDA, NDMA, MoIA, MoFDP, EPA
	Infrastructure	• Mainstream climate change consideration into infrastructure planning, design, emergency preparedness and response.	√	√	√	0.2	MPW, MOT, NDMA EPA, MoFDP
		• Implement and reinforce land-use policies; design standards and planning codes for roads and other infrastructure to cope with flooding, sea level rise and windstorm	√	√	√	0.2	MoPW, MoT,MoLME, MoJ, LLA EPA, MoFDP
		• Regulate development in coastal areas; prevent construction in areas of known vulnerability, and protect coastlines at critical sites in order to mitigate the risk to coastal communities	√	√		1	MoPW, MoT,MoLME, MoIA, NDMA EPA, MoFDP
		• Employ significant investment in building coastal protection including eco-based solutions (planting of trees) and hard structures (grooynes, revetments etc.) in coastal cities like Monrovia, Buchanan, Robertsport, Greenville, Harper, Cestos and Grandcess	√	√	√	250	MoPW, MoLME, MoA, NDMA, MoIA, MoFDP, EPA

Intervention Type (Adaptation/Mitigation)	Sectoral and Cross-Sectoral Intervention Areas	Strategic Interventions	Intervention Period (Years-2017 to 2026)			Estimated Cost (Million USD)	Implementing Agencies (IAs)[16]
			(1-3) Shor-term	(4-5) Mid-term	(6-10) Long-term		
	Urbanization and settlement	• Conduct assessment for hazard mapping, risk reduction and vulnerability of urban and rural settlements in erosion and flood prone areas and sites of national economic priority. Plan and implement adaptation actions in those areas	√	√		10	MoLME, EPA, NDMA, MoIA, MoFDP
		• Introduce and promote the use of low emission, energy efficient lighting and appliances, and more efficient passenger vehicles[17] in human settlements and land use planning.	√	√	√	5	MoLME, RREA, MoT, MoFDP, EPA
		• Develop and implement waste management plans (solid and liquid) for cities that includes waste separation, disposal, reuse, and recycling facilities and landfills with methane recovery for electricity generation.		√	√	5	EPA, MUNICIPAL AUTHORITIES, MoH, MoIA, MoFDP, EPA
		• Develop and implement proper "spatial Land Use Planning" which considers existing and predictions of climate change and which encourage vertical instead of horizontal expansion of urban housing projects.		√	√	1	MoPW, NHA MoLME, EPA, MoFDP,
		• Support the rehabilitation and conservation of vital coastal ecosystems such as wetlands and the mangroves they support through the development of an Integrated Coastal Zone Management Plan, a National Disaster Risk Management Response Plan and implement the National Environment Action Plan[18]	√	√	√	14	MoLME, NDMA, MoIA EPA, MoFDP,
	Health	• Integrate climate change considerations into existing health policies and strategies, taking into account gender-differentiated impacts and responses	√	√		0.5	MoH, MoGSP, EPA, MoFDP
		• Strengthen integrated disease surveillance response systems and emergency preparedness to prevent, mitigate, and respond to climate-induced epidemics	√	√		5	MoH, NDMA/MoIA, EPA, MoFDP

[17] "Passenger transport" to be implemented in integration with 'transport' sector

[18] To be implemented in integration with "coastal & water, fishery" sectors.

