



LIBERIA

NATIONAL ADAPTATION PROGRAMME OF ACTION
(NAPA)

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Table of Contents

Acknowledgements.....	X
Preface.....	xi
List of Tables	iv
List of Figures.....	iv
List of Acronyms	v
Executive Summary	xii
1. Introduction and Setting.....	1
<i>POPULATION AND GEOGRAPHY</i>	<i>1</i>
<i>CLIMATIC PATTERNS.....</i>	<i>1</i>
<i>INFRASTRUCTURE.....</i>	<i>2</i>
<i>ECONOMY</i>	<i>2</i>
<i>INSTITUTIONS</i>	<i>2</i>
<i>DEVELOPMENT CHALLENGES AND VULNERABILITY TO CLIMATIC VARIABILITY.....</i>	<i>3</i>
<i>NATIONAL GOALS, PLANS, AND FRAMEWORKS.....</i>	<i>5</i>
<i>BARRIERS TO THE IMPLEMENTATION OF NAPA RESULTS.....</i>	<i>6</i>
2. Identification of Key Adaptation Needs	7
<i>VULNERABLE GROUPS IN URGENT NEED OF ADAPTATION ACTIVITIES.....</i>	<i>7</i>
<i>KEY ADAPTATION ACTIVITIES IN AGRICULTURE.....</i>	<i>7</i>
<i>KEY ADAPTATION ACTIVITIES IN PUBLIC HEALTH</i>	<i>8</i>
<i>KEY ADAPTATION ACTIVITIES IN FISHERIES.....</i>	<i>8</i>
<i>KEY ADAPTATION ACTIVITIES IN FORESTRY.....</i>	<i>8</i>
<i>ADAPTATION PROJECTS PROPOSED BY STAKEHOLDERS</i>	<i>8</i>
3. Criteria for Selecting Priority Projects	9
<i>DEVELOPMENT OF LOCALLY-DRIVEN EVALUATION CRITERIA</i>	<i>9</i>
<i>ASSIGNING SCORES TO LOCALLY-DRIVEN EVALUATION CRITERIA.....</i>	<i>9</i>
4. List of Priority Activities.....	11
<i>HIGHEST PRIORITY ADAPTATION PROJECTS.....</i>	<i>11</i>
5. NAPA Preparation Process	12
<i>ORGANIZATION.....</i>	<i>12</i>
<i>ACTIVITIES</i>	<i>12</i>
<i>DEVELOPMENT OF INTERIM TECHNICAL REPORTS.....</i>	<i>12</i>
6. List of References	14
Annex 1: Profiles of Institutions Involved in the Stakeholder Consultation Process.....	16

Annex 2: Highest Priority Project Profiles19

6.1. *DURATION: THE DURATION OF THE PROJECT IS SET FOR THIRTY-SIX (36)*
MONTHS..... 25

List of Tables

	<u>Page</u>
Table 1: Major hazards and vulnerable areas/sectors	4

List of Figures

	<u>Page</u>
Figure 1: Political map of Liberia	1
Figure 2: Daily temperature (°C) in Liberia, 1953-82	2
Figure 3: Organizational chart for the Liberia NAPA process	15

List of Acronyms

ACC	Agricultural Coordinating Committee
APF	Adaptation Policy Framework
ARI	Acute Respiratory Infection
CARI	Central Agricultural Research Institute
CC	Climate Change
CBOs	Community Based Organizations
CCD	Convention to Combat Desertification
CCU-EPA	Climate Change Unit-Environmental Protection Agency of Liberia
CITES	Convention on International Trade in Endanger Species
CO ₂	Carbon Dioxide
ECOWAS	Economic Community of West African States
EPA	Environmental Protection Agency of Liberia
FAO	Food and Agriculture Organization of the United Nations
FDA	Forestry Development Authority
GCM	General Circulation Model
GEF	Global Environment Facility
GDP	Gross Domestic product
GOL	Government of Liberia
HIV/AIDS	Acquired Immune Deficiency Syndrome
IBA	Important Bird Area
IDPs	Internal Displaced Persons
IEC	Information Education and Communication
IPCC	Intergovernmental Panel on Climate Change
ITMs	Insecticide Treated Materials
IUCN	International Union of Nature Conservation
LDC	Least Developed Countries
LDHS	Liberia Demographic Health Survey
LEG	Least Experts Group
LEC	Liberia Electricity Corporation
LPRC	Liberia Petroleum Refining Corporation
LWSC	Liberia Water & Sewer Corporation
MCA	Multi Criteria Analysis
MCC	Monrovia City Coporation
MDGs	Millennium Development Goals
M&E	Monitoring and Evaluation
MEAs	Multilateral Environmental Agreements
MGD	Ministry of Gender and Development
MIAT	Multidisciplinary Integrated Assessment Team
MLME	Ministry of Lands, Mines and Energy
MOA	Ministry of Agriculture

MPW	Ministry of Public Works
NAPA	National Adaptation Programme of Action
NBSAP	National Biodiversity and Strategy Action Plan
NCCC	National Climate Change Committee
NCSA	National Capacity Self-Assessment
NECOLIB	National Environmental Commission of Liberia
NEP	National Environmental Policy
NGOs	Non Governmental Organizations
NRDP	National Reconstruction and Development Plan
NSC	National Steering Committee
NTGL	National Transitional Government of Liberia
PMT	Project Management Team
RBM	Roll Back Malaria
RCWWC	Ramsar Convention on Wetland and World Cultural Heritage
RFTF	Result Focus Transitional Framework
SEDF	Social Enterprise Development Foundation
TB	Tuberculosis
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme
UNFCCC	United Nations Framework Convention on Climate Change
UNHCR	United Nations High Commission for Refugees
UNICEF	United Nations Children and Educational Funds
V & A	Vulnerability and Adaptation
WHO	World Health Organization
WVL	World Vision Liberia

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Preface

Adaptation to increasing climate variability and climate change is a very important topic in Liberia. While some national coping strategies have already been developed to deal with extreme climatic phenomena, they are only a beginning. As such, the NAPA process has afforded Liberia the opportunity to reflect systematically and in concert with a comprehensive set of stakeholders, the type of measures that could increase the capacity of vulnerable communities to cope with the urgent and immediate needs associated with increasing climatic volatility and future climate change. Indeed, I believe that the NAPA consultation process has yielded an excellent set of recommendations that can pave the way for the development of institutional and individual capacity to address the mainstreaming of adaptation into national development planning.

Liberia, like other Least Developed Countries, suffers from low adaptive capacity due to widespread poverty and limited resources available to improve basic services and infrastructure. The population of the country, particularly those living in rural areas, is particularly vulnerable to climatic shocks and will benefit from the implementation of the measures advocated in this document. They will help to strengthen Liberia's capacity to confront the adverse impacts of climate change and represent ways to address Liberia's urgent and immediate adaptation needs at all levels - community, regional, and national. Hence, Liberia views the NAPA Document as a positive step toward the integration of climate risks into development policies and programmes.

