

Priorities and Challenges of Adaptation to the Impacts of Climate Change – A Focus on the Liberian Agricultural Sector



Author: Wollor E. Topor, National Expert

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Executive Summary

This paper examines the role of the agricultural sector as it relates Investment and Financial Flow (I&FF) for adaptive measures in connection to climate change for sustainable economic growth and development of Liberia. The study identified investment gaps in the sector as there were limited information and I&FF analysis being novel to Liberia. However, I&FF analysis is essential to Liberia at many fronts: aid in formulating appropriate national policies for adaptation measures; identify capacity building requirements and increase the country's bargaining position with realistic/adequate, up-to-date and practical information at international fora.

Agriculture is the economic mainstream of Liberia; and it could be affected by climate change and extreme weather conditions. Ecological factors such as increases in temperature, wind speed and humidity limit growth of flora and fauna which have far-reaching consequences on average Liberian farmers in terms of food security and poverty reduction. The forces that shape the climate are equally critical to farm productivity.

This desk study revealed that the increase in heat intensity and erratic rainfall patterns could be symptoms of climate change which have an adverse effect on crop yields and livestock production beyond the impacts expected. In most cases, these abnormal changes create the possibility for surprises with much distortion which sometimes happened sooner than predicted. The case in point is the recent pests (*Achaea catocaloides* Genue) outbreak in Liberia.

Climate change and agriculture are interrelated processes. If one dysfunctions, it has consequences on the other. Certain changes in temperature and rainfall patterns would have negative results on agricultural productivity, affecting food and fiber. Agriculture has much unexploited possibilities to lessen emissions of greenhouse gas (GHG) through reduced deforestation, better land-use planning and state of the art agricultural practices.

Investigation on the impacts of climate change disclosed that agro-ecological systems are the most vulnerable sectors. Liberia has started to experience the induced changes of climate change, which include reduced soil moisture, shifts in temperature, erratic rainfall and heat waves. These changes have not only triggered secondary stresses such as the spread of pests, but have decreased crop yield and increased competition for resources, resulting to human migration in the northwest and central regions of Liberia, and could even derail the current peace.

Lamentably, Liberia's adaptive capacity for climate change and the practice of sustainable development initiatives is very much inadequate and unsatisfactory to be used as a gauge for poverty reduction and food security. This can best be explained by the lack of meteorological stations and/or data for agriculture purposes, the outdated curriculum of

the College of Agriculture and Forestry, the state only institute for higher agricultural education, the slow rehabilitation of the lone research institution Central Agriculture Research Institute (CARI), and the snail pace reactivation of the Cooperative Development Agency (CDA). The implication is that the effect of climate change on agriculture will further hamper a country already reeling from host of socio-economic factors such as high unemployment, food insecurity, malnutrition, etc. and ecological setbacks in its desire to develop, resulting from a fourteen-year civil unrest.

Readjusting to the climate change impacts is a must and urgent. Currently, adaptation practices in Liberia include integrated emergency and risk reduction management by the NDRA; the promotion of paddy fields cultivation and distribution of drought-resistant planting materials and the strengthening of CARI to encourage relevant agriculture research initiated by the MOA; the diversification of livelihood options like the FAO/World Bank CBED project, the UNDP Sustainable Land Management Project which is implemented by EPA; the introduction of agro-forestry through the community forestry projects like the IUCN Landscapes and Livelihood Strategy (LLS). Appropriate integrated farming practices with low cost technologies are employed to alleviate some of the impacts of climate change. Importantly, the involvement of the target communities in the participatory planning is leading to local institution building and serving as motivating factor for changing attitudes from receiving relief items in post-conflict era to release – building their capacities to handle their development agenda be it climate change or livelihood alternatives.

In addition, establishing an effective monitoring mechanism to identify, assess and monitor (on a regular basis) the impacts of climate change and the major causes of land degradation, soil erosion, abuse of watershed and poor policy implementation, should be of high priority. Serious consideration to the above is the way forward to poverty reduction and the achievement of the Millennium Development Goals. The industrialized nations can assist in this process through fair trade in Liberia's agricultural products.

This study strongly recommends an immediate Investment and Financial Flow analysis. I&FF analysis is one of the best tools to meet challenges of climate change. It allow county to plan and better argue logically with substantial data as they relate to impacts of climate change.