Intervention Type (Adaptation/Mitigation)	Sectoral and Cross-Sectoral Intervention Areas	Strategic Interventions	Intervention Period (Years-2017 to 2026)			Estimated Cost (Million USD)	Implementing Agencies (IAs)[16]
			(1-3) Shor-term	(4-5) Mid-term	(6-10) Long-term		
		• Strengthen preventive measures to restrict preventable disease transmission	√	√		3	MoH, NDMA/MoIA MoFDP, EPA
		• Improved community-level health care and disseminate information on changing health risks to enhance the response to climate-related diseases	√	√	√	5	MoH, MICAT, MoIA, MoFDP, EPA
		• Promote the use of household level water purification technologies such as water filters that provide access to clean water while reducing demand for firewood used to boil water and, therefore, slowing deforestation.	√	√		2	MoH, FDA, EPA, MoFDP
		• Support research on health vulnerability and impact, and develop scenarios to facilitate adequate planning.	√			1	MoH, EPA, MoFDP
		• Conduct periodic health Impact assessments on proposed mitigation and adaptation strategies to determine impacts on vulnerable populations and cumulative health impacts	√	√	√	5	MoH, NDMA/MoIA, EPA, MoFDP
II. Mitigation Interventions	Forestry and Wildlife	• Promote the development and enhancement of REDD+ activities and protected areas across the forest landscapes of Liberia	√	√		20	FDA, MoA, EPA, MoFDP
		• Build national carbon registry and accounting system as well as clarify the issues of carbon rights, ownerships, and tenure.		√	√	1	FDA, MoIA, MoFDP, EPA
		• Strengthen and enforce national forest management law and policies or adopt fiscal and regulatory measures addressing driver of deforestation as well as wildlife degradation.	√	√	√	30	FDA, MoJ, MoFDP, EPA
		• Promote activities which enhance carbon density such as reforestation, afforestation and agroforestry initiatives across the country, which also brings benefits to reduce the stress and pressure on th natural forest and ecosystems	√	√	√	30	FDA, MoA, MoFDP, EPA
		• Promote conservation activities around forested communities by regularly training community members and regulators; providing incentives for community participation in conservation efforts and recognizing	√	√	√	60	FDA, EPA, MoFDP

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			(1-3) Shor-term	(4-5) Mid-term	(6-10) Long-term		
		initiatives targeting protection of forest and wildlife.					
		• Ensure the sustainable use of forest and wildlife resources to contribute to the livelihoods of the rural communities as they adapt to climate change; contribute also to mitigation.	√	√	√	15	FDA, MoIA, NGOs, MoFDP, EPA
	Agriculture	• Support and encourage local farmers towards lowland farming by providing tools, training on soil management and organic fertilizer preparation, and seeds adapted for low land farming to farmers.	√	√	√	30	MoA, MoFDP, EPA
		• Discourage the traditional approach of shifting cultivation or swidden agriculture by providing inputs and training that can improve productivity in a sustainable way within the same plot of land over a longer period	√	√	√	15	MoA, FDA, MoFDP, EPA
		• Support the development of agriculture cooperatives by organizing farmers field school groups to ensure adequate coordination and learning towards sustainable agriculture	√	√	√	10	MoA, MoFDP, EPA
		• Develop measures and policies for use of degraded land by agriculture concessionaires to reduce impacts and pressure on forest lands which in turns increases country carbon sink potential and reduce emission level		√	√	2	MoA, NIC, MoFDP, EPA
	Energy	• Promote exploration of renewable energy sources and enhance the mix of renewable energy share in the national grid and off-grid	√	√	√	2	RREA, LEC, MoLME, MoFDP, EPA
		• Promote a system to enhance off-grid power supply to rural areas with additional objective of reducing deforestation	√	√	√	20	RREA, FDA, MoLME, MoFDP, EPA
		• Identify, promote and support the use of energy efficient low carbon as well as green energy technologies and practices, including the efficient use of domestic appliances	√	√	√	5	RREA, MoLME, MoFDP, EPA
		• Strengthen the participation of the private sector in the production and use of clean energy, including public	√	√	√	2	MoLME, NIC, MoFDP, EPA, private

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			(1-3) Shor-term	(4-5) Mid-term	(6-10) Long-term		
		private partnership (PPP).					entrepreneurs etc
		• Design and implement urban waste dumps for methane capture in all major urban areas		√	√	3	LEC, EPA, MoLME , Municpal, MoFDP, private entrepreneurs etc
	Mining	• Raise energy diversification, energy management, efficiency and cleaner production (green mining), which also uses environment friendly chemicals and practices in mining, through appropriate policies and investments in the sector		√	√	1	LEC, EPA, MoLME, MoFDP
		• Exploring the mechanism for affordable and hybrid technologies in capturing and storing GHG so that the mining sector in Liberia will incorporate carbon management policies to be competitive in the world market.		√	√	5	LEC, MoLME, MoFDP, EPA
	Industry	• Promote and raise energy diversification, efficiency and cleaner production practices and technologies in industries through appropriate policies and investments		√	√	2	LEC, RREA, MoCI MoLME, EPA, MoFDP
		• Set up small power plants by capturing methane from waste dumps using CDM		√	√	30	LEC, MLME, RREA, Municipal City Corporation (MUNICIPAL AUTHORITIES), Monrovia City Council (MUNICIPAL AUTHORITIES), EPA, MoFDP
	Transport	• Enhance and promote the use of mass transport systems in major cities and major destinations using, for example, buses	√	√	√	20	MoT, NTA, MoFDP, EPA
		• Construction of new road infrastructure and rehabilitation of the existing ones to gradually avoid traffic congestion	√	√	√	500	MoT, MoPW, MoLME, . (Liberian Land Authroity), EPA, MoFDP
		• Integrate urban and regional planning approach to	√	√		2	MoT, MoIA, Liberian