The preparation of the Liberian NAPA Document was overseen by the Climate Change Coordination Unit of the Environmental Protection Agency (EPA). It is the outcome of a highly consultative effort that include experts, government policymakers, NGO representatives and assorted stakeholders from rural communities. May each of them who so ably contributed to the realization of the NAPA document accept my sincere thanks and the gratitude of Government and people of Liberia.

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Executive Summary

Although endowed with bountiful and diverse natural resources, Liberia has become susceptible to the adverse effects of climate change. Contributing factors include shifting cultivation, unsustainable logging practices, unregulated coastal mining, high levels of biomass consumption(charcoal and fire wood) and decreasing river flows due to high evaporation. Each of these contributing factors is further aggravated by inadequate infrastructure, low levels of social development, population displacement, low institutional capacity, and inadequate meteorological and hydrological data.

The National Adaptation Programme of Action (NAPA) has been prepared by the Environmental Protection Agency based on the initiative that emerged from the Seventh Session of the Conference of the Parties (COP-7) of the United Nations Framework Convention on Climate Change (UNFCCC) held in Marrakech in 2001. The preparation of NAPA followed guidance provided by the Least Developed Country Expert Group (LEG) in their annotated guidelines. Consistent with this guidance, the NAPA document explicitly accounts for synergies between adaptation and national development plans, such as the National Reconstruction and Development Plan (NRDP), as well as with multilateral initiatives such as Millennium Development Goals (MDGs) and the National Biodiversity and Strategy Action Plan.

The participation of stakeholder groups was an essential part of the NAPA process. Civil society organizations, women groups, indigenous people, CBOs, National and International NGOs, policy makers, academic and research institutions played major roles in the development of the NAPA document, as well as in the assessment of impacts, vulnerabilities, and adaptation measures.

As a result of this process, it is now overwhelmingly clear that the adverse effects of climate change variability and

extreme events are already significantly impacting sustainable development priorities in Liberia. At the policy level, several adaptation initiatives aimed at reducing the adverse effects of climate change while promoting sustainable development were identified as being of the highest priority, including:

- ❑ Capacity building to integrate climate change in development planning, designing infrastructure, land and coastal zone management planning and institutions
- ❑ Raising awareness by dissemination climate change and adaptation information, particularly to vulnerable communities such as farmers and costal settlements
- ❑ Mainstreaming adaptation to climate change into policies through programs in agriculture, forestry, fisheries, energy, health, gender and meteorology/hydrology.

At the project level, several highest priority initiatives aimed at reducing the vulnerability of local communities to increasing climatic variability were identified through a participatory process, including:

- ❑ Integrated cropping/livestock farming with the objective of diversifying crop farming through the cultivation of soybeans, lowland rice and small ruminants rearing;
- ❑ Improved Monitoring of Climate Change with the objective of generating reliable hydrometeorological data and improving the measurement of climatic parameters.
- ❑ Coastal defense systems for the cities of Buchanan and Monrovia with the objective of reducing the incidence of flood, erosion, and siltation in Monrovia and Buchanan.

1. Introduction and Setting

The National Adaptation Program of Action of Liberia has been developed based on extensive stakeholder input obtained in a series of consultations. Additional information was gathered through expert studies and research, all of which revealed that environmental degradation is occurring at various levels throughout the country, a situation that is being exacerbated by increasing climatic variability.

Local communities employ a variety of coping strategies to address climatic shocks. One challenge facing policymakers today is to better integration of Liberia's indigenous and effective coping strategies into its national development policy and planning so that as climatic shocks increase in frequency and intensity, the country will be in a better position to address the situation within the context of its existing sustainable development policy processes.

Population and Geography

The population of Liberia is about 2.9 million (Ministry of Planning, 2003), with an annual growth rate of almost 5 percent – one of the highest in the world. Population density throughout most of the country is less than 30 people per square kilometre, except in certain location by the coast and in the north where population density per square kilometre is considerably higher – over 340 people per square kilometre.

Liberia is situated on the Atlantic Coast of West Africa along the wide South-West Curve North of the Gulf of Guinea Coast (see figure to the right). Lying within Longitude $7^{\circ} 18' - 11^{\circ} 30'$ West and Latitude $4^{\circ} 20' - 8^{\circ} 30'$ North, Liberia covers an area of 38,000 square miles (just over 102 thousand square kilometres). The

coastal belt is 350 miles long and extends approximately 9 miles (15 kilometres) inland.

Climatic Patterns

Liberia is comprised of 4 distinct relief zones: the coastal belt, rolling hills, plateaus and northern highlands. Liberia has two weather seasons: dry and rainy. The Dry Season runs from November through March, while the Rainy Season runs from April through October.

Liberia falls within the West African Monsoon Climate, which alternates between wet and dry periods, with intermittent rain and dry seasons. The seasons do not necessarily depend on changing temperature but are determined by the prevailing moisture-laden monsoon winds that come from the southwest, hitting the Liberian coast at roughly a right angle. As a result, the air rises, then these air masses condense, and heavy precipitation ensues. During the months of November-March, the dust-laden *harmattan* wind, which originates in the Sahara Desert, blows in from the northwest producing a chilly and dry climate.

The average rainfall ranges between 4770 mm along the coast and 2030 mm in the interior. Due to the equatorial position of Liberia, the sun is overhead at noon

Figure 1: Political Map of Liberia



throughout the year producing a temperature range of 28° C to 32° C. Monthly temperatures, averaged over the period 1953 to 1982, are shown in Figure 2.

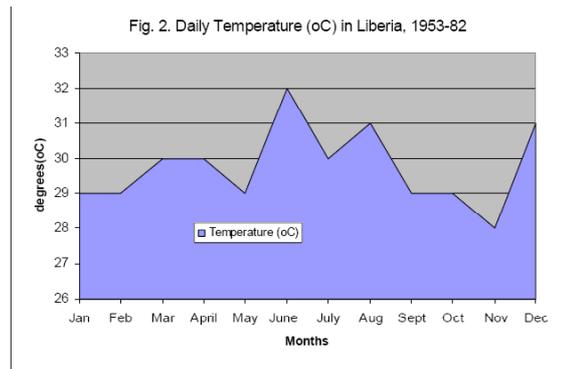
Infrastructure

Liberia is currently confronted with major infrastructural challenges. Prior to the civil war (1989-2003), Liberia had made significant strides in developing its social infrastructure. There existed a highly functional health and education system and the transport sector had made significant progress in connecting urban and rural sites through a network of primary roads (in the capital), feeder roads (rural provinces) and a major high way. Because the civil war destroyed this infrastructure, most of the country (except for the capital of Monrovia) has spent the last 15 years without needed public infrastructure such as electricity, public sanitation or safe water supply. Outside of the capital, the country relies on wells as the principal source of drinking water. Charcoal and fuel wood are the primary sources of household energy.

Liberia is now in the process of rebuilding. Today, there is an ongoing effort to improve the health and education system. A total of 954 primary, secondary and vocational schools are in the process of being rehabilitated, together with 2 teacher-training colleges, the state university and several non-state universities. In addition, the 16 hospitals, 30 health centers and over 100 clinics that were destroyed during the war are being rebuilt (Result Focus transitional Framework, MDGs Report 2004, NAPA Regional Workshops 2005).