Why Agriculture is a Key Sector for Liberia?

Recent assessment report¹ of the Intergovernmental Panel on Climate Change (IPCC) indicates that the agriculture sector could be greatly affected by the impacts of CC than any other sectors in the South. Agriculture plays an interesting environmental role; it is both a casualty of, and contributing factor to climate change. For instance, CC impacts such as changes in temperature, rising sea levels, erratic rainfall patterns, etc. would have negative results on agricultural productivity, and affect food (crop yields and livestock) production. These could exacerbate food insecurity and poor quality of life, thus aggravating poverty.

In Liberia, the February 2009 catastrophe of tropical storms that hit Karmo's Town, Juazon District, Sinoe County and Karnplay, Nimba County destroyed most of the upland rice fields. This adversely affected subsistence farm workers' foodbaskets and income levels. Furthermore, Stella Subah, nutrition adviser at the Ministry of Health and Social Welfare, predicts that close to 80,000 children could die from malnutrition by 2015 if no action is taken to arrest food inadequacy.² Whether these are already the results of climate change, is the subject of scientific debate. However, there is an increase in the incidence of poverty from 64 percent to 70 percent; while the household food cost has increased by 25 percent in January of this year.³

The most important sector in Liberia's economy is agriculture, and being an agrarian nation, Liberia is no exception to CC impacts (erratic rainfall patterns, drought, flood and desertification). Agriculture maintains its pivotal role in the reconstruction and peace building efforts of Liberia. Its mutual and important association with the overall economy is apparent. This is evident in the PRS (the national development blue print 2008-2011), which emphasizes the national priorities of peace and security, economic revitalization, rehabilitation of infrastructure, delivery of basic services.

Accordingly, the agriculture sector is anticipated to contribute significantly to the priorities of poverty reduction, food security, employment, increased personal income, and foreign exchange. This is why the government of Liberia committed 2.23 percent of US \$276.8M for fiscal year 2008-2009 budget to the agriculture sector. Agriculture sector has attracted an investment close to US\$1,000M within the last 24 months. Major foreign agriculture companies include Sime Darby (US\$ 800M); Buchanan Renewable Energy (BRE) has invested US\$150M, while the Foundation for African Development Aid Commercial (ADA) netted US\$ 30M.⁴

¹ Based on IPCC, 2007.

² New Democrat, 2009.

³ Based on the UN Integrated News Network, 2009.

⁴ The Analyst, 9 April 2008.

The agricultural sector is estimated to employ over 70 percent of the entire labor force although its contribution to GDP is over 20 percent.⁵ Close to two thirds of Liberia's population depends on agriculture and related activities for its livelihood.⁶ Despite that the larger proportion of the active population is engaged in agriculture, there are still constraints in this sector, where 81 percent of the rural population was found to be either moderately vulnerable (41 percent) while 40 percent was highly vulnerable to food insecurity. Eleven (11) percent was food insecure and only 9 percent was food secure. Accordingly, 39 percent of children under five were suffering from chronic malnutrition. The above scenarios of food insecurity and child malnutrition impede socio-economic development and poverty alleviation. Furthermore, it is projected that poor nutrition could lead to productivity losses of US\$431M by 2017.⁷ The adverse effects of climate change could compound existing risks and vulnerabilities.

In order to be resilient to the above scenario, the agriculture sector is forced to adapt to challenges involving new soil conditions, more erratic weather patterns, and changing water availability. To lessen some of these negative impacts, careful assessment of the dissimilarity of occurrences (on crops, animals and even fishery) from global warming is needed. This careful assessment requires genuine and active involvement of the farmers in tapping their own knowledge and experience, no matter how limited, in order to complement scientific information. Such relevant information could help the farmers know the right time to apply fertilizer and/or when and how to spray their fields or go fishing.

The principal farming practice of Liberia, which is the slash and burn, plays an interesting environmental role. For example, shifting cultivation is believed to be one of the primary culprits among others like slaughter logging, firewood, and charcoal, which cause 2 percent or 480,000 acres of Liberia's land of 24, 000,000 acres lost to deforestation annually.⁸ In short, forest clearing which is normally conducted in Liberia for food production does not only contribute to climate change but also increases biodiversity loss, flooding, siltation as well as reducing timber supply.