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			(1-3) Shor-term	(4-5) Mid-term	(6-10) Long-term		
		the national planning to optimize location of facilities so as to reduce travel time and cost					Land Authority, MoFDP, EPA
		• Introduce and gradually enhance the blending of domestically produced biofuels with fossil fuel to substitute imported fossil fuels for cars with domestically produced biodiesel and bioethanol		√	√	20	MoT, MoLME, RREA, MoA, FDA MoFDP, EPA
		• Strengthen the control on the importation of used cars and stricter fuel efficiency standards	√	√		1	MoT,EPA, LRA, MoCI, NPA, MoFDP, EPA
		• Provide fiscal and regulatory investment incentives to make water, rail and air transport in Liberia gradually develop and become safer and more accessible		√	√	50	MoT, NIC, MICAT, MoCI, LRA, MoFDP, EPA
	Tourism	• Put in place a system to enable investing in energy-efficient, energy saving and renewable technologies in tourism.	√	√		15	MICAT, FDA, MoT, RREA, MoFDP, EPA
		• promote programs for enhancing vegetation cover in tourist sites through afforestation and ecosystem enrichment	√	√		5	MICAT, FDA, MoT, MoFDP, EPA
	Waste management	• Strengthen capacity at the community and institutional level for integrated waste management	√	√		30	MUNICIPAL AUTHORITIES, MoH, MoFDP, EPA and other city corporations
		• Develop an integrated waste management strategy and system for all types of waste, assigning priority for prevention of waste generation with nationally appropriate low greenhouse gas emission technologies that are well managed and compatible with methane capture and use for electricity generation	√	√		10	LEC, MoLME, MUNICIPAL AUTHORITIES, MoFDP, EPA. a other city corporations, Universities and Colleges.
		• Promote private public partnership (PPP) and other ventures that attract financing for infrastructure investments in the waste sector	√	√	√	1	NIC, MoPW, MICAT, MoFDP, EPA
		• Design and implement a system to turn urban waste into input for agricultural production through composting of waste for use in food security programs in the urban	√	√		35	MoA, MoFDP, EPA, city corporations

Intervention Type (Adaptation/Mitigation)	Sectoral and Cross-Sectoral Intervention Areas	Strategic Interventions	Intervention Period (Years-2017 to 2026)			Estimated Cost (Million USD)	Implementing Agencies (IAs)[16]
			(1-3) Shor-term	(4-5) Mid-term	(6-10) Long-term		
		(urban agriculture) and rural areas					
		• Develop landfills for all major cities and use CDM and NAMAs to develop projects for methane recovery and for power generation in landfills	√	√	√	100	MoLME, Municpal City Corporation (MUNICIPAL AUTHORITIES), Monrovia City Council (MUNICIPAL AUTHORITIES),MoFDP, EPA,
III. Cross-cutting themes	Communication, education and awareness	• Raise awareness and education for diverse spectrum of the society, including decision makers on climate change through various means	√	√	√	2	MICAT, EPA, MoE, MoFDP
		• Publish and disseminate the climate change policy and response strategy from the policy level decision making body down to villages, towns and communities	√			0.05	MICAT, EPA, MoE, MoFDP
		• Develop communication, education and public awareness strategy on climate change	√			0.01	EPA, MoFDP
	Capacity development and training	• Integrate climate change concerns in all sectorial plans and policies	√	√		1	EPA, MoFDP, NCCS,
		• Update national capacity assessment report on climate change	√			0.01	EPA, MoFDP, NCCS,
		• Integrate climate change into the national curriculum (from primary to tertiary level) and regularly update it based on changing circumstances.	√	√	√	3	MoE together with commission for Higher Education, EPA, MoFDP
		• Establish partnership with national and international NGOs and institutions in climate change capacity development activities	√	√	√	1	EPA, All Sectoral implementing Agencies, EPA, MoFDP
		• Design and implement capacity building programs and projects (trainings, workshops, experience exchange visit, etc.) at community, government and non-government organizations level to enhance the adaptation capacity at different levels, recognizing the importance of youth and women (the vulnerable	√	√		10	EPA, MoYS, MoGCSP, MoFDP, NCCS