Economy

Liberia, a least developed country, is a struggling market-oriented economy burdened by a national debt of about US\$ 3.1 billion. Its GDP in 2003 was equivalent totaled US\$ 438 million, with a per capita income of US\$ 151. In recent years, Liberia's economy has been declining at the rate of about 2% per year.



Source: Hydrometeorological Department, Ministry of Lands, Mines and Energy

In 2003, agriculture accounted for 54% of GDP; forestry 22%; services 21%, industry less than 4%, and mining less than 0.1%; and (MDG report for Liberia 2004). The agriculture and forestry sectors accounted for 95.3% of export earnings in 2001/2002. Prior to the civil war, the main export commodity was iron ore followed by rubber, agriculture and forestry (logging).

Liberia's Human Development Index score dropped from 0.311 in 1996 to 0.276 in 1999. Unemployment in the formal sector is 85%. Access to health, education, safe drinking water and sanitation is less than 25% of the pre-war level (before 1990).

For medium-term economic growth and socio-political development, Liberia has designed a five-year development plan (2002-2007) known as the National Reconstruction and Development Plan (NRDP). The primary objective of NRDP is to reduce the proportion of Liberians in absolute poverty from 76% to 56% by 2007, and to 27% by 2015. Liberia hopes to raise incomes through economic development, rehabilitating the social infrastructure, improving access to social services as well as encouraging private sector participation.

Institutions

On November 8, 2005, a new President and members of the National Legislature were elected, thus formally ending the leadership crisis in the country. This welcome development created an enabling environment for democratic institutions, including the Environmental Protection Agency, which has the task of administering

the affairs of the environment. Within the context of climate change, building the institutional and human resource capacities of environment related institutions are among key priorities in the NRDP's five year plan.

Regarding Liberia's environmental institutions, one of the outcomes of the 1998 Vision 2024 Conference mandated that the Government of Liberia set up a national agency for environmental management. In fulfilment of that mandate, the National Environmental Commission of Liberia (NECOLIB) was established in 1999. The main objective of NECOLIB was to work out the modalities for the establishment of an Environmental Protection Agency, which was successfully instituted in December 2003.

Recent political events in Liberia have facilitated a positive environment in which the new Environmental Protection Agency may operate. In August 2003, under the auspices of ECOWAS, parties in the Liberian conflict reached a political agreement in Accra, Ghana and brought into being the National Transnational Government of Liberia (NTGL). The key mandates of the NTGL were to disarm combatants of the civil war, resettle IDPs and refugees, and hold democratic elections for National leadership.

Development Challenges and Vulnerability to Climatic Variability

Much of the effects of increasing climatic variability and climatic change threaten key economic sectors in Liberia, namely agriculture, fisheries, forestry, energy, health, meteorology/hydrology. Production systems in each of these sectors have already experienced reduced productivity that is linked to changing climatic patterns.

The socio-economic consequences fall particularly on rural populations whose livelihoods depend on natural resources and for whom prevailing poverty persists despite national efforts to rebuild the country. Rural communities represent 70% of the country's population and the overwhelming majority of these people are classified as living below the poverty level.

Against this background, it is important to emphasize that poverty reduction strategies and other national strategies for economic development do not currently account for climatic risks. Indeed, for Liberia the key development challenges vis-à-vis climate risks are linked to the following issues:

- ❑ Degradation of the agricultural lands and the lost of biodiversity, putting small holder households at risk;
- ❑ Absence of an effective early warning system (i.e., a system of meteorological stations) that could allow farmers and other stakeholders to make informed decisions on production strategies;
- ❑ Coastal erosion mainly in low-lying areas such as the urban centers of Robertsport, Monrovia, Buchanan and Cestos.

- ❑ *Agriculture:* Traditional subsistence agriculture dominates the Liberian agricultural sector. As a result, their livelihoods are highly tied to dependable rainfall. Recent changes in rainfall patterns have increased the vulnerability of farmers as it is becoming increasingly difficult to identify the optimal time to plant crops, resulting in low yields. In particular, the Northwest and Central Regions of Liberia have experienced lower cereal crop yields relative to baseline conditions due to reduced soil moisture. Rainfall changes have also resulted in more pests, weeds, and animal diseases in the near-term. In the long-term, these changes are expected to contribute to species extinction, narrowing genetic pool and promote pest development.
- ❑ *Forestry:* According to Forestry Development Authority (FDA, 2000), the natural forests of Liberia cover 4.8 million hectares. Managed plantations cover another 10,000 hectares. Longer periods of rain lead to the slower tree growth and in some cases have resulted in the death of certain tree species, particularly in the southeast and northwest forest blocks. Higher temperatures also pose various problems to Liberian forestry; in addition to facilitating the spread of a variety of forest pest, such as the pine caterpillar, *Dendrolmus punctatu*, increased temperatures impede the growth of certain plant and tree species. The *Tetra berlinatubmanan* of southeastern Liberia, has been documented to be severely affected by changes in temperature. When added to unsustainable practices in logging, mining and farming, these changes in climate are even more acute.
- ❑ *Wetlands:* Liberia has few wetlands that provide both subsistence and economic benefits to its inhabitants. Like wetlands all over the world, they have become stressed by human induced activities.

These are four (4) major wetland types: inland riverine, inland swamp, coastal and lacustrine wetlands. Presently only eight major wetlands exist in Liberia, five of which are targeted for conservation due to their international importance (total surface area of nearly 96 thousand hectares).¹

- ❑ *Fisheries:* Over 20,000 workers nationwide earn their livelihoods from fishing activities. Indeed, fish represent the main source of animal protein in the typical Liberian diet. The major aquatic habitats consist of: sixteen rivers, their tributaries and floodplain systems, as well as coastal habitats and mangrove swamps. Data availability constraints currently limit a thorough synthesis of the vulnerability of fisheries. Nevertheless, it is estimated from the few studies available that the combined effect of changing water temperatures and rainfall patterns are adversely affecting fish stock in terms of declining levels of certain species. When combined with the destruction of habitats (wetland or mangrove swamps), the situation becomes even more serious.
- ❑ *Public Health:* Changes in rainfall and temperature patterns are expected to lead to increased levels of water-borne diseases, particularly among Liberia's rural populations. These diseases, which are more prevalent during the rainy season, include but are not limited to: cholera, dysentery, giardiasis, amebiasis, typhoid fever, and malaria. Of these diseases, malaria has the highest mortality rate and poses the most significant threat to public health, particularly among infants, pregnant mothers and their unborn children. When combined with poor hygienic practices, a scarcity of safe drinking water, and limited public health

¹ Gbedin (25 hectares), Kpatawee (835 hectares), Lake Piso (76,091 hectares), Marshall (12,168 hectares) and Mesurado (6,760 hectares)

facilities, many areas in Liberia will become increasingly vulnerable apart from the implementation of adequate adaptation measures.

