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Water for Agriculture and Energy in Africa: the Challenges of Climate Change

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National Investment Brief

LIBERIA

EXECUTIVE SUMMARY:

An estimated 1.3 million of Liberia's 3.5 million people are living in poverty, of which 48 percent are living in extreme poverty. Poverty is higher in the rural areas, where about 73 percent of the population is poor. Food insecurity is high, as evident by the poor nutritional status of the population. About 39 percent of children under age 5 are stunted and one-fifth of children are severely stunted. Given the impact of the war, coupled with the weak supporting environment, it is unlikely that Liberia will attain the benchmark of the World Food Summit or the Millennium Development Goals.

Prior to the civil conflict, agriculture accounted for approximately 40 percent of GDP. In 2007 GDP was US\$725 Million of which agriculture accounted for 66 percent. Agricultural activities are still considerably reduced and food insecurity is worsening. Imports of agriculture produce continue to increase, as compared to export, putting a strain on foreign currency needed for other essential goods and services. Low productivity of land and labour, shifting cultivation and low livestock production remain the main characteristics of traditional farming in Liberia.

The total land area in Liberia is 9.8 million ha, of which 4.6 million ha is arable (46 percent). Irrigation potential is estimated at 600 000 ha, consisting mainly of freshwater swamps. The equipped area for irrigation is 2,100 ha but area actually under irrigation is 300 ha, with an average of 237 hectares farmed at any one time. The main irrigated crop is rice. 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.

There are six major rivers (Mano, Lofa, Saint Paul, Saint John, Cestos and Cavalla), originating in Sierra Leone, Guinea or in Côte d'Ivoire. Internal renewable surface water resources are estimated to be 200 km³/year and internal groundwater is estimated to be 60 km³/year. Prior to the war, there were three functional hydropower stations but were destroyed during the war.

The Government development agenda, the PRS, spells out various strategies for the development of water, agriculture and energy, in collaboration with its many development partners. The central goal for agriculture during the PRS period is to revitalize the agricultural sector in order to contribute to inclusive and sustainable economic development and growth, and to provide food security and nutrition, and employment. An agricultural policy has been drafted within the context of the PRS and the MDG. It outlines specific policies and strategies that will revitalize and strengthen the agriculture sector, of which water and energy are integral components. Moreover, a Renewable Energy & Energy Efficiency policy and Action Plan has been developed to induce investment, transfer technology, develop the market, and build local capacity.

The financial envelope for the short to long term is US\$51.0 Million. Currently, there are ten projects in the portfolio. Two are ongoing, while 7 are in the pipeline. In the pipeline is one Bankable Investment Project Profiles dealing with inland swamp rehabilitation and development for US\$ 7 million. Additionally, there are four projects developed in the CAAS investment proposal with cost ranging from US\$ 2.5 million for a land and water institutional capacity building project, to US\$ 22.1 for land and water development for swamp rice production. There are over 10 donors complementing the efforts of the Liberia government.

1. CONTEXT

1.1 AGRICULTURE AND FOOD SECURITY

Agriculture

Prior to the civil conflict in 1989, agriculture accounted for approximately 40 percent of GDP and Liberia was the producer and exporter of basic raw materials such as timber and rubber. The agriculture sector accounted for employment of nearly 70 percent of the economically active population, and over 90 percent of total export. By the end of 1996, real GDP was as low as 10 percent of its pre-war level. However, from 1997 it increased, reflecting a post-war surge in rice, timber and rubber production, and in 2002, reached US\$442 million. In 2007 GDP was US\$725 million of which agriculture accounted for 66 percent.

The agriculture sector is forest based, dominated by traditional subsistence farming systems mainly in the upland. It is characterized by labor intensity, shifting cultivation, low technologies and productivity. The sector is confronted with many challenges, such as low capacities of farmers and institutions, as well as ruined infrastructures.

While in the mid-1980s about 235 000 ha of swamp rice were cultivated, this figure dropped to 120 000 ha in 2003, leading to a decrease in total rice production from about 290 000 tonnes in the mid-1980s to 110 000 tonnes in 2003.