Intervention Type (Adaptation/Mitigation)	Sectoral and Cross-Sectoral Intervention Areas	Strategic Interventions	Intervention Period (Years-2017 to 2026)			Estimated Cost (Million USD)	Implementing Agencies (IAs)[16]
			(1-3) Shor-term	(4-5) Mid-term	(6-10) Long-term		
		groups).					
		• Establish and build the capacities of climate change focal points in all government entities	√	√		3	EPA, NCCS, MoFDP
		• Identify, design and implement adaptation and resilience, building physical projects and programs at grass root level, particularly around the vulnerable communities such as youth, women, and people with disabilities.	√	√	√	30	EPA, NCCS, MoYS, MoGCSP, MPW, MLME, , MoFDP
		• Establish the "Liberia Climate Change Trust Fund" and put in place a system and mechanism for access to appropriate technologies and finance for adaptation and mitigation to climate change.	√	√		5	MoFDP, EPA, NCCS,
		• Design a system to monitor, evaluate and draw lessons from capacity building programs targeted at climate change resilience building.	√	√	√	3	MoFDP, EPA, NCCS
		• Establish a unit for knowledge management and research on Climate Change at LISGIS, which will collaborate with the NCCS and MICAT to ensure Liberia has access to the latest ideas and technologies available globally; and ensure that data and information is widely and freely available to researchers and other end users	√	√		2	MoFDP, EPA, NCCS, LISGIS, MICAT
	Research and development	• Develop the research capacity of the relevant organizations to make reliable predictions of climatic parameters and river flows at seasonal, inter-annual and inter-decadal levels, to assess the corresponding likely impacts on various sectors and develop appropriate adaptation measures	√	√		20	MoFDP, EPA, NCCS, LIGIS, Universities and Colleges
		• Develop climate change research and development capacities at higher institutions of learning	√	√		5	MoFDP, EPA, NCCS, Universities
		• Strengthen Environmental Units in key sector institutions such as the Ministry of Agriculture, Forestry Development Authority, Rural Renewable Energy Agency, Ministry of Lands, Mines and Energy, Ministry	√			2	EPA, NCCS, MoFDP

Intervention Type (Adaptation/Mitigation)	Sectoral and Cross-Sectoral Intervention Areas	Strategic Interventions	Intervention Period (Years-2017 to 2026)			Estimated Cost (Million USD)	Implementing Agencies (IAs)[16]
			(1-3) Shor-term	(4-5) Mid-term	(6-10) Long-term		
		of Public Works and the Liberia Water & Sewer Corporation to devise adaptive strategies in coordination with the Environmental Protection Agency for projected impacts of climate change on the sectors, and to identify opportunities for reducing emissions					
		• Promote the integration of indigenous knowledge and latest technology with scientific research and to provide support to rural communities, schools and rural-based institutions through participatory training to acquire skills for conducting simple and appropriate methods of collecting and managing localized climate data and information	√	√		5	EPA, MoE, MoFDP
		• Harness and provide support to build the capacity of national institutions, NGOs and the private sector to undertake research in technology development	√	√	√	15	EPA, MoE. MoFDP, NCCS
	Technology transfer	• Develop a technology policy that aligns with Liberia's Low Carbon Development Strategy and the country's long-term sustainable development Vision, as well as its needs towards technology transfer for climate change mitigation and adaptation	√			0.1	MoC, MoLME, MoE, EPA, MoFDP, NCCS
		• Conduct a technology needs assessment in order to identify technology for adaptation and mitigation for various sectors.	√			0.3	EPA, LISGIS, MoFDP
		• Explore technologies and best practice that are available globally; select nationally appropriate innovative technologies; disseminate and implement them to the extent possible with sound mechanisms for monitoring their effectiveness	√	√	√	50	MoC, MoLME, MoE, EPA, MoFDP, NCCS
		• Harness and patronize local technologies and traditional knowledge available in the relevant sectors with protection of the intellectual property rights of their sources	√	√	√	5	MoFDP, NCCS, MoIA, EPA
		• Establish and provide economic incentives to the private sector, including NGOs, to promote the use of	√	√	√	3	MoFDP, NCCS, NIC, EPA