The meteorological infrastructure of Liberia is one final and important concern. During the civil war Liberia's entire meteorological and hydrological monitoring capability, which included forty-seven hydrometric stations, was destroyed. Without the necessary infrastructure, the ability to gather and distribute basic meteorological information and forecasts – so vital to farmers, health workers, foresters, and fishermen - has been severely limited. Farmers in particular are severely disadvantaged as they are unable to determine optimal planting and cultivation periods..

National Goals, Plans, and Frameworks

The NAPA process in Liberia was designed to be consistent with ongoing national strategies, plans, and frameworks. It is consistent with the National Environmental Policy, which calls for the sustainable management of Liberia's environment and natural resources, the National Reconstruction Development Plan (NRDP), and Liberia commitment under its Millennium Development Goals. Specific sustainable development goals within these national strategies include but are not limited to the following:

- ❑ Maintain forest cover of 3.4 million hectares through 2015;
- ❑ Increase the percentage of population with sustained access to improved water sources from 26% to 63% by 2015;
- ❑ Increase the percentage of people with access to improved sanitation from 26% to 68% by 2015;
- ❑ Increase the percentage of people with access to secure tenure from 54% to 92% by 2015;
- ❑ Increase GDP per unit of energy consumed fourfold by 2015;

- ❑ Reduce the number of people living in poverty from 76.2% to 27% by 2015.

Moreover, the NAPA process in Liberia has been actively seeking to identify ways to mainstream adaptation to climate change in the development process, by inclusion of climate and vulnerability in sectoral and development policies that are complementary to climate change. There are numerous ongoing national policy processes that have parallel aims to climate change adaptation such as those listed below:

- ❑ *Poverty reduction strategy:* Major portions of Liberia's interim Poverty Reduction Strategy Paper (2007) focuses on rebuilding infrastructure in agriculture, fisheries, and forestry, some of the very sectors that the NAPA process has targeted. Many of the interim Strategy Paper's specific projects and strategies for responding to the development needs of Liberia's poor populations can serve as future points of departure for consideration of adaptation initiatives.
- ❑ *Roll Back Malaria:* Liberia has implemented a national program called Roll Back Malaria (RBM), which contains a comprehensive approach to improving surveillance and epidemic management, enhancing disease management, and providing options for preventive interventions. Given the potential of climate change to exacerbate the already serious public health challenge of malaria through increased transmission potential, NAPA-RBM coordination is a major strategy.
- ❑ *Other:* Liberia has implemented a number of projects funded by the Global Environment Facility (GEF) and Multilateral funding. Some of these activities include management of organic pollutants under the Stockholm Convention, protection of the ozone layer, National Action Plan for persistent organic pollutants, Country Programme for ozone depleting substances, National

Biodiversity Strategy and Action Plan under the Convention on Biological Diversity and capacity building under the National Capacity Self Assessment programme. All these projects are intended to contribute to reduction of Liberia's vulnerability thereby promoting sustainable development.

Barriers to the Implementation of NAPA Results

Liberia faces numerous challenges and barriers when it comes to the implementation of urgent and immediate activities identified by the NAPA process. Some of the major barriers that will need to be overcome can be summarized as follows:

- *Post-conflict situation:* In the elections of January 2006, Liberia emerged from a long dark period in its history characterized by violence, divisiveness, and economic mismanagement. National and local institutions will need time to put in place the regulatory, political, and informational framework necessary to deal with integrating adaptation to climate change into national action

- *Capacity.* Institutional and individual capacity at both the national and local levels is limited and will need to be strengthened in order to realize the benefits from the NAPA process;
- *Funding.* Inadequate funding both at the national and international levels threatens to limit the level of implementation of key measures identified in the Liberia NAPA;
- *Poverty.* In rural areas, there is continues to be persistent extreme poverty, poor health conditions which make communities more vulnerable to climate change.
- *Infrastructure.* Very poor roads, telecommunications, and sanitation may exceed the cost of activities in certain of the most vulnerable areas.

2. Identification of Key Adaptation Needs

Liberia is a country of rich resource potential, richly varied geography, and tremendous human capability. It has made significant development strides as it emerges from recent civil war in promoting sustainable development policies, engaging in international environmental processes, and seeking to strengthen its human and institutional capacity.

Climatic risks pose a serious challenge to its emerging development priorities in agriculture, fisheries, forestry, and public health. Yet, fundamental to any of the adaptation measures discussed below is the rehabilitation of the meteorological and hydrometric stations that were destroyed during the civil war. Re-establishing the infrastructure by which to monitor climatic patterns and making near-term predictions is absolutely essential

In the subsection below, major adaptation needs and initiatives are summarized relative to the key vulnerable sectors identified during the consultation process. Indeed, the identification of potential adaptation-related activities that build upon existing national processes, forge new linkages where possible, and break new ground where needed, has been firmly in view throughout all NAPA activities.

Vulnerable Groups in Urgent Need of Adaptation Activities

The groups most vulnerable to climate risks are those that live in coastal areas and whose livelihoods consist of fishing, farming and low level trading. They are typically the least able to cope with climate-related shocks due primarily to a combination of extreme poverty levels and household income-generating activities that are highly limited.

Changing rainfall patterns will adversely affect urban and rural communities insofar as the on which they depend for farming, municipal water supply and electricity

production (based on hydro resources) – are threatened. Ordinary Liberians will also suffer from frequent occurrence of illness due to vector-water borne diseases that will likely increase due to water shortages. Changes will also cause loss of crops and livestock herds.

These factors, together with other specific non-climatic factors contribute to increased vulnerability of local communities during climatic shocks. The NAPA consultation process confirmed that there is widespread interest in the introduction of measures to maintain fishery production capability, inhibit the spread of disease, preserve forests/wetlands, and increase agricultural productivity.

Key Adaptation Activities in Agriculture

In many parts of Liberia, rain-fed farmers have devised numerous kinds of coping strategies to deal with agricultural production in the face of climatic variability. With the advent of changes in climatic patterns in recent decades, many of these strategies are proving to be no longer effective. Major adaptation activities and needs that were identified during stakeholder consultations are as follows:

- ❑ Carrying out the timing of crop cultivation in response to changing patterns of rainfall;
- ❑ Intercropping, irrigation, and the optimization of lowland/swamp farming practices;
- ❑ Pest control including fencing of farms against rodents, bird scare scrolls, regular weeding, and the use of high echoing bells; and
- ❑ Maintaining fast growing nitrogen fixing tree species to improve soil fertility and using multiple-purpose tree species on farmlands to maintain forest cover.

Key Adaptation Activities in Public Health

Ongoing work in Liberia is confirming the correlation between temperature and precipitation patterns and malaria, cholera, dysentery, giardiasis, amebiasis, typhoid fever - diseases that afflict thousands throughout the country. While the NAPA consultation process confirmed that malaria is the highest concern, the other diseases were also considered for adaptive measures. Adaptation activities will need to take into account the diversity of factors that influence the capacity to cope with health outbreaks. Specifically, major adaptation activities and needs that have been identified are as follows:

- ❑ Identifying and disinfecting stagnant water sources that are breeding grounds for insects;
- ❑ Promoting hygiene and sanitation education and awareness, including clinical interventions and community health education programs; and
- ❑ Strengthening the Roll Back Malaria program and providing a range of herbal treatments.