Irrigation and water control

Liberia has a total land area of approximately 9.8 million ha, of which 4.6 million ha is arable land (46 percent). Of the arable land, 4 million ha is upland while the remaining 600,000 ha is swampland, with irrigation potential. Prior to the war, about 634,000 ha (13.8% of total arable land) was cultivated, mainly under rice and cassava. At present, it is estimated that annual cultivation is less than 5 percent of the arable land. The equipped area for irrigation is 2,100 ha but area actually under irrigation is 300 ha, with an average of 237 ha, farmed at any one time. Most of the swamp areas on which subsistence farmers cultivate rice comprise narrow inland valleys and widely scattered small swamps which are cleared using hand labour, and which make extensive of water control structures. Under traditional farming practices, yields of rice, is about 1ton/ha. However, under improved water management practices, rice yield is in the range of 3-4 tons/ha.

According to the assessment on agriculture conducted in 2007, irrigation infrastructure is virtually non-existent, despite the presence of abundant water resources in the country. Areas with good water control and having the possibility of two crops per year are limited. Conventional upland irrigation is not considered an issue in Liberia because of water surplus in all the agro-ecological zones in the country and the large area of swampland available for development. Shallow well irrigation farming and peri-urban irrigation also take place on a limited scale in Liberia. These activities are probably taken for granted and therefore do not receive any recognition in the plans for achieving food security.

Food security

An estimated 1.3 million people in Liberia are living in poverty, of which 48 percent are living in extreme poverty. Poverty is higher in the rural area, where about 73 percent of the population is poor. The level of undernourishment in Liberia is also very high; 42 percent of the population is undernourished. Both the number and the proportion of undernourished people increased from 1990-92, benchmark period of the WFS and the MD, to 1999-2001, the last period available.

The Comprehensive Food Security and Nutritional Survey (CFSNS) conducted in March 2006, revealed that about 40 percent of households in rural and semi/urban Liberia are food insecure. The figure reaches as high as 28 percent in areas most affected by war and displacement. The report stated that the underlying causes of food insecurity include low agricultural production capacities and limited economic access to food. This can mainly be attributed to the lack of access to safe drinking water. Children are vulnerable as a result of food insecurity. In 1997, an estimated 14.8 percent, and in 2000, an estimated 8 percent of children under the age of five were underweigh. The situation seems to be getting worse, as the 2007 Liberia Demographic and Health Survey (LDHS) shows that 39 percent of children under age of 5 are stunted, and one-fifth of children are severely stunted. This indicates chronic malnutrition. About 70 percent of rural households rely on food from their own

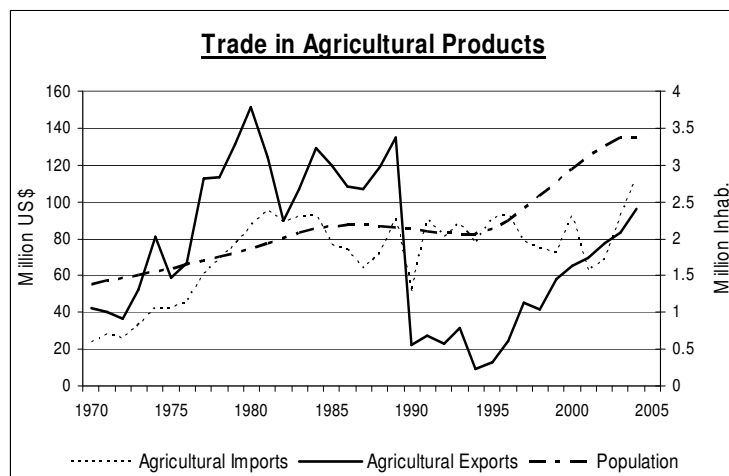
farms or gardens as compared to 5 percent in the urban area. Given the impact of the war, coupled with the weak supporting environment, it is unlikely that Liberia will attain the benchmarks of the World Food Summit, or the MDG goal of food security.

Food and agriculture trade and import balance

The war has resulted in severe reduction in the production of agricultural and food products. Although production has increased over recent years, there is still a deficit in food trade. Liberia imports about 70 percent of its staple food rice, it consumes annually. Officially no rice is exported, but dealers from neighbouring countries have been buying rice on Liberia's market to resell in neighbouring countries where it is more expensive.

As shown in the graph, export of agricultural produce increased progressively from US\$40 million in 1970, to US\$130 million in 1989. It subsequently started to decline in 1990, falling to about US\$10 million in 1993, reaching its lowest value. This period coincided with the commencement of rebel activities in the country and the overthrow of the constitutional government, which left virtually the entire population either displaced, or in refugee camps in neighbouring countries. Moreover, the activities of almost all concessions producing agricultural raw materials such as rubber were halted. Thereafter, export has been increasing progressively up to the year 2004, reaching nearly US\$100 million.