Intervention Type (Adaptation/Mitigation)	Sectoral and Cross-Sectoral Intervention Areas	Strategic Interventions	Intervention Period (Years-2017 to 2026)			Estimated Cost (Million USD)	Implementing Agencies (IAs)[16]
			(1-3) Shor-term	(4-5) Mid-term	(6-10) Long-term		
		technologies that address climate change					
	Gender, HIV and AIDS	• Mainstream gender (including women, youth, children, and people with disabilities and HIV/AIDS) in planning, decision making and implementation of climate change responses across the landscape of Liberia.	√	√		0.3	MoFDP, MoGCSP, MoYS, National AIDS Commission, EPA
		• Ensure that all climate change research data are disaggregated reflecting the significance of the impacts and response measures on gender, youth, people living with HIV/AIDS, and children	√	√		1	MoFDP, LISGIS, MoGCSP, MoYS, National AIDS Commission, EPA,
		• Develop safeguards and other measures to ensure equity with respect to gender, people living with HIV/AIDS, youth and children toward benefit and sharing related to climate change	√	√		0.2	MoFDP, MoYS, MoH, MoGCSP, EPA
		• Integrate issues relating to gender, youth and people living with HIV/AIDS into climate change programs, interventions and actions	√	√		0.3	MoH, MoGCSP, EPA, MoFDP
Total Estimated Cost					**$ 1,939,240,000**		

10.2 Resource Mobilization Plan

To address Climate Change in Liberia largely requires financial support from the international Community. Domestic resources obtained from government treasury, private sector and individuals will complement this effort. The establishment of a financial mechanism called "Liberian Climate Change Trust Fund", targeted at addressing climate change is an effective means to finance focused climate actions. In addition, integrated working approach is essential to utilize the funds obtained so that the objectives set in this Policy and Response Strategy document are met. Moreover, this funding approach will address the critical adaptation responses while also considering mitigation interventions in a balanced way, so that the country will gradually strengthen the green path of development. The consideration of enabling pillars of capacity building, technology development, transfer and the awareness raising component of the Strategy in the funding approach is also critical towards the achievement of the climate change policy and strategy objectives. The funding sources identified are domestic public-private sources, bilateral and multilateral sources and international climate fund.

I. Domestic Public-Private Sources

Liberia has shown its commitment to fight climate change through various actions and policy measures taken so far. These measures, however are not enough to cope with the existing and future pressure of climate change. In this respect, public finance collected in the form of taxes and revenues from different investments will consider the rational allocation of public funds for fighting climate change, recognizing that development efforts can't be realized without mainstreaming climate change in development planning. Other sources of funds to be considered as domestic sources are funds to be obtained from NGOs, through public-private partnership and the REDD scheme. The establishment of national climate change trust Fund, such as the one mentioned above, as well as a system of Payment for Ecosystem Services (PES) are also to be considered.

II. International Climate Funds

These are funds established with special a purpose of supporting climate change under the UNFCCC and its Kyoto Protocol. These include the Special Climate Change Fund (SCCF), Green Climate Fund (GCF), Adaptation Fund (AF), and Least Developed Country Fund (LDCF).

a) Special Climate Change Funds (SCCF): SCCF is the fund established under the UNFCCC to support adaptation and technology transfer in developing country parties. Its support focuses on adaptation interventions related to agriculture, water resource management, integrated coastal zone management, land management, health, infrastructure development, and fragile ecosystems including mountainous ecosystems. This climate financing window, hence, can be taken as a source of financing the interventions identified in this Policy.

b) Green Climate Fund (GCF): The Green Climate Fund is the newest actor in the multilateral climate finance architecture to assist developing countries in the adaptation and mitigation practices (including REDD+), technology development and transfer, capacity building and the preparation of national reports to counter climate change. Countries will also be supported on a program or project-based approach in the implementation of their strategies and plans (such as low emission development and adaptation strategies in developing country Parties) which became fully operational since 2015. COP 21 also decided that the GCF, together with the GEF, will be the entities entrusted with the operation of the Financial Mechanism of

the Climate Change Convention. The GCF therefore will be taken as one of the significant sources of funding for Policy intervention for Liberia.