Key Adaptation Activities in Fisheries

Ongoing studies in Liberia have been able to conclude that during the peak of the dry season, the drying of ponds and inland rivers are major factors in the reduction of fish populations. Surviving fish are then threatened with pollution, caused by pesticide run-offs and industrial discharges. In addition, Liberia's fishery sector suffers from a lack of surveillance, low licensing fees for demersal trawlers and foreign fishing vessels, and year-round fishing even in fish nursery areas. Major adaptation activities and needs that have been identified are as follows:

- ❑ Reducing the number of fishing licenses issued to foreign vessels;
- ❑ Raising the licensing fee for demersal trawlers;

- ❑ Regulating fishing practices to prevent overexploitation and fishing in restricted areas;
- ❑ Instituting appropriate surveillance of Liberian fishing waters;
- ❑ Funding research aimed at fishery-related database development; and
- ❑ Formulating a national fishing policy.

Key Adaptation Activities in Forestry

As indicated earlier, Liberia still has large tracts of forested area. These lands are being threatened by a combination of unsustainable practices that are being compounded by a changing climate. While serious, it is recommended that no immediate adaptation initiatives be undertaken at the present time apart from raising the climate change awareness and finalizing wetlands legislation currently in process.

Adaptation Projects Proposed by Stakeholders

During the course of the regional stakeholder consultations, numerous other types of projects that were considered to have the potential to decrease vulnerability relative to climate variability and extreme events were proposed and discussed. Overall, there were 28 specific adaptation projects across the agriculture, fisheries, health, and forestry. These projects were deemed to have sufficient consensus among the range of stakeholders for them to be evaluated relative to the criteria developed for the multi-criteria assessment phase, discussed in the next section.

3. Criteria for Selecting Priority Projects

Prioritizing adaptation projects involved two major steps in the Liberia NAPA process. First, a number of evaluation criteria were locally determined through the stakeholder consultation process. Then, through a scoring, weighting, and ranking process – part of a multicriteria assessment process recommended in the Annotated Guidelines - a discrete set of prioritized adaptation projects were developed.

Development of locally-driven Evaluation Criteria

Throughout the NAPA process in Liberia, there was an emphasis on the development of local evaluation criteria that were driven by the concerns expressed by extensive stakeholder consultations. This provided a basis for determining appropriate trade-offs between the various adaptation initiatives relative to the unique concerns of the stakeholders participating in the evaluation development process. See Annex 1 for a profile of institutional involvement in the stakeholder consultation process.

There were five criteria that emerged from these consultations, as summarized in the bullets below. These criteria represent a mix of both quantitative and qualitative indicators and were fully established and supported by the range of stakeholders assembled.

- ❑ Impact on vulnerable groups and resources (qualitative; scale from 1 to 5);
- ❑ Impact on economic growth rate of poor people (quantitative; expressed in percentage terms);
- ❑ Losses avoided by people (quantitative; expressed in physical units per capita per year);
- ❑ Synergy with multilateral environmental agreements to which Liberia is a signatory (qualitative; scale from 1 to 10); and

- ❑ Cost ((quantitative; expressed in cost per million units);

Assigning Scores to locally-driven Evaluation Criteria

Once the evaluation criteria were fully identified, each of the 28 adaptation projects that had been proposed by the stakeholders was assigned a raw score for each of the proposed criteria. These scores were determined on the basis of discussions - sometimes quite extensive – with stakeholders.

Where necessary, uncertainty in stakeholder consensus was resolved on the basis of the best judgement of the NAPA team. After standardizing the raw criteria scores for each proposed adaptation project using conventional mathematical techniques, and applying criteria weighting system that treated each criterion equally with others, a final set of prioritized projects for each vulnerable sectors was obtained.

The results from the scoring exercise were presented to a stakeholder Validation Forum, and a set of the eight (8) highest prioritized projects in each vulnerable sector emerged, as briefly summarized below:

- ❑ *Agriculture*: Integrated crop/livestock farming;
- ❑ *Forestry and wetlands*: switching from fossil fuel based to biomass based energy products;
- ❑ *Fisheries*: promoting sustainable fishing practices;
- ❑ *Energy*: Promoting energy efficiency and conservation;
- ❑ *Water*: Awareness and sensitization about the importance of water resource management;

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- ❑ *Coastal zones:* development of an integrated coastal zone management plan
 - ❑ *Meteorological:* rebuilding the national meteorological monitoring network; and
 - ❑ *Public health:* use of insecticide treated materials (ITMs), ranked first under the health sector.

4. List of Priority Activities

The final prioritization of adaptation activities was twofold. First, the top-ranked sectoral projects that emerged from the process described in the previous section were identified (as identified in the previous section). Then, a further prioritization was carried out in which the top three projects were identified in the context of further stakeholder consultations.

Highest Priority Adaptation Projects

After an appreciable period of deliberations, stakeholders winnowed the list of 8 high priority adaptation options to the top three. The high-level policymakers who conducted the final evaluation and project rankings sought to ensure that the final outputs of the NAPA process would be well linked to the government's ongoing strategies to reduce poverty.

The resulting prioritized options as summarized in the bullets below, ranked from highest to lowest priority. Full project profiles are provided for each of these options in Annex 2.

- *Top priority project:* Enhancing resilience to increasing rainfall variability through the diversification of crop cultivation and small ruminants rearing (agriculture);

- *2nd highest priority project:* Enhance adaptive capacity through the rebuilding of the national hydro-meteorological monitoring system and improved networking for the measurement of climatic parameters;
- *3rd highest priority project:* Reducing the vulnerability of coastal urban areas (Monrovia, Buchanan) to erosion, floods, siltation and degraded landscapes.

It is important to note that the underlying need for rebuilding the meteorological monitoring and forecasting capability of Liberia underpins all other options. It is nevertheless fundamental to creating the adaptive capacity in the country needed to cope with current climate variability and future climate change.

After the process of selection and prioritization of adaptation projects was completed, the NAPA consultation process gave considerable emphasis to the analysis of existing policies and institutional framework so as to assess their suitability for integration and implementation of the NAPA in national development context.

5. NAPA Preparation Process

During the process of completing the Liberia NAPA, there were many consultations, workshops, meetings, and roundtables. The objective of the NAPA process was to build awareness about climate risks, solicit feedback on urgent and immediate needs, and synthesize a wide range of information. A brief overview of the process is provided below.

Organization

A participatory process, involving multiple stakeholders and national consultants, guided the preparation of the NAPA document. This process began with the establishment of an administrative structure, which included: a) the National Steering Committee - to provide strategic oversight and guidance to the NAPA process; b) the Multidisciplinary Integrated Assessment Team - to conduct climate change studies and vulnerability assessments; and finally c) the Project Management Team - responsible for the day-to-day administration of the project.

The Figure on the following page illustrates the organizational design of the project. Included in this figure are also some of the major milestone activities that took place over the duration of the NAPA process in Liberia.

