

ASSESSING THE COST OF CLIMATE CHANGE IN THE AGRICULTURE, FORESTRY AND ENERGY SECTORS IN LIBERIA



Women harvesting rice. Farming in Liberia is mostly rainfed and therefore prone to climate change. Photo: Panos / Aubrey Wade

<http://www.undpcc.org/en/liberia>

to identify the most appropriate policy responses. This work was conducted as part of the global UNDP project, Capacity Development for Policy Makers to Address Climate Change, which was funded by the governments of Norway, Switzerland, and Finland, UNDP and the UN Foundation.

Selection of key sectors

The **energy** sector is a major driving force for nearly all socio-economic activities in Liberia. Besides its share of about 0.8% (CBL, 2008) of the overall gross domestic product, energy also contributes to employment, trade, fiscal revenues, food security, and sub-regional development. In addition to imported petroleum, it is estimated that over 95% of the population relies on firewood, charcoal, and palm oil for their energy needs (CSET, 2004). The Ministry of Lands, Mines & Energy formulated a National Energy Policy in 2008 that set greenhouse gas reduction targets (of 10% by 2015), as well as energy efficiency and renewable energy targets.

Forests are one of the most important natural resources in Liberia, yet there have been many years of mismanagement and/or no management of forest resources. Other issues include lack of adequate investments in sustainable forestry, including afforestation/reforestation, restoration of degraded forestlands, and promotion of community and conservation forestry.

Agriculture is a major source of employment, with nearly 70% of the economically active population engaged in the sector. Agriculture is the dominant contributor to export trade and earnings, and a source of livelihood for a greater number of people than any other sector (PRS, 2006). Farming in Liberia is mainly rainfed and therefore very sensitive to climate change.

Institutional arrangements

Upon invitation from the Acting Executive Director of the Environmental Protection Agency of Liberia, national experts

→ Liberia is slowly recovering from the civil unrest that has blocked development during the last decades. However, climate change now threatens to undermine efforts on socio-economic improvement that happen across the country. According to a national assessment of investment and financial flows (I&FF) completed in August 2011, more than US\$ 2.89 billion is needed through to 2030 to implement priority actions to:

- Reduce emissions of greenhouse gases in the forestry and energy sectors, and
- Adapt to the impacts of climate change in the agriculture sector.

Nearly 50% of these funds (US\$ 1.41 billion) is needed to secure the agriculture sector against the effects of climate change. Proposed measures include improving soil fertility; protecting plants; and developing livestock species that are more resistant to climate change. A further US\$ 1.29 billion (45%) is required for the energy sector to improve efficiency of energy production and use; and to provide access to renewable energies, particularly as alternatives to firewood. Lastly, about US\$ 0.19 billion is needed in the forestry sector for the sequestration (or storage) of carbon through enhanced forest cover; enrichment of degraded forests; and afforestation and reforestation actions.

Having completed the assessment, the government of Liberia is now well placed to discuss the costs of climate change in the international climate change negotiations, and

were selected from government ministries, agencies, NGOs and academia to create a multidisciplinary set of experts in finance, climate change, statistics and sector practitioners.

A Regional Centre of Excellence, ENDA Tiers Monde, based in Senegal, trained the three sectoral teams (i.e., energy, forestry

and agriculture) in the approach outlined in UNDP's *User Guidebook and Methodology for Assessing I&FF to Address Climate Change*. In total, 25 national experts were trained on three occasions in Monrovia from 2009 to 2011. ENDA and UNDP also provided backstopping and technical reviews for the duration of the I&FF assessment.

ASSESSMENT OF INVESTMENT AND FINANCIAL FLOWS

Objectives of the Investment and Financial Flows Assessment

The overall objective of the I&FF assessment is to determine the extent and sources of funds needed to address climate change at the national level, and builds directly on national government strategies, plans and programmes. In essence, the assessment seeks to answer the question: *“From a development perspective, what can my country do to address climate change in selected key sectors, and what level of financial contributions will be needed to achieve these objectives?”*

In this context, the I&FF team examined the following questions:

- What are the main adaptation / mitigation measures for the selected sectors in the next 25 years?
- Who is investing in the sector / Who are the main stakeholders and sources?
- What changes / increase in I&FF will be needed in the sectors?
- What additional I&FF are needed to address climate change?



“The Investment and Financial Flows assessment is the first of its kind to be done by the Government of the Republic of Liberia in collaboration with UNDP. It is envisaged that the results of this assessment will influence national budgetary allocation to address climate change adaptation and mitigation in the short, medium and long term. Climate proofing the national budget will promote low carbon development, thereby helping to reduce the country’s vulnerability to climate change and propelling the country to a sustainable middle income status by 2030” Mr. Ben Karmorb, Environmental Protection Agency, Liberia.