c) Adaptation Fund (AF): Adaptation Fund was established in 2001 to finance concrete climate change adaptation projects and programs in developing countries parties to the Kyoto Protocol under the United Nations Framework Convention to Climate Change (UNFCCC). Eligible Parties can submit their projects/programs directly to the AFB through an accredited National Implementing Entity (NIE), which is direct access modality; or parties can submit their proposal through accredited Multilateral Implementing Entity (MIE) such as UNEP, UNDP, World Bank, AFDB, etc., or may use regional or sub-regional entities (RIE) such as ECOWAS as implementing entity. Liberia is also legible to access the Fund by preparing competent projects based on the national circumstances. Therefore, the Fund can be considered as one of the funding mechanism to turn the Policy and Strategy elements into action.

d) Least Developed Country Funds (LDCF): Least Developed Country Fund is a fund established under the UNFCCC to address special needs of LDCs on climate change. By its nature LDCF was established under the Convention to support interventions identified under NAPA and to reduce vulnerability of sectors important to ensure livelihoods and sustainable development. Hence as this Climate Change Policy and Strategy is complementary with the interventions proposed under NAPA of Liberia and also as it is based on development priorities of the country, LDCF will be considered as the funding source of this Policy and Strategy.

III. Bilateral and Multilateral Sources

Bilateral funds are those funds which can be obtained through bilateral agreement between donor country and recipient country or their institutions. Multilateral agreements on the other hand are support mechanisms established under the agreement entered among more than two countries/parties such as the agreement entered under UNFCCC, the Kyoto Protocol or other pertinent multilateral agreements. The mechanisms to be shown under this are the World Bank, Africa Development Bank, Bilateral Funds, General Budget Support, LDCF and The GEF.

a) The World Bank: The World Bank is the known multilateral funding mechanism which also includes climate change in its funding windows. The World Bank provides funding for legible countries in the form of grant and loans. The World Bank Group consists of five organizations engaged in grant and loan activities relevant for funding this Policy and Strategy, three of which are shown below:

- **International Bank for Reconstruction and Development**: The International Bank for Reconstruction and Development (IBRD) lends to governments of middle-income and creditworthy low-income countries. IBRD finances projects across all sectors and provides technical support and expertise at various stages of a project. IBRD's financial products and services help countries build resilience to shocks by facilitating access to products that mitigate the negative impact among other natural disasters and extreme weather. Liberia has been a member of IBRD since March 28, 1962 and is eligible for funding by the IBRD.
- **International Development Association (IDA)**: IDA is one of the largest sources of assistance for the world's poorest countries, 39 of which are in Africa, and is the single largest source of donor funds for basic social services in these countries. IDA lends money on concessional terms. This means that IDA credits have a zero or very low interest charge and repayments are stretched over 25 to 40 years, including a 5- to 10-year grace period. Some portion of the IDA is also provided in grant terms. For instance in 2015, 13% of the total

commitment amount under IDA was given in grant terms (http://ida.worldbank.org/about/what-ida). IDA's work covers climate improvement, infrastructure and other social services such as primary education, basic health services, clean water and sanitation, agriculture, business and institutional reforms.

- **The International Finance Corporation (IFC)**: IFC Is the largest global development institution focused exclusively on the private sector. It is a funding mechanism under the World Bank Group to help developing countries achieve sustainable growth by financing investment, mobilizing capital in international financial markets, and providing advisory services to businesses and governments. It works in areas where there is constraints, such as infrastructure, finance, skill and regulatory environments. As the engagement of the private sector in climate change architecture, be it in solitary investment or through public-private partnership is vital, the funding mechanism can be considered as an opportunity to finance the relevant interventions of this Policy and Response Strategy. It can also be considered as one of the financial engines that encourages private sector to be active in climate change architecture.