Activities

Following the establishment of the administrative structure, Liberia's NAPA process was launched with a kick-off workshop. The objectives of this workshop were to publicize the program activities of the NAPA Project and to cultivate public awareness of the adverse effects of climate change to Liberia.

A major activity in the NAPA process was to carry out the participatory vulnerability assessment, which identified climate change related problems as well as traditional coping mechanisms and strategies among key stakeholders and in key areas of the

country. Hence, both a desktop research component and a consultative component were included in the vulnerability assessment.

The vulnerability assessment was followed by the national stakeholders' consultation. In addition to summarizing the climate change related issues and traditional coping strategies, the consultation identified requisite adaptation needs of Liberia as well as barriers to proposed adaptation measures. The Prioritization of Adaptation Workshop followed the national stakeholders' consultation. This workshop identified appropriate national adaptation measures.

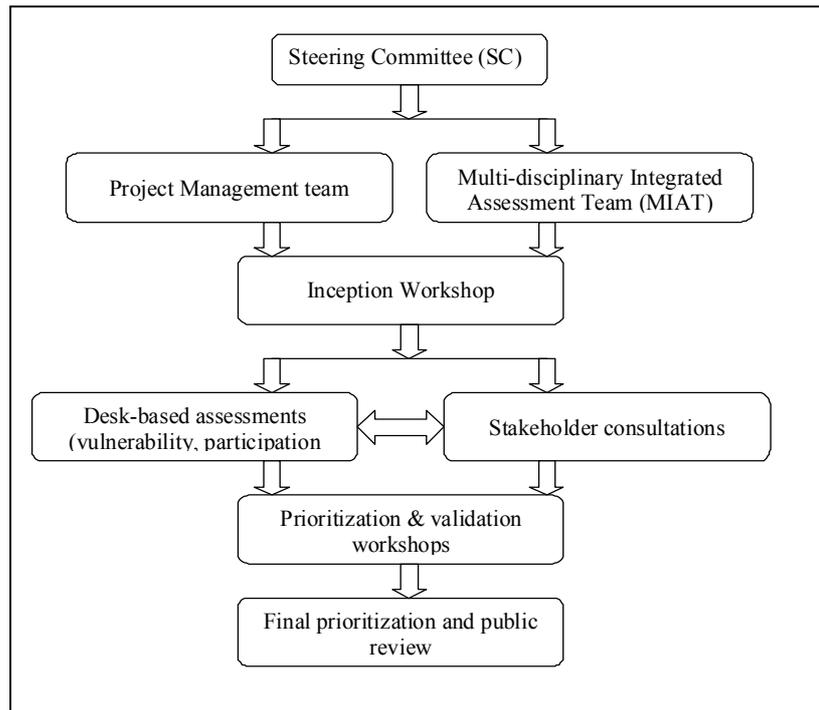
Development of Interim Technical Reports

Expert groups were formed to synthesize available information and prepare a variety of interim technical reports. These reports had the result of consolidating emerging knowledge about climate change in Liberia. They also represent the building of a library of permanent material at the climate change Secretariat of the EPA that will be useful in subsequent efforts.

The following reports were prepared by expert groups and are cited in the List of References:

- ❑ Scoping reports for methodology to be used in undertaking the stakeholder consultation workshops;
- ❑ Reports on the vulnerability of the various sectors to climate variability and climate change based on reviews of local data, observations, and available studies;
- ❑ Reports based on the results of the participatory vulnerability assessment; and
- ❑ Reports on the proposed adaptation projects, policy and institutional framework recommendations.

Figure 3: Organizational chart for the Liberia NAPA process



6. List of References

- Amara, S.S. (1993) Environmental Change Flooding in Gambia River Basin. Ph.D. Thesis, University of Reading, Reading, 362 p. U.K.
- Ambrose, B. (1978) Models Mathematiques Dynamiques En Geographic Physique. *Revue Geographique de l'est.*, 3, 149-167.
- Bailey, T.C. and Gattrell, A.C. (1995) Interactive Spatial Data Analysis. Longmans Scientific and Technical Publications, 156-159. London
- Barnes, D.W. and Edmonds, J.A. (1990) An Evaluation of the Relationship Between the Production and Use of Energy and Atmospheric Methane Emissions, U.S. Department of Energy, DOE/NBB-088p U.S.A.
- Benioff, R.S. Guill, and J. Lee (eds) (1995) Guidance for Vulnerability and Adaptation Assessment, U.S. Country Study Program, Government Printing Office, Washington, D.C., U.S.A.
- Chow, V.T. (1964) Handbook of Hydrology. McGraw-Hill Book Co., New York.
- Clans Fridmont, (1995) Illustrated Guide to the Commercial Warm Water Fish, Denmark, Fishing News Book.
- Dennis, K.C., Niang-Diop I., and Nicolls, R.J., 1956. Sea Level Rise in Senegal: Potential Impacts and Consequences: *J. Coastal Res. Special Issues* 14, 243-261
- Desk Study on the Environment in Liberia (2004), UNEP, Nairobi, Kenya
- Evans, J.L. and Allan, R.J. (1992) El-Nino/Southern Oscillation Modification to The structure of the Monsoon and Tropical Cyclone Activity in the Australasian Region. *International Journal of Climatology*, 12, 611-623.
- Forestry Development Authority (FDA), 2000. Annual Report, Monrovia.
- Gasse, F. and Van Carpo, E. (1994) Abrupt post-glacial climate events in West Asia and North Africa Monsoon Domains. *Earth and Planetary Science Letters*, 126, 435-456
- Gifford, R.M. (1992) Interaction of carbon dioxide with growth-living Environmental factors in vegetation productivity: Implication for the global warming cycle. *Advances in Biochemistry*, 1, 24-58..
- Hennessy, K.J. Gregory, J. M. and Mitchell, J.B. (1997) Changes on Daily Precipitation Under Enhanced Greenhouse Condition. *Climate Dynamics*, 13, 667-680.
- Liberia Demography Health Survey 1999/2000, Vol.III (Analytical Report) Monrovia, Liberia
- Millennium Development Goals Report (2004) Government of Liberia, Monrovia, Liberia
- National Malaria Control Program (2002) Insecticide Treated Materials (ITMs) Ministry of Health & Social Welfare, Liberia
- Njie, M. (1987) Monographie Lydrologique du bassin versant du pruju (Monographs on the pruju Bolong) Dipli-Ing. Dissertation, AGRHYMET Center, Niamey, Niger
- Government of Liberia/World Bank/UNDP (2004) Needs Assessment, Monrovia, Liberia
- The Adaptation Policy Framework (2003) User's Guidebook, GEF-UNDP, New York
- UNFCCC (2002) Annotated Guidelines for the preparation of national adaptation programmes of action, Least Developed Countries Expert Group, Bonn, Germany

UNFCCC (2004) National Adaptation Programmes of Action, Least Developed Countries Expert Group, UNITAR, Geneva, Switzerland

Wiles, David L. (1998) Geographical Features of Liberia. Department of Geography, University of Liberia, Monrovia, Liberia

Wiles, David L. (2003) The Impact of Population on the Environment in Liberia, Institute of Population Studies, University of Liberia, Monrovia, Liberia.