For the energy sector (mitigation of greenhouse gas emissions)

It was determined that US\$ 1.29 billion is needed to improve efficiency of energy production and use (US\$ 0.73 billion) and promote renewable energy (US\$ 0.57 billion):

With respect to improving energy production and use efficiency, three fields were analysed:

- Lighting (US\$ 0.49 billion);
- Cooking (US\$ 0.18 billion); and
- Charcoal production (US\$ 57 million).

The cost of measures to promote renewable energy, namely solar PV systems, biomass-fired power plants, and hydro power plants, amounted to US\$ 0.57 billion.

For the forestry sector (mitigation of greenhouse gas emissions)

A total of US\$ 0.19 billion is needed to reduce emissions of greenhouse gases in the forestry sector. Four measures were analysed:

- Sustainable forest management (US\$ 0.14 billion);
- Enrichment of degraded forest (US\$ 13.22 million);
- Restoration of existing plantations (US\$ 5.9 million); and
- Afforestation and reforestation actions (US\$ 27.7 million).

For the agriculture / livestock sector (adaptation to the impacts of climate change)

US\$ 1.41 billion is needed to adapt to the effects of climate change in the agriculture sector through the implementation of:

- Intercropping, irrigation and the improvement of farming practices (US\$ 0.50 billion);
- Development of livestock species most resistant to climatic conditions (US\$ 0.21 billion);
- Development of fish farming (aquaculture and fishing) (US\$ 0.43 billion);
- Measures to fight new diseases and prevent proliferation of old diseases (US\$ 0.21 billion); and
- Improvement of soil fertility by maintaining fast growing nitrogen fixing tree species and using multi-purpose tree species (US\$ 0.07 billion).

EVALUATION OF POLICY IMPLICATIONS FROM THE I&FF ASSESSMENT

For the energy sector (mitigation of greenhouse gas emissions)

As noted earlier, Liberia has in place a National Energy Policy (2008) that includes targets to:

- Reduce greenhouse gas emissions by 10% by 2015;
- Improve energy efficiency by 20% by 2015;
- Increase renewable energy from current level of 10% to 30% of electricity production by 2015; and
- Increase the level of biofuels in transport fuel to 5% by 2015.

The ultimate goal is to implement a long-term strategy to make Liberia carbon-neutral country.

The establishment of the legal and regulatory framework remains crucial and will include restructuring the Ministry of Land, Mines and Energy by upgrading the energy section to a Deputy Ministerial level; and establishing an Energy Regulatory Board, the Rural and Renewable Energy Agency, and a Rural Energy Fund.

For the forestry sector (mitigation of greenhouse gas emissions)

- The Forest Law (2006) calls for the establishment of refugia within commercial forest plantations to conserve plants, animals and habitat of high conservation value.
- Government together with private companies and local

communities can invest in programs that add value to the production of non-timber forest products to diversify the income of forest dependent communities and relieve pressure on the forest as their sole income source.

- Together with logging companies and local communities, government can initiate a process whereby companies undertaking meaningful social development projects can get a tax break because of their work in the communities.
- Government can also invite international rights and environmental groups at regular intervals to review the progress on the maintenance of high environmental and social standards and the distribution of the social funds from commercial forestry, and to also verify actions to promote fair play, transparency and accountability in the sector.

For the agriculture/livestock sector (adaptation to the impacts of climate change)

It would be prudent for the Ministry of Agriculture to revise its policy on food security and agriculture by capturing the selected adaptation activities and interventions stated in this assessment. Key components of these agriculture policies and strategies include:

SUMMARY TABLES OF INCREMENTAL INVESTMENT COSTS

Table 1: Cumulative discounted IF and FF for all investments in each sector, by investment entity and funding source.

Incremental cumulative (2005-2030) discounted sectoral investments (million 2005 US\$).

Category of Investment Entity	Source of I&FF Funds		Mitigation				Adaptation				
			Energy			Forestry		Agriculture			
			ΔIF	ΔFF	ΔO&M	ΔI&FF	ΔO&M	ΔIF	ΔFF	ΔO&M	
Households	Domestic	Equity and debt	-	-	-	-	-	-	-	-	
	Total Household Funds (all domestic)		802.35	80.24	200.59	29.678	7.454	407.45	98.85	127.05	
Corporations	Domestic	Domestic equity (including internal cash flow)	-	-	-	-	-	-	-	-	
		Domestic borrowing (bonds and loans)	-	-	-	-	-	-	-	-	
		Total Domestic Sources	-6.06	-0.61	-1.51	-	-	-	-	-	
	Foreign	Foreign direct investment (FDI)	-	-	-	-	-	-	-	-	
		Foreign borrowing (loans)	-	-	-	-	-	-	-	-	
		Foreign aid (ODA)	-	-	-	-	-	-	-	-	
		Total Foreign Sources	36.86	3.69	9.21	-	-	-	-	-	
	Total Corporation Funds		30.80	3.08	7.70	51.944	13.062	316.91	76.89	98.82	
	Gouverne-ment	Domestic	Domestic funds (budgetary)	-6.37	-0.64	-1.59	-	-	-	-	-
		Foreign	Foreign borrowing (loans)	-	-	-	-	-	-	-	-
Bilateral foreign aid (bilateral ODA)			-	-	-	-	-	-	-	-	
Multilateral foreign aid (multilateral ODA)			-	-	-	-	-	-	-	-	
Total Foreign Sources		127.05	12.70	31.76	-	-	-	-	-		
Total Government Funds		120.68	12.07	30.17	66.778	16.804	181.11	43.93	56.47		
Total (all investment entities and all sources)			953.83	95.38	238.46	148.44	37.32	905.46	219.66	282.33	