Despite the nation's endowment of natural resources, Liberia is still one of the poorest nations on the face of the earth. The Gross Domestic Product (GDP) is only US\$ 169 per capita; of which agriculture and fisheries contribute 2.7 percent.⁹ According to the final National Census report, released on May 10, 2009, the poverty incidence is higher than during pre-war period, with over half of 2.3 M Liberians living on less than a dollar per day. Moreover, literacy is very low at around 15 percent and probably much lower in many rural areas; which also implies low adaptive capacity. The poor are unduly vulnerable to the adverse effects of CC because they, to a larger extent, eke out agriculture.

⁵ Based on CSSA, 2007.

⁶ Based on PRS, 2008.

⁷ Based on PRS, 2008.

⁸ Based on NBSAP, 2005.

⁹ Based on CAAS, 2007.

Technology relating to CC takes a great deal of time and requires extensive training. However, the blending of traditional and modern technologies shows bright promise for mitigation and adaptation to CC impacts. Thus, finding alternatives to slash and burn which is associated with inadequate technological capacity of farmers and low level of productivity could be due to lack of agricultural research and weak extension programs. The reason for this is, like other government institutions, the working conditions of the Ministry of Agriculture (MOA), have drastically deteriorated since 1989. The reform process going on at the MOA should establish linkages within and network the various agriculture-related research and extension institutions to disseminate new innovations to the ultimate users – farmers.

Description of the Agricultural Sector in Liberia

Liberia has 30 percent arable land; 2.5 percent of which is used as pastureland.¹⁰ Through subsistence farming, crops like rice (nation's staple), root and tubers, oil palm, cacao, coffee, sugar cane, legumes, maize, plantain and bananas are grown. Because of the civil conflict, many subsistence farmers left their fields unplanted and food production plummeted. Food production is yet to recover to pre-war levels. All of the food crops grown are meant for home consumption; but far too low (30 percent only of the total food requirement) to meet consumers' need.¹¹ The CFSNS (2006) report indicates that per caput dietary energy supply has been very low, making the poor, particularly children and women who depend on the agriculture sector disproportionately vulnerable to the effect.¹² According to UNEP 2004 State of the Environment Report, Liberia remains one of the most food insecure nations on earth. One third of its population is undernourished.

Liberia imports 90 percent of **rice** – the staple it consumes. According to CAAS 2007 report, Liberia's cereal import requirement (mostly rice) in 2006 was placed at 204,000 m.t. Of this, private businesses imported 90,000 m.t. while 74,000 m.t. were nationally produced and the rest of the 40,000 m.t. through food aid by donors, which were managed by the World Food Programme (WFP). Liberians annual consumption is estimated at 300,000 tons, yet Liberia only produces about one third of this. In 2008 alone, the importation of rice cost the Liberian economy US\$ 200M.¹³ Domestic production of rice still depends on traditionally low inputs. One major implication is: there is local market potential for swamp rice production to save some hard earnings on rice importation.

The impacts of climate change could affect traditional food systems. For instance, Liberia is working on climate change mitigation measures such as carbon trade and renewable energy projects. This could threaten traditional landscapes and livelihoods of people residing near and within the affected communities; causing unstable food supply, inaccessibility to food and its improper utilization. The aftermath is both acute and chronic nutritional problems that are associated with climate variability and climate change. As earlier stated, 92 percent of rural population is vulnerable to food security.

Rubber as one of Liberia's main export cash crops contributes to export earnings. Production grew in 1999 to 62,705 m.t. (valued at US\$33.3 M) from 48,916 m.t. (valued at US\$28.9 M in 1998) - an increase of 28.2 percent. In 2000, production of rubber rose to 102,412 m.t. (valued at US\$53.2 M), 63.3 percent increase over 1999 production. In 2002,

¹⁰ Based on NCSA, 2005.

¹¹ Based on UNMIL, 2007.

¹² Zinnah, 2009.

¹³ See also the Annual Message of President Sirleaf, 2008.

rubber contributed more than US\$57.4 M.¹⁴ Foreign investors own and operate eight large-scale rubber plantations with total acreages of 57,000 hectares (ha), of which few are managed to international standards, but with persistent clamors of violations of basic workers' rights.¹⁵ In addition to these multinational enterprises, several smallholders-owned plantations of rubber, cacao and coffee are dispersed all throughout the country. These cash crops are exported without processing. Therefore, no value added, but significantly contribute to households and domestic income.