Annex 1: Profiles of Institutions Involved in the Stakeholder Consultation Process

There were numerous institutions consulted for the assessment of evaluation criteria scores, as outlined below

- ❑ *Ministry of Agriculture:* Plans, executes, administers, managers and supervises agricultural programs, with extension as it major components; works with local farmers to encourage improved varieties for food Security.
- ❑ *Ministry of Education:* plans, executes, administers, managers and supervises educational activities for primary, junior and secondary schools; responsible for accreditation of all academic institutions.
- ❑ *Ministry of Gender and Development:* Plans executes, administers, manages and supervises gender and development activities with special emphasis on women, youth and the elderly.
- ❑ *Ministry of Internal Affairs:* Administers the affairs of all Government functionaries ‘within local and Urban areas; oversee the activities of local Government bodies such as the chiefdoms and clans; guarded by the revised interior regulations, has custodianship over all private and public properties within the territorial confines of the country.
- ❑ *Ministry of Lands, Mines and Energy:* It has the statutory responsibility for the development of mineral, water and energy resources of the country and the administration of its lands.
- ❑ *Ministry of Public Works:* responsible for road construction, maintenance and other public infrastructure. The Ministry also provide technical guidance to any institution involve in infrastructure development. It is one of the key agencies implementing zoning policy of the country.
- ❑ *Liberia Produce Marketing Corporation:* Operates nurseries and distributes seedlings of farmers for increased each crop production. Set prices of commodities.
- ❑ *Liberia Water and Sewer Corporation:* Responsible to plan, execute, administer, manage and supervise the generation and distribution of water to the public. It is also responsible for the supply of safe drinking water and provides services concerning the sanitary disposal of water and maintains the water sewerage facilities. The Corporation produces, transmits and distributes pipe-borne water. They rehabilitate water and Sewer facilities throughout Liberia and improve and expand services to meet the water needs of all residents.
- ❑ *Forestry Development Authority:* Responsible to sustainably manage the forest and its related resources. Provides long and medium-term planner in the forestry sector as well as prepares forestry policy, law and responsible for the administration; supervises adherence to forest legislation and concession agreements; calculates and determine forestry fees; evaluates investment proposals, executes reforestation and forest research and training; monitor activities of timber companies and executes protected area programmes and administers Wildlife and national parks.
- ❑ *Environmental Protection Agency of Liberia:* Creates and promotes environmental awareness; develops national environmental policy, environmental protection and management law. Coordinates activities of environmental related organizations, including NGOs and oversees international environment related conventions.

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- ❑ *Forestry Development Authority*: National Agency responsible for Liberian forest and its resources
 - ❑ *Liberia Community Development Foundation*: Community Based Organization engaged in local empowerment through skill training and macro financing.
 - ❑ *Save My Future Foundation*: local environmental organization that works on the sea turtle program and other sustainable activities.
 - ❑ *Environmental Relief And Development Organization*: local environmental organization that works on solid wastes activities.
 - ❑ *Green Advocates*: local environmental organization that provides pro-bono legal assistance to indigent populations and advocates for transparency in the usage of natural resources.
 - ❑ *Liberia Council of Churches*: association of mainstream churches; advocates for freedom and justice.
 - ❑ *Sustainable Development Institute*: local environmental organization that works on sustainable forest management.
 - ❑ *Society Against Environmental Degradation*: local environmental organization that works in the area of wetlands management.
 - ❑ *Liberia Indigenous Forum for the Environment*: local environmental organization that works on the conservation of medicinal plants.
 - ❑ *United Nations Military Mission in Liberia*: Provides security and other national capacity building assistance to the Government of Liberia.
 - ❑ *Liberia community Infrastructural Program*: Implements United States Agency for International Development (USAID) community infrastructure program for rural Liberia.
 - ❑ *Farmer Association to Conserve environment*: one of the local environmental organizations working to ensure sustainable management in Liberia.
 - ❑ *Cutting ton University College*: one of the higher institutions of learning in Liberia involved with training young men and women in various academic disciplines as part of the national human resource development effort of the country.
 - ❑ *University of Liberia*: the only publicly owned institution of higher learning in Liberia. The mission of the university is to train, research and provide community services.
 - ❑ *Center for Environmental Education and Program*: one of several environmental non-governmental organizations involve in public awareness and environmental education in local community.
 - ❑ *Sustainable development Promoter*: local relief and development NGO concentrated mainly in central Liberia; implemented programs for UN agencies during the height of the civil war.
 - ❑ *Social Enterprises Development Foundation*: involved with micro-loan program to vulnerable women.
 - ❑ *Liberia Broadcasting System*: state-owned broadcasting outlet in the country. It had radio and television programs prior to the civil war. Presently, it beams programs on FM 99.9 transmitter.
 - ❑ *News Newspaper*: one of the local dailies in the country.

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- ❑ *Truth FM*: one of the many FM broadcasting outlets that emerged at the end of the civil war. It has both radio and television programs for Monrovia and its environs.
 - ❑ *Non Governmental Environmental Coalition*: umbrella organization bringing together over 10 environment-related civil society organizations in the country. Its main objective is to synchronize and harmonize civil society position on environment issues in the country.

Annex 2: Highest Priority Project Profiles

This Annex presents a total of three (3) projects that have emerged as the highest priority adaptation projects from the complete NAPA consultative process. They have been determined through a structured the multi-criteria assessment process that involved a broad range of stakeholders (see Section 6 for a discussion of the NAPA stakeholder consultation process) and multiple layers of review and consultation. Each project is briefly described regarding its rationale, objectives, activities, expected outcomes, implementation arrangements, and budget.

Highest Priority Project: Integrated Cropping/Livestock Farming

Background: The Liberian economy is dualistic, characterized by a traditional subsistence sector, which engaged in agriculture and a modern sector, mainly export oriented. The traditional sector, although employing over seventy percent of the labor force, contributes less than one-fifth to the GDP.

Justification: Liberia's agriculture is agrarian. The civil war destroyed the agricultural infrastructure and disrupted farming. There was large population displacement, particularly the rural one into IDPs' and refugees' camps. Farms and equipment were abandoned and looted, with livestock either killed or looted by fighters of the civil war. The Central Agriculture Research Institute (CARI), responsible for research activities including the development of germplasm and breeding of animals, was vandalized and destroyed. The Ministry of Agriculture was not spared by the destruction and looting of the civil war. This has created an acute shortage of planting materials and livestock and livestock products in the country. Reviving agriculture to its pre-war levels with emphasis on slash and burn method, will further increase forest cover/vegetation loss, a major contributing factor to climate change in Liberia according to the vulnerability assessment of NAPA.

Integrated cropping and livestock farming is a low cost alternative to increased agricultural productivity and ensuring ecological integrity. This method of farming will further help address the severe food security problem Liberia face which is at crisis proportion in rural areas. With fifty four percent (54%) of the estimated 2.9 million population of Liberia being rural and survive on subsistence agriculture, farming method with such potential is therefore desirable if alleviating poverty and enhancing food security at the local level will be a reality.