The graph also shows that import of agricultural products has been following similar pattern as export, rising after 1970, and then declining in 1980 and 1989. Imports have taken an upward trend after 2000.



It must be noted, however, that export of agricultural produce mainly consist of cash crops and other agricultural raw materials. There is a need to promote food production, especially rice, to cater to the growing population of 3.5 million. One strategy being used is public statements by the President encouraging communities to contribute to food production by growing food in their back yards. The statements are accompanied by songs and jingles on local radio stations.

1.2 WATER RESOURCES AND HYDROPOWER

There are two kinds of river systems found in Liberia. One is the major basins, which drain 97 percent of the territory in a general northeast-southwest direction. Of these, the six major rivers (Mano, Lofa, Saint Paul, Saint John, Cestos and Cavalla) originating in Sierra Leone, Guinea or in Côte d'Ivoire, together drain 65.5 percent of the country. The second is the short coastal watercourses, which drain about 3 percent of the country.

Internal renewable surface water resources are estimated to be 200 km³/year, and internal groundwater is estimated to be 60 km³/year; all of the latter is believed to be drained by watercourses. Thus, the total internally produced renewable water resources remains at 200 km³/year, while an additional 32 km³/year comes from Guinea and Côte d'Ivoire, bringing the total renewable water resources to 232 km³/year.

Three hydropower stations were functioning in the 1970s and 80s, but two of these have been destroyed. The smallest, a 4MW plant located in Harbel, Margibi County, is reportedly still working. Liberia generated 182MW of electricity through a combination of hydro and oil-fired generator before the war. The biggest lost was the Mount Coffee hydro-power plant which generated 35 percent of the electricity for the country. Before the crisis, hydropower provided about 70% of electricity in Liberia, but now, as a result of the crisis, the bulk of the present energy consumption, is derived from firewood and charcoal. About 97% of Liberian households are without state generated electricity. Power is

produced from individual generators, which use gasoline and diesel. This method is not environmentally friendly and also extremely expensive.

Energy production, supply and utilization have serious implication for Liberia's economy and environment. As such, the government is seeking alternative sources of energy production. A US\$112 million project was recently approved for a 35 MW steam powered electric plant. The plant will be fuelled with wood chips from rubber trees that are beyond their useful life.

1.3 CLIMATE CHANGE

Liberia's climate is tropical hot to humid. Rainy season is between April and November. Subsistence agriculture dominates the Liberian agricultural sector. As a result, crop 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, thus 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.

2. NATIONAL STRATEGIES FOR WATER, AGRICULTURE AND ENERGY

2.1 POLICY CONTEXT

Even before the civil crisis, successive governments initiated strategic policies for the development of the agricultural sector. The goal has always been food sufficiency and food security. For example, Operation Production, Self Sufficiency in Food Production, and the Green Revolution were national strategies of the Tubman, Tolbert, and Doe Governments respectively. The Taylor Government also established a two phase approach to rehabilitate the agriculture sector contained in the National Reconstruction Program (1998 - 2000), and the five year National Reconstruction and Development Program (2001 - 2006).

The *Poverty Reduction Strategy*, the present development agenda for the next three years (2008 - 2011) sets out its agenda for agriculture and food security in Liberia. The central goal for agriculture during the PRS period is to revitalize the sector in order to contribute to inclusive and sustainable economic development and growth, food security and nutrition, employment and income, and poverty reduction. The Government plans to expand agricultural production by 3.2 percent per annum during the first two years of the PRS.

To realize the above growth in the agricultural sector, the government has earmarked three strategic objectives. Firstly, it will develop more competitive, efficient and sustainable food and agriculture value chains and linkages to market; secondly, it will strive to improve food security and nutrition, especially for vulnerable groups, including lactating women and children under five; and thirdly, it will strengthen human and institutional capacity. The role of women will also be expanded in the agricultural value chain.

An agricultural policy has also been drafted, and is being validated, within the context of the PRS and the MDG. It outlines specific policies and strategies that will revitalize and strengthen the agriculture sector within five years, beginning 2008. The policy seeks to establish operational, legal, and institutional framework to ensure efficient development, utilization and management, monitoring and conservation of country's water resources for agriculture. The rehabilitation of previously established swamps to increase rice production will be pursued. The total cost for food and agriculture under the PRS is US\$38.7 million.