The concept of **bio-fuels** has been introduced in Liberia. BRE is using old rubber tree chips to generate electricity. However, Topor (2002) cited authors like Robert Chamber as well as David Suzuki who claimed that there is danger in mono-cropping; in spite of high value commercial tree (i.e. rubber) planted, mono-cropping cause financial losses to subsistence farmers. Mono-cropping does not provide crop security for the ordinary farmers. Furthermore, the Food and Agriculture Organization (FAO) State of Food and Agriculture 2008 Report indicated that while it is true that bio-fuels could reduce greenhouse gas (GHG) emissions, converting huge land areas to this process could have an undesirable end product such as loss in biodiversity. Increasing carbon sequestration through reforestation or change from traditional to more scientific practices in agriculture could be cost effective and ecologically sound. The cultivation of the savannah ecosystem for mechanized rice production found in Lofa County, predominantly in Foya District, is of concern, bringing with it the threat of desertification in Liberia.

Livestock industry in Liberia has always been the least prioritized compared to crops. The industry plays a negligible role in agricultural development which can be explained by the high annual importation of livestock and livestock products. Although the local breeds of cattle, goat, sheep, pig, rabbit, guinea pig, chicken, duck, and guinea fowl raised in Liberia are well adapted to the local conditions, their productive capacity is lower than the exotic breeds. Research in animal husbandry and livestock production has been very weak due to lack of technical experts, support and resources. Livestock industry should be taken seriously since Liberia is committing 10 percent of its forest land to Protected Areas. One of the implications is that people whose livelihoods depend on this trade (bushmeat) should have alternatives. According to ITTO 2005 Diagnostic Assessment Mission Report on Liberia, bushmeat trade is estimated to worth at least US\$70M annually. In 2002, under Contract OL/1743/97/05, European Union funded livestock development project aimed at improving and rehabilitating livestock production in Lofa, Bong and Nimba counties. This contract should be revisited and scaled-up.

As farming in Liberia is under threat from the problems of flooding, water control, pests and other natural elements (even though this is not countrywide), higher agricultural

¹⁴ Based on UNEP, 2004.

¹⁵ Based on CAAS, 2007.

institutions of learning should update their curricula for understanding the phenomena of climate change so as to deal with the problems correctly. Also, the institution offering courses on climate change should match today's realities; few of which are animal husbandry.

Principal Impacts of Climate Change

Globally, Liberia's quota to global warming is negligible as compared to other African countries. In spite of this, however, Liberia is likely to be unreasonably affected by the impacts of climate change due to limited adaptive capacity and widespread poverty. On the other hand, the government has made a significant step by incorporating the issues of climate change into agriculture sector of the PRS as a national strategy for sustainable development. For instance, the three major strategic objectives of the agriculture sector are:

1. "develop more competitive, efficient, and sustainable food and agriculture value chains and linkages to markets,"
2. "improve food security and nutrition, especially for vulnerable groups such as pregnant and lactating women and children under five,"
3. "strengthen human and institutional capacities to improve needed services, create strong enabling environment, and reduce vulnerability."

Close to 90 percent of the crop area in Liberia is under rain-fed agriculture that is highly vulnerable to climate change. Whichever adverse impact, be it water availability or decrease in rainfall and even increased flooding would threaten food security, affecting species that sustain the livelihood of rural households. When climate change impacts get linked with the farming systems, finite resource (i.e., farmlands of economic importance) would go under water because of the rise in sea levels like the cases in Buchanan, Bassa County, Robertsports, Grand Cape Mount County, and beaches around Monrovia. Liberia could be experiencing drought and/or desertification that could cause decrease in crops yield, and increase pest infestation. This chain reaction includes food insecurity, and for those whose eking out non-timber forest products (NTFPs) are to be affected.

Proposed Adaptation Measures for the Agriculture Sector

This paper deals with agriculture or the food security sub-sector, specifically rice and livestock production. Liberia is a small food importing nation, therefore, as climate change impacts cause a decline in crop yield and livestock production, adaptive capacity toward sustainable food security should be one of the government's top priorities; as reflected in the second pillar of the PRS. Liberia has a National Adaptation Programme of Action (NAPA) plan, which was officially approved and signed by The House of Representatives in 2008. NAPA's adaptation strategies include:

Intensification and diversification of farming practices. Liberian farmers are adapting low land cultivation (swamp rice production) rather than the usual slash and burn methods. Despite the benefits from the inter-cropping of upland rice, swamp rice is more profitable than upland rice production, once it is practically well managed. The irrigated field yield of 3,500 kg per hectare is higher than upland rice yield of 1, 800 kg per hectare (CAAS, 2007). Other farmers are being taught to practice agroforestry – maximizing the utilization of a piece of land by employing optimum farm inputs to have maximum profit with relatively no environmental damage.