Negative values mean net savings

IF = Investment Flows, FF = Financial Flows

ΔI&FF = incremental changes of Investment and Financial Flows

Source: National I&FF assessment

- *Pro-poor agriculture and agric business development*: Provide micro-finance & low-cost extension services to needy farmers; Supply of timely farm inputs.
- *Food and nutrition security*: Promote production and consumption of local food items.
- *Intensification and diversification of farming system*: Proper land use plan; optimal water usage; crop rotation; low-external inputs; resistant crops and animals.
- *Farm mechanization*: Introduction of appropriate technology; irrigation.
- *Increased market access*: Improved transport system; quality control & fair price for local agricultural produces; formation of cooperatives.
- *Reduce post-harvest losses*: Processing of agricultural produce to add value chain; improved storage; pest control.
- *Human and institutional capacity building*: Develop a national policy on climate change; provision of funding to build human capacity on climate change and food security.

Table 2: Annual IF and FF for all investments in each sector.
Annual sectoral investments (million 2005 US\$)

Year	Mitigation					Adaptation		
	Energy			Forestry		Agriculture		
	ΔIF	ΔFF	ΔO&M	ΔI&FF	ΔO&M	ΔIF	ΔFF	ΔO&M
2005	128.65	12.86	32.16	-	-	1.66	0.41	0.53
2006	116.47	11.65	29.12	0.44	0.09	1.98	0.52	0.63
2007	96.79	9.68	24.20	0.89	0.23	3.47	0.86	1.08
2008	95.58	9.56	23.90	1.37	0.34	4.16	1.06	1.32
2009	89.29	8.93	22.32	1.80	0.45	8.00	2.00	2.52
2010	84.55	8.46	21.14	2.25	0.57	2.06	0.75	0.64
2011	150.26	15.03	37.56	2.69	0.67	2.58	0.63	0.82
2012	140.50	14.05	35.12	3.15	0.78	3.23	0.78	1.02
2013	129.58	12.96	32.39	3.62	0.90	4.02	0.98	1.25
2014	118.38	11.84	29.60	4.05	0.99	5.03	1.22	1.58
2015	107.53	10.75	26.88	4.52	1.14	6.29	1.53	1.36
2016	96.75	9.68	24.19	4.94	1.23	7.86	1.92	2.46
2017	87.40	8.74	21.85	5.45	1.37	9.84	2.39	3.08
2018	78.82	7.88	19.70	5.91	1.48	12.29	2.98	4.54
2019	70.96	7.10	17.74	6.35	1.60	15.38	3.73	4.80
2020	63.78	6.38	15.95	6.82	1.72	19.2	4.66	5.98
2021	57.21	5.72	14.30	7.29	1.82	24.02	5.82	7.49
2022	45.24	4.52	11.31	7.76	1.95	30.01	7.27	9.35
2023	45.69	4.57	11.42	8.22	2.06	37.51	9.10	11.72
2024	40.63	4.06	10.16	8.70	2.17	46.90	11.36	14.64
2025	35.99	3.60	9.00	9.18	2.30	58.61	14.22	18.29
2026	31.73	3.17	7.93	9.65	2.43	73.27	17.76	22.86
2027	27.80	2.78	6.95	10.12	2.54	91.60	22.22	28.58
2028	24.18	2.42	6.05	10.60	2.66	114.49	27.75	35.72
2029	20.84	2.08	5.21	11.07	2.77	143.11	34.70	44.68
2030	17.76	1.78	4.44	11.57	3.79	178.90	43.36	55.84



Knowledge Platform
The project website www.undpcc.org contains information on activities in Liberia, the I&FF methodology, and many other resources in French, English, Spanish and Russian.

August 2011

IF = Investment Flows, FF = Financial Flows
ΔI&FF = incremental changes of Investment and Financial Flows
Source: National I&FF assessment

More information on activities in Liberia

Ben Karmorh
National Focal Point
Environmental Protection Agency
benkarmorh@yahoo.com

Kumeh Assaf
Project Focal Point
UNDP Liberia
kumeh.assaf@undp.org

Rebecca Carman
Global project manager
UNDP New York
rebecca.carman@undp.org