Overall Objectives: The primary objective of the project is to reduce vulnerability of farmers to climate change by diversifying crop farming through the cultivation of soybeans, lowland rice and small ruminants rearing.

Goals: The major goals of the project are as follows:

- To reduce to a considerable extent the impacts of extreme effects of weather on farm productivity
- To encourage and promote the diversification of sustainable agricultural productivity
- To increase food production level of farm families

Expected Results: The major results expected from the implementation of the project are as follows:

- Rural communities capacities strengthened
- Increased in sustainable livestock and crop production
- Poverty levels at both national and households levels reduced
- Farmer's income increased due to diversify agricultural production
- Malnutrition levels amongst rural communities reduced

Activities: The major activities of the project are as follows:

- Project staff and relevant stakeholders incorporated

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- ❑ Identified and recruit extension agents to provide technical backstopping in existing agricultural zones
 - ❑ Introduce and popularize lowland farming methods as a way of reducing pressure on forest cover or vegetation
 - ❑ Provision of crop varieties and improved breeds of livestock and medication
 - ❑ Provision of requisite inputs to enhance project objectives

Indicators: The major indicators that will be reviewed to assess the efficacy of the project are as follows:

- ❑ Considerable number of rural community people experiencing increased agricultural activity
- ❑ Increased number of farmers adopting diversified agricultural production
- ❑ Number of malnourished and under nourished population reduced
- ❑ 1,500 poverty stricken farm families recruited to adopt appropriate technologies in sustainable livestock production

Risks: There are two major risks associated with the implementation of the project, namely the security situation of the country and the potential non-cooperation of farm families to adopt to the proposed method of farming

Institutional Arrangement: The key national institutions that would be involved in the process are the Ministry of Agriculture, World Vision-Liberia, and the Sustainable Enterprise Development Foundation

Duration: The duration of the project is set for twenty-four (24) months

Budget: A total budget of US\$ 5 million is needed.

***Second Highest Priority Project:
Improved Monitoring of Climate Change***

Background: Prior to the war, Liberia had forty-seven hydrometric networks throughout the country to monitor meteorological and hydrological parameters. The civil war (1990-2003) destroyed nearly all of these facilities. From the period of the end of the civil war to the present, the hydrometeorological monitoring capacities remain non-existent and therefore no recorded data for the period mentioned except the Roberts International Airport and Firestone Rubber Plantations Company.

Justification: The annual variability of rainfall experienced in Liberia manifests changes in our weather and thus in our climate. Water resources, agriculture, forestry, aviation, fishery, land transport, etc. are vulnerable to changes and variations in our climate. Henceforth, predicting climate change, including regional aspect of analysis of climate variability constitute the primary in the planning and operational stages in these sectors.

Overall Objectives: The principal objective is to aid national adaptation capabilities through the generation of hydrometeorological data and improved networking for the measurement of climatic parameters.

Goals: The major goals of the project are as follows:

- To make hydro meteorological information timely available to end users
- To improve informed decision making
- To enhance effective networking among stakeholders

Expected Results: The major results expected from the implementation of the project are as follows:

- Availability of hydro meteorological data
- Strengthened national capability to forecast climatic events thereby reducing level of vulnerability to climate hazards
- Strengthened coordination among climate related institutions

Activities: The major activities of the project are as follows:

- Rehabilitate existing hydro meteorological stations
- Establish hydrometric networks at river basins
- Acquisition of materials and equipment
- Conducting training programme for hydrometeorological personnel
- Provide public awareness

Indicators: The major indicators that will be reviewed to assess the efficacy of the project are as follows:

- Existing hydro meteorological stations functional
- Report of Hydro meteorological data
- Adequate personnel trained
- General public informed

Risks: There are two major risks associated with the implementation of the project, namely the security situation of the country the fulfillment of co-funding commitments

Institutional Arrangement: The key national institutions that would be involved in the project are the Ministries of Transport, Lands, Mines and Energy and Environment Protection Agency

Duration: The duration of the project is set for twenty-four (24) months

Budget: A total budget of US\$ 3 million is needed.

Third Highest Priority Project:
Coastal Defense System for the Cities of Buchanan and Monrovia

Background: Coastal and marine ecosystems in Liberia have been subjected to rapid deterioration due to a combination of factors including anthropogenic as well as natural. As a consequence, flooding, erosion, siltation of seaports and major water bodies are on the increase. It has affected human settlements and livelihood.

Justification: The coastal ecosystem consists of mangrove related vegetation, which serves as nurseries for fisheries and sanctuaries for many marine reptiles, mammals and migratory birds. Also common in the coastal zone are oil palms, raphia, mango and other fruit and ornamental plants. The areas along the coast where erosion is most severe are Monrovia City, (Bushrod Island), Buchanan and Cestos Cities. The development of seaports and the sand spits along the coast give rise to coastal cities being sand starved. Actions to control beach erosion around seaports and costal settlements in Liberia are therefore critically important to maintaining their viability as sites for potential tourism, recreation and commercial activities. Initiatives to reverse negative economic and ecological consequences to achieve sustainable use of coastal and marine resources cannot be overemphasized.

Overall Objectives: The main objective is to strengthen national capacities in reducing the incidence of floods, erosion, siltation and degraded landscape in the cities of Monrovia and Buchanan.

Goals: The major goals of the project are as follows:

- To restore and maintain the viability of the coastal areas (Monrovia and Buchanan) as sites for potential tourism, recreation and commercial activities;
- To check the alteration of the natural river systems which is caused by harbor construction in Monrovia and Buchanan
- To control beach erosion around seaports in Monrovia and Buchanan

Expected Results: The major results expected from the implementation of the project are as follows:

- Provide immediate shoreline hardening and stabilization techniques to protect the beaches from erosion;
- Increased socio-economic potentials of the coastal areas;
- Improve utilization of coastal resources such as sand and gravels;
- Establish coastal and urban growth planning schemes;

Activities The major activities of the project are as follows:

- Construction of a Groyne System in Monrovia (Mamba Point, West Point and New Kru Town)
- Construction of Break Water System in Buchanan (Walvis Bay, Robert Street and Port of Buchanan)

Indicators The major indicators that will be reviewed to assess the efficacy of the project are as follows:

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- ❑ Coastal Land reclaimed in Monrovia (West Point, New Kru Town and Banjor)
 - ❑ Coastal Land reclaimed in Buchanan (Walvis Bay, Robert Street and Port of Buchanan)
 - ❑ Increased protection of coastal infrastructures
 - ❑ Threats to human settlements and livelihood reduced

Risks: There are two major risks associated with the implementation of the project, namely the security situation of the country the fulfillment of co-funding commitments

Institutional Arrangement: The key national institutions that would be involved in the process are the Climate Change Coordination Unit of the Environmental Protection Agency, the Ministry of Lands, Mines and Energy, the Ministry of Public Works, and the NPA

6.1. Duration: The duration of the project is set for thirty-six (36) months

Budget: A total budget of US\$ 60 million is needed.