Water management by local communities. Today, many parts in Liberia are facing severe water scarcity. Erratic rainfall, poor soil and water management, including relentless ground water extraction has led to cycles of 'quiet drought' and water scarcity since the early 1980s (Minister Mitchell, pers. Comm., 2009). Because of this, MOA has interest in rehabilitating the small, traditional water harvesting and irrigation systems that have existed in Liberia for centuries. Water management is given serious attention as there are concrete empirical facts to suggest that as forest cover lessens; water resources also decrease, thereby increasing the risk of perennial streams becoming seasonal. Without proper mitigation and adaptation strategies put in place to manage water, government's efforts to expand agricultural production by about 3.6 percent annually during the PRS implementation could be thwarted. The MOA and the FAO as well as other partners-in-development with the Liberia government should be committed to this worthy cause for food security. An effort to minimize water scarcity is to develop partnership with local communities.

Agroforestry/afforestation practices. In the absence of scientific and modern technology among the rural people, it is hardly possible to think of slash and burn farming system being replaced so easily. So, the practice of agroforestry/afforestation, intercropping with fast growing nitrogen fixing tree species are encouraged to help improve soil fertility and minimize land degradation. One of the constraints in agroforestry is land tenure system and this should be highly considered. This is because tree planting requires a level of security in terms of land ownership since return-on-investment for this practice takes long time in terms of years. Put differently, land users

need to have the guarantee that their investments in the land will yield good potential returns and that they must be confident that they will be able to harvest what they plant. Forestry Development Authority (FDA) Community Forestry along with International Union for the Conservation of Nature (IUCN) livelihoods and landscapes program in two counties (Bassa and River Cess) and the Associate Rural Development or Land Rights and Community Forestry Program (LRFCFP) Community Forestry in Nimba and Sinoe counties are efforts in developing and applying a community forestry framework in conjunction with the requisite rights and responsibilities of communities to the land where they reside, and to manage resources.

National policy action. Some attempts have been made in terms of food security in Liberia. For example, the Comprehensive Food Security and Nutrition Survey (CFSNS) of 2006 provides the baseline of household food insecurity of Liberia whereas the Comprehensive Assessment on the Agriculture Sector (CAAS) of 2007 identified the specific potential agricultural commodity value chains of traditional farming that could lead to food security and income generation. Likewise, the joint program of the Liberian Government and the United Nations on Food Security and Nutrition document of June 2008 did not place emphasis on climate change impacts. Despite the above mentioned facts, the CAAS document placed US\$10M as the cost for revitalization of the Central Agricultural Research Institute (CARI) from 2008 to 2015. The lead national research center, CARI, when rehabilitated, could be involved directly with adaptive research activities for selected crops and provide advice on mitigation and introduce crops and livestock that will thrive under the changing climatic conditions.

Collaborative adaptation measures. Integrated emergency and risk reduction management that are undertaken by the National Disaster Relief Agency include: the promotion of swamp rice or paddy fields cultivation and the strengthening of CARI to encourage relevant agriculture research initiated by the Ministry of Agriculture; the diversification of livelihood options like the FAO/World Bank Community-Based Forest Enterprise Development (CBED); the UNDP Sustainable Land Management Project which is implemented by EPA; the introduction of agro-forestry through the community forestry projects like the IUCN Landscapes and Livelihood Strategy (LLS). Appropriate integrated farming practices with low cost technologies are employed to alleviate some of the impacts of climate change.

Rehabilitating metrological stations. Adaptation measures in agriculture require early warning for prompt action. MOA has no national meteorological section that provides information on seasonal forecast of precipitation, rainfall, temperature increase and tropical storm around the country. This is very important to carryout weather forecasting for the farmers. Meteorological data that are currently available are insufficient and unconsolidated. For instance, releasing information on the rainfall patterns, increased incidence of soil erosion or reduction in water sources should place farmers on the alert in

decision-making as to when and what to begin planting. Mr. Arthur Gar-Glahn, Director of Meteorology and permanent representative for Liberia with the World Meteorological Organization (WMO), indicated that there are plans to reactivate the setting up of small weather stations around the country. This was confirmed by the Ministry of Agriculture.