b) African Development Bank (AFDB): African Development Bank has become one of the active actors in the climate-change funding architecture in recent times. It has also become one of the GEF Implementing Agency through which countries prefer to access GEF funding. As part of its responsibility to finance climate change and the environment, the Bank has also opened a window called Climate Investment Funds (CIF), through which African countries can enjoy grants or concessional loans for risk mitigation instruments. In order to leverage substantial funds for climate change from the public and private sector, as well as from multilateral development banks, it has a blending scheme of resources available from CIF with other resources of multilateral development banks. Hence, it is considered part of the climate funding mechanism under this policy and Strategy financing.

c) Bilateral Funds: The other source of funding opportunity is bilateral funding which can be obtained through bilateral agreement between a donor country and the Liberian government, or the appropriate institutions. Bilateral supports can be sent from donor countries through their special agencies in donor countries, such as USAID; or thorough multilateral agencies such as UNDP, UNEP, UNIDO, etc.; or through international NGOs. Some supporters are Regional focus and may prefer sub-regional organizations such as ECOWAS to channel their support, and some may affiliate to Regional organizations such as UNECA and EU. The Government of Liberia, therefore, will make use of all means and channels to access funding through bilateral agreements with the objective of attaining the Policy objective set in this document.

d) General Budget Support: This is the type of support extended to developing countries by developed country partners to supplement the domestic budgetary source for various development initiatives. Liberia's partner countries involved in this type of support are many, including USA. Liberia also welcomes the support of other countries in this aspect. As this is a good source of funding for domestic effort, attention will also be given to include climate change as it is one of the major funding areas under this support type, recognizing that climate change has a potential to hamper development efforts.

e) The Global Environment Facility (GEF): The Global Environment Facility is a multilateral funding mechanism hosted under the World Bank to support developing countries striving to manage their environment. GEF funds are available to developing countries and countries with economies in transition in order to meet the objectives of the international environmental conventions and agreements. Among others is the UNFCCC. Of the GEF's thematic areas for grant funding, Climate Change is the one. GEF has been

supporting developing countries since its establishment in 1991, on the eve of the 1992 Rio Summit. GEF is also recognized as one of the funding mechanisms for climate change under the Paris Climate Change Agreement. Liberia has been benefiting from GEF on several Environmental Projects and needs to continue accessing the grant to attain the objective set in this Policy and Response Strategy.

11. Monitoring and Evaluation Framework

11.1 Monitoring Framework

The adaptation and mitigation strategies identified in this policy document are supposed to be integrated or mainstreamed into national, sectorial and cross-sectorial plans following the national planning process. The EPA as a leading government organization to spearhead the implementation of this policy and response strategy, will design detail mainstreaming and monitoring tools and guidelines. At the process level the EPA shall monitor the success of climate change mainstreaming in existing and planned sectorial and cross-sectorial activities, which have been or are about to be implemented, within the given time frame for implementation in the country (2017 – 2026), based on the action plan matrix shown in Table 5.

Each ministry or agency is supposed to conduct internal *process monitoring* during the whole implementation process so that they be able to rectify problems as they exists and enhance good achievements. They will prepare periodic monitoring reports (quarter and annual reports) on the achievements of the Policy's strategies mainstreamed in their sectorial or cross-sectoral plans; and they will submit the report to the EPA (Fig 5). EPA will organize and provide technical backup and capacity building on the monitoring process. EPA will also prepare aggregate quarterly and annual national summary reports on the achievements obtained and challenges encountered, including proposed remedial measures, and submit them to the Ministry responsible for National Planning and the higher body assigned by the President's office, as explained in section 9.1, i.e., the NCCSC, to oversee the actualization of this Policy.

The sub-national levels will form part of the county and district monitoring systems set-up to monitor development programs and projects in the districts and communities.

11.2 Evaluation Framework

The evaluation of the implementation and effectiveness of the response Strategies stated under each sectorial and cross-sectorial policies will be conducted at different steps in the process. The first type of evaluation will be conducted during the whole implementation period as an on-going basis starting from the approval by the GoL. The second type of evaluation is the short-term evaluation, the third is the mid-term evaluation and the other is final evaluation.

The first type of on-going evaluation (mainly quarterly and annual) will be conducted internally by each sector to track the implementation of the strategies as undertaken by relevant sectors, and integrated in their development plan. Periodic (quarterly and annual) aggregated monitoring reports of the sectors will be the bases for this evaluation. EPA, as a lead Agency, will lead and conduct annual evaluations on the implementation of the Strategy by the respective sectors and report the findings to NCCSC.