For energy, the PRS has targeted the completion of an energy policy and strategy. The Government will also begin to develop new hydropower generation capacity and assess other energy sources, complete the Mt. Coffee feasibility study, and assess the potential for other renewable energy resources such as solar, wind and biomass. Under the Renewable Energy & Energy Efficiency Partnership Program, an Action Plan has been developed. The Plan will serve as the basis for developing the renewable energy sub-sector in order to induce investment, transfer technology, develop the market, and build local capacity. The Ministry of Land Mines and Energy is the

government agency responsible to coordinate implementation of activities in the energy sector. The cost for rehabilitating this sector is estimated at US\$156.6 million.

Under the agricultural policy, a mechanism will be put in place to monitor climate change situation ensuring agricultural activities in Liberia do not contribute to such changes, and undermine effort aimed at poverty alleviation, food security and environmental protection.

The Government, is working in collaborative partnership with the donor community in order to accomplish its goals for the agricultural sector.

2.2 INVESTMENT ENVELOPE

The investment envelope for the short, medium and long term is presented in the Table below and expressed in million US \$ (based on CAADP investment projections). In total, it is estimated that small scale water investment (including small scale irrigation, soil and water conservation, etc.) would cover 19,000 ha. There is no investment in rehabilitation of irrigation schemes, as there is no irrigated food crop production in the country as yet. Large scale projects would cover 2,000 ha. As mentioned above, large scale conventional upland irrigation is not considered an issue in Liberia because of water surplus in all the agro-ecological zones in the country and the large area of swampland available for development.

Time scale	Type of investment (million US\$)			
	Small scale water control	Rehabilitation of irrigation	Large scale hydraulic projects	Total
Short-term	17	0	1	18
Medium-term	11	0	6	16
Long-term	5	0	12	17
Total	33	0	19	51
Area (ha)	19 000	0	2 000	21 000

2.3 PROJECT PORTFOLIO

Section 3 presents ongoing and pipeline projects related to the above investment envelope. Currently, there are ten projects in the portfolio.

The two ongoing projects are aimed at repairing rural roads and water network for US\$37 million and US\$30 million, sponsored by the World Bank.

The pipeline projects include a value chain for rice project for US\$38.5, a European project with water component for about 125 Euro (equivalent to US\$237.5 million), as well as four projects developed in the CAAS Investment Proposal, 3 with large water component. They range from US\$2.5 million for land and water institutional capacity building, to a land and water development for swamp production for US\$22.1 million. There is also a community watershed Management project for 7.5 million. Lastly, there is one bankable investment project profile dealing with inland swamp rehabilitation and development project for US\$ 7 million.

There are multiple donors complementing the efforts of the Liberia government.

3. PROJECT PROFILES (ON-GOING AND PROJECTED)

Project title	Funding Partners	Lifeline	Total Budget	Description
I. PROJECTS RECENTLY IMPLEMENTED				
Bong County Agricultural Development Project II	IFAD	Approval date: 04/04/1984	11.74 US\$ million	
II. ONGOING PROJECTS				
Emergency Infrastructure Project	World Bank	2006-2010	US\$30 million	This project will, on an emergency basis, assist the Government to reconstruct part of the country's devastated infrastructure. These actions will help revive the economy by restoring vital transport links throughout the country. It will also improve living conditions in the capital, Monrovia, by restoring and expanding bulk water supply services
Agriculture and infrastructure and Development	World Bank	2007 -2012	US\$37.0 million	To develop policies that will enhance agriculture value chain, promote public-private partnership and provide farmers access to local, national and international markets
III. PIPELINE PROJECTS				
Value Chain for Rice	African Development Bank (AfDB)	2009 - 2013	US\$22 million	The objective of this project is to restore farmers' income and create employment opportunities through revamping the rice value chain. The three components are: Value chain development, rural infrastructure rehabilitation including water management and marketing, and rural transportation infrastructure and project management including capacity building.
Rehabilitation of basic infrastructure	EU	2008 - 2011	US\$237.5 million (€ 125 million)	The objective of this project is to rehabilitate basic infrastructure to include roads, power and water
Bankable Investment Project Profile (BIPP): Inland Swamp Rehabilitation and Development	FAO-NEPAD	5 years	US\$ 7.0 million	The project consists of three components: rehabilitation & Development of inland swamps, promotion of small scale community irrigation, and strengthening institutional capacity in water resource management. The overall objective is to increase food production and rural income through developing inland swamps to produce up to 32,000 tons of paddy rice annually.
CAAS Investment Proposal : Land and water sector Institutional capacity building	IFAD, World Bank, FAO	2-5 years	US\$2.5million	This project aims to build capacity for the land and water sector institutions for strategic planning and management of land and water resources to support agriculture and other sectoral development
CAAS Investment Proposal : Land and water development for swamp rice production I	IFAD, World Bank, FAO	2-10 years	US\$22.1 million	The aim of this project is to increase rice production through the reclamation of swamps lot during the war and expansion of new ones with the aim of improving house hold food security, nutrition and income
CAAS Investment Proposal : Land and water development for upland rice production II	IFAD, World Bank, FAO	2-5 years	US\$3.0 million	To increase rice yield on the uplands through sound field management practices with the aim of conserving soils and maintaining soil fertility on slopes and to identify suitable technical options for intensification and increased efficiency of upland rice development and management, allowing for intercropping and soil conservation
CAAS Investment Proposal : Community Watershed Management	IFAD, World Bank, FAO	1-5 years	US\$7.5 million	The objective of this project is to build the capacity of land and water sector institutions for the strategic planning and management of land and water resources to support agricultural and other sectoral development.