Key Issues in Assessing Investment and Financial Flow (I&FF) to Address Climate Change in the Agricultural Sector

Understanding the concept of I&FF is very important in any agricultural analysis. Generally, in agricultural projects, one conceives the notion of an investment, the fact that farming is like any business (agribusiness) that requires optimal and timely inputs for maximum returns over a period of time. This is referred to as capital outlay or fixed asset investments. With some projects, costs are incurred for production expenses or maintenance which are spent within a year, such are operating or working capital investments.

Indeed, the dividing line between an “investment” and “production” expenditure in an agricultural project is not too clear. For instance, fertilizers, pesticides, and the like are by and large thought of as production expenses used up within a single crop season, or in any event, within a year. A dam, a tractor, a building or a breeding herd is usually considered as fixed asset investment, from which a turnover is realized after several years. But the same kind of activity may be thought as a production expenses in one project and an investment in another. Furthermore, transplanting rice is a production expense likewise planting rubber seedlings is an investment. Agronomically and economically both activities do not differ at all. At any rate, nurseries are established, from which benefits are expected when the rice and rubber are matured. The only difference is the time span which the rice (e.g. 90 days) and rubber (e.g. 5 years) will be ready for harvest.

In agribusiness, farmers engaged in farming should have profits on their investments. Therefore, looking Liberia circumstances, this paper selected the following sub-sectors which are relevant to the analysis. In these sub-sectors, emphasis is to be placed on increasing the productivity of tradable products (market orientation), which is an essential component of agricultural growth and normally the driving force behind any agricultural investment.

The sub-sectors to be considered:

1. *Agricultural Concession /Plantations* (e.g. Firestone, LAC, etc.): This generates much of the country’s foreign earnings. Moreover, close to 60,000 hectares are under cultivation.
2. *Livestock* (e.g. small ruminants (goats, sheep, rabbits, etc.), cattle, poultry, swine, etc.): Aside from being a vital protein source, this sub-sector has become a source of liquid cash for emergency situations like paying children’s tuition, health related matters.
3. *Fisheries* (e.g. tilapia, catfish, etc.): Although Liberia has a long coastal line, fish-catch per boat has apparently reduced due to unsustainable fishing methods

adopted. Therefore, placing emphasis on inland aquaculture or using fish cages on rivers are alternative remedies.

4. *Food Crop Production* (e.g. rice, cassava, etc.): Rice is Liberia's staple food which she imports almost half of what she consumes. If resistant varieties are developed and planting methods are improved, the country could be saving lots of foreign earnings. Additionally, cassava is the nation's second staple and serves as a security crop.
5. *Cash crop/Tree crop production* (e.g. coffee, oil palm, cocoa, etc.): These cash crops are collectively abundant around Liberia, which serve as an easy source of cash, once there is fair market price.

Processes and nature of data

Relevant information is necessary for I&FF analysis; unfortunately, there is limitation to precise information for climate change projections when it comes to agriculture. In I&FF analysis, there are three major actors from whom data can be generated and also serve as the units of analysis, namely:

- a. *Households* - This can be viewed as production/consumption units in which agricultural products grown by household in a period of time using appropriate/local technology for household satisfaction or welfare. Data to be collected from this level include but not limited to: socio-demographic characteristics, economic profile, etc. Such data should be sector-focused with the intent of strengthening agricultural marketing systems, distribute resources (land titles, stewardship contracts, agricultural inputs) fairly, introduction of new or improved production or post production technologies and inputs, as well as institutional development.
- b. *Government* – This is seen as the institution that seeks bilateral and multilateral agricultural funding. From this position, the government needs to understand global trends affecting international grants/loans and to incorporate these in the strategic thinking and policy making. Keeping abreast of the geo-political changes are happening and their effects that they could have on international funding is very essential. Domestic data can be obtained from MOA (e.g. total agricultural land, number hectares under rainfed/irrigated, type of farm machineries, etc. For the, Liberian Institute of Statistics and Geo-information Services (LISGIS), Ministry of Planning and Economic Affairs is to provide analysis of investment gap in the agricultural sector, the nature and size of projects to address investment gaps and to achieve a given set of goals; Ministry of Internal Affairs (MIA) county authority could mobilize local communities for adaptive measures, CARI as a research center is to develop resistant planting materials and technological breakthroughs in relations to farming methods, agricultural educational institutions such UL-CAF is to indicate the nature of training and manpower that is being provided as it relates