Short-term evaluation will be conducted at the end of the third year i.e., at the end of 2019 (figure 5); the outcomes of the planned short-term strategic interventions (table 5) and their effectiveness will be measured. In addition, the short-term evaluation will be conducted to obtain an overview of the achievement of objectives, effectiveness of technical approaches and implementation framework. The evaluation output obtained will help to adjust or amend the implementation plan and approaches or to strengthen them towards better results.

Mid-term evaluation will be conducted at the end of the 5th year, and this evaluation period will used to evaluate intermediate climate change and development related impacts obtained by the policy and strategy implementation. This level of evaluation will be high level and aggregate evaluation reports prepared by independent evaluators will be the base of evaluation. The outcome of the mid-term evaluation will be used to measure the achievement of policy and strategy objectives and rectify challenges toward facilitating the implementation of long term strategic interventions.

Final evaluation will be conducted at the end of the 10th year, i.e. at the end of 2026, to measure the results achieved against the planned ones. The evaluation results will be used *to revise the Policy and Strategy* and give feedback to the national planning process depending on the strength of climate change impact and the corresponding level of adaptation and mitigation responses needed.

The relevant body assigned by the Office of the President of the Republic of Liberia (see section 9.1) will oversee and provide guidance to the evaluation process (that is the NCCSC). The Environmental Protection Authority of the Republic of Liberia, as the leading government entity responsible to make a follow up on the implementation of the Policy and Response Strategy, will play a spearheading and vital role in the regular and periodic evaluation process. As mentioned in the monitoring section, the sub-national levels will also form part of the county and district evaluation systems set-up to evaluate development programs and projects in the districts and communities.

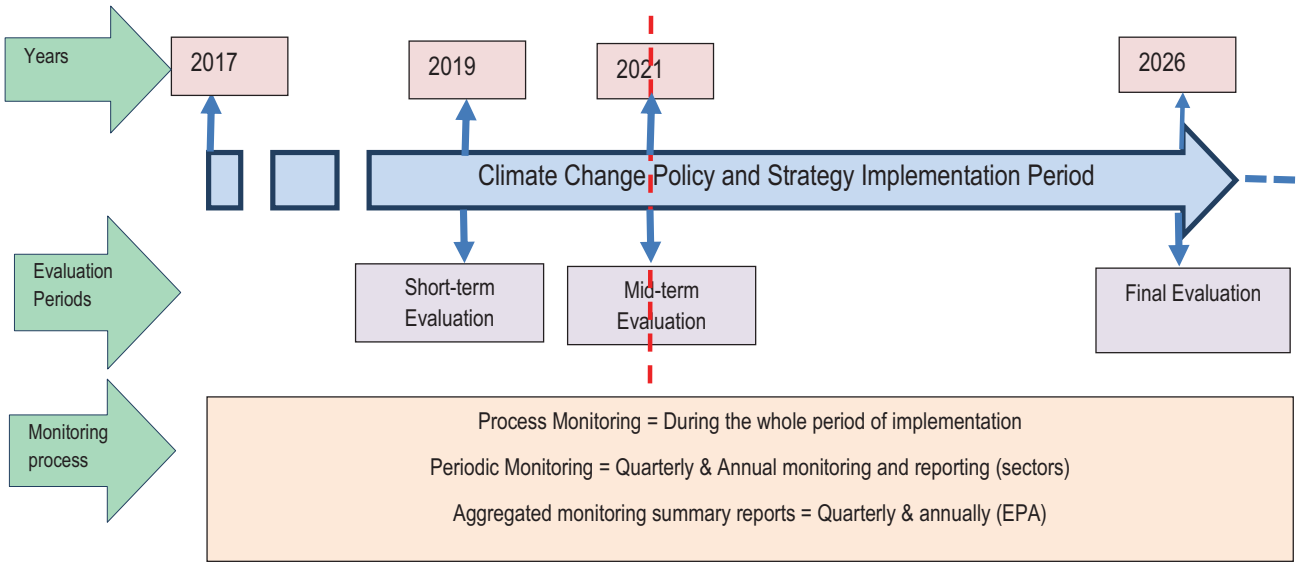

Figure 5: Monitoring and Evaluation Framework

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