ANNEX 1: MAP OF WATER CONTROL IN LIBERIA:



ANNEX 2: COUNTRY STATISTICS

Country and population								
Area of the country	2005	11137	1000 ha					
Cultivated area as % of the total area of the country	2005	5.4	%					
Total population	2005	3283	1000 inhab					
• of which rural	2005	52	%					
Population economically active in agriculture	2005	796	1000 inhab					
• as % of total economically active population	2005	65	%					
• female	2005	45	%					
• male	2005	55	%					
Economy and Development								
Gross Domestic Product (GDP) (current US\$)	2007	725	million US\$/yr					
• value added in agriculture (% of GDP)	2005	66	%					
• GDP per capita	2007	193	US\$/yr					
Access to improved drinking water sources								
Total population	2006	64	%					
Urban population	2006	72	%					
Rural population	2006	52	%					
Water Resources and management								
Average precipitation	2007	266.3	10 ⁹ m ³ /yr					
Total actual renewable water resources	2007	232	10 ⁹ m ³ /yr					
Dependency ratio (transboundary rivers)	2007	13.8	%					
Total actual renewable water resources per inhabitant	2007	70667	m ³ /yr					
Total dam capacity		-	10 ⁹ m ³					
Total water withdrawal	2000	0.11	10 ⁹ m ³ /yr					
• as % of total actual renewable water resources	2000	0.05	%					
IRRIGATION AND DRAINAGE								
Irrigation potential	2007	600	1000 ha					
Water Management								
Area equipped for irrigation: full control - total	1987	0.1	1000 ha					
Equipped lowlands	1987	2.0	1000 ha					
Total area equipped for irrigation	1987	2.1	1000 ha					
• Area equipped for irrigation as % of cultivated area	1987	0.3	%					
• Annual increase rate		-	%					
• Power irrigated area as % of area equipped for irrigation		-	%					
• Area actually irrigated as % of area equipped for irrigation		-	%					
Non-equipped cultivated lowlands and flood recession	1987	18.0	1000 ha					
Total agricultural water managed area	1987	20.1	1000 ha					
• Agricultural water managed area: as % of cultivated area	1987	3.3	%					
• Drained cultivated area as % of total cultivated area		-	%					
Typology of irrigation schemes								
Small-scale schemes (<ha)			1000 ha					
Medium-scale schemes (- ha)			1000 ha					
Large-scale schemes (>ha)			1000 ha					
Irrigated crops								
Vegetables	1998	3.0	1000 ha					
ENERGY INDICATORS								
Energy Production			Mtoe					
Net Imports			Mtoe					
TPES			Mtoe					
- TPES/Pop			toe/capita					
- TPES/GDP			toe/thousand 2000 US\$					
- TPES/GDO (PPP)			toe/thousand 2000 US\$ PPP					
Electricity Consumption			TWh					
- EC/Pop			kWh/capita					
ENERGY SUPPLY AND CONSUMPTION (2005)*								
	Coal	Gas	Crude oil	Petroleum products	Hydro	Other Renewable & Waste	Others	TOTAL
Production								
Imports								
Exports								
International Marine Bunkers								
Stock Changes								
Total Primary Energy Supply (TPES)								

* in thousand tonnes of oil equivalent (ktoe) on a net calorific value basis.

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