to national human resource in meeting the challenges and threats posted by CC. In similar manner, the Ministry Health and Social Welfare is to give nutritional data, while the Central Bank of Liberia is to provide information of debts and funds available both domestic and foreign for CC. The Ministry of Gender and Development should provide gender-responsive planning programming and monitoring in line with CC. Cooperative Development Agency is to report on how its members' interests are protected and how their living standards are achieved, including changes in incomes and employment, as well as of the extent of social services provided. On the other hand, multi-national institutions like FAO, WFP, WB, IMF, UNICEF could provide data on the agricultural grants and loans received by the Liberian government.

- c. Corporation/private sector refers to profit making institutions like commercial banks/cooperatives that are strictly for profit and 'non-for-profit' organizations such as NGOs that provide services for the benefit of their clients. As for these private commercial sectors, they are to provide data on availability of CC funds and the procedures of accessing these funds as loan. Also, they have to be clear on items that are being subsidized by the national government. In similar manner, NGOs are to clearly define their target groups, transparent with the nature funding and where specifically those funds are to be spent. Working with the target groups from project identification up to monitoring and evaluation will not only reduce the wastage of merger resources but could also help build the capacity of the locales, thereby, reinforcing the feeling of ownership.

Data timeline

Using the year 2005 as the historical timeline for forecasting is appropriate; below that (1989-2004) was the business as usual scenario or the peak of the Liberian civil strife. From 2005 until now the Liberian government has been making significant impacts in policy reforms e.g. law has been crafted for natural resources management, institutional building, etc has won both local and international confidence. The suggested base year could be 2010 from which projection could be made for the next 25 years for the agricultural adaptation scenario.

Table 1. MATRIX OF PROPOSED INVESTMENT & FINANCIAL FLOW STUDIES SECTOR: AGRICULTURE

Sub-sector	Nature of Data/Data Gap	Source of Data	Duration	Proposed Cost US\$	Potential Funding Sources
Agricultural Concession /Plantations	Total number of hectares covered by concessional agreements Actual number of hectares under cultivation	MOA/MOF/ National Archive	1 months	5,000	Concession companies e.g. Firestone/ GoL
Livestock production	Kinds of livestock Production suitability/regional complete advantage Occurrence /outbreak of disease EU funded livestock development project (Contract OL/1743/97/05)	MOA/FAO/MI A/CBL	3 months	20,000	FAO/ GoL/ UNDP/ WB/ UNDP/ EU
Fisheries	People's perception on inland fishery Availability of appropriate technology Production suitability/regional complete advantage	MOA,/UL- CAF/CDA		10,000	FAO/ GoL/ UNDP/ WB
Food crop production (rice)	Farms under rainfed/irrigated Annual volume of rice import Local production/consumption Land tenure systems Farm-to-Market infrastructure Supply and demand forecast Farm inputs (fertilizers, pesticides, machineries, etc) Agricultural labor	MOA, UL/CAF/LPMC		30	FAO/ GoL/ UNDP/ WB
Cash crops	Market supply & demand (domestic &foreign) Revenue generated from this subsector Current farms situations Postharvest technology for value added	MOA, UL/CAF/LPMC		20,00	FAO/ GoL/ UNDP/ WB
Total				85,000	

Approaches/Recommendations for Assessment of I& FF to address Climate Change

The Institutional Framework

Climate change issues are cross-cutting and require line agencies, civil society and even partners in development- the international community. There are main bodies directly or indirectly involved with climate change issues in Liberia, namely:

- a. The Environmental Protection Council (EPA) – serves as a focal agency to internalize the United Nations Framework Convention on Climate Change (UNFCCC) mandate, which is to achieve stabilization of the greenhouse gas concentration in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system through the National Adaptation Programme for Action (NAPA). NAPA consists of public-private multi stakeholders that is established and coordinated by the EPA with Mr. Benjamin S. Karmorh, Jr. serving as the focal point. Primarily, NAPA aims at reducing the adverse effects of climate change and the promotion of sustainable development. Line institutions like the MOA, Ministry of Lands, Mines and Energy, Ministry of Planning and Economic Affairs, Ministry of Transport, the FDA along with the civil society and non-governmental organizations like Conservation International (CI), Sustainable Development Institute (SDI) and the civil society ensuring that their efforts support mainstreaming of climate issues into NAPA are fully implemented.
- b. In September 2007, the Liberian government formed a National Carbon Working Group (multi stakeholder) whose activities are coordinated by Forestry Development Authority (FDA). Among the Group’s thrusts is to explore opportunities as well as create the necessary awareness on the merits and demerits of carbon trade or reducing emissions from deforestation and forest degradation (REDD). Understanding the concept of carbon tax at a grass-roots level is highly important. Again, this is a multi-stakeholder group that is mandated to formulate programs and raise sufficient funds that are to contribute to efforts in mitigating climate change impacts and build capacity of local people’s livelihoods through REDD. Through this initiative, Liberia could act as custodians for protected forest and reserves in return for foreign aid or debt relief. Accordingly, the carbon market is the most visible result of early regulatory efforts to mitigate climate change. The carbon trade initiated by Conservation International and coordinated by FDA that has brought international community like the World Bank-Liberia, International Monetary Fund- Liberia, and the United States Forestry Mission in Liberia and donor stakeholders could scale-up in addressing climate change at wider scale.
- c. National Disaster Risk Management Commission (NDRMC) is under the Ministry of Internal Affairs which is in charge of local governance. The Commission considered all government ministries as members, along with United Nations Resident Coordinator (UNRC), a donor, one non-governmental organization and a civil society organization, a private sector representative. NDRMC developed an action plan (2008 to 2015) for

disaster risk reduction. Liberia being an agrarian nation, the Commission recognizes that in any disaster (natural or man-made) farmers are affected. Therefore, in its preparedness and emergency response operations, it stated that agriculture/development project officers are to be assigned in affected areas to provide technical expertise/advice to farmers on how to adapt to their new environment.

All of these line agencies, one way or the other contributed to the evolution of the Poverty Reduction Strategy (PRS) of Liberia. The primary goal of the PRS as a national development plan (2008– 2011) is to alleviate poverty and increase food security. The PRS sets out a comprehensive strategy for achieving the Millennium Development Goals (MDGs). The PRS second pillar, in particular, focuses on improving the welfare of Liberians by increasing incomes and improving food security, particularly for swamp reclamation, through pro-poor economic growth that creates decent employment and provides new opportunities for Liberians to participate in remunerative and sustainable livelihoods. This pillar sets out the nation's goal to improve food security at national, community and household levels, thereby solidifying the important investments made to create a peaceful, secure and stable country.

The FDA, EPA and the NDRMC are somehow engaged in climate change activities separately. A challenge is how well they increase the effectiveness of information by coordinating data gathering initiative to avoid duplication and to make sure that the relevant information/data are used to inform and influence decisions and actions. Crafting policy related to climate change that is specifically geared toward more vulnerable sectors in the country, with an emphasis on poverty reduction and food security should be of concern.

Conclusion

While it is true that several undertakings such bilateral and multinational funds have been dished out to developing nations without concert justifications and supportive data; on the grounds that the West contributes significant to climate change and therefore should compensate the South, this cannot always be the case that I&FF analysis is next to uselessness; nor is the failure of some carefully-studied CC projects a valid reason of placing I&FF in the backset of national development agenda. I&FF, in the first place, do not claim to be an antidote to CC problems. Its primary purpose is to enhance agricultural adaptation activities at the local and national levels.

I&FF can never be a worthless exercise in these times of great climatic uncertainty, I&FF studies become even more important in evaluating multitude alternative arising from multitude of possibilities. Investment and Financial Flow analysis is one of the best tools to meet challenges of climate change. It allow county to plan and better argue logically with substantial data as they relate to impacts of climate change.

Recommendation

1. This study strongly recommends an immediate Investment and Financial Flow analysis. I&FF analysis is one of the best tools to meet challenges of climate change. It allow county to plan and better argue logically with substantial data as they relate to impacts of climate change.
2. That all line agencies and organizations dealing with climate change matters be placed under one umbrella called the climate change secretariat for better coordination, avoid duplications and minimize wastage of merger resources.

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