

Republic of Liberia



United Nations Development Programme
(UNDP)



**UNDP Global Project:
Capacity Development for Policy Makers
to Address Climate Change**

Final report

**Assessment of Investment and Financial Flows
to Mitigate Climate Change in the Forestry Sector
in Liberia**

August 2011

Investment and Financial Flows to Address Climate Change UNDP Global Project

Climate Change poses significant challenges to development and policy makers are faced with complex tasks to respond to them and to ensure sustainable development. Particularly in Least Developed Countries decision makers have to balance poverty alleviation, economic development as well as social and environmental questions, while also questions of costs that occur with associated policies and measures play a vital role.

To better understand the magnitude of funds needed to tackle climate change now and in the long term, developing countries are undertaking assessments of investment and financial flows (I&FF) to address climate change for key sectors in a groundbreaking UNDP Environment & Energy Group project: Capacity Development for Policy Makers to Address Climate Change.

Liberia is one of 19 countries participating in this project, which was launched in May 2008 with the generous contributions of the Government of Norway, Government of Finland, Government of Switzerland as well as the UN Foundation and UNDP.

Authors:

John D. Kantor
Shadrach Parwon Kerwillain
Jonathan W. Yiah
Jefferson P. Dahn, Jr.
Luther B. Harmon
Kumeh S. Assaf

National coordination:

Ben Karmorh
UNDP Liberia: Kumeh Assaf

Global coordination:

Rebecca Carman, Global Project Manager, UNDP New York
Susanne Olbrisch, Technical Specialist Climate Change – Financial Assessments, UNDP New York
AnnaLisa, Programme Associate, UNDP New York

The author(s) gratefully acknowledge the technical comments received from Environmental Development Action in the Third World (ENDA), based in Senegal, which operated as a Regional Centre of Excellence under this project.

Suggested citation

Kantor and UNDP. 2011. Assessment of Investment and Financial Flows for mitigation in the forestry sector in Liberia.

Disclaimer

The views expressed in this publication are those of the author(s) and do not necessarily represent those of the United Nations, including UNDP, or their Member States.

Contents

- Acronyms 5
- Executive Summary 6

- I. Introduction..... 8
 - 1.1 Objectives of the I&FF Assessment 10
 - 1.2 Background 10
 - 1.3 Previous analysis used 11
 - 1.4 Institutional Arrangement and Collaborations..... 13
 - 1.5 Basic Methodology and Key Terms 15
 - 1.5.1 Methodology..... 15
 - 1.5.2 Definitions of key terminologies..... 16
- 2. Scope, Input Data and Scenarios..... 19
 - 2.1. Sectoral Scope 19
 - 2.2 Input Data and Scenario 22
 - 2.2.1 Period of Assessment and Costing Parameters 22
 - 2.2.2 Analytical Approach 23
 - 2.2.3 Historical Data on I&FF and O&M..... 23
 - 2.2.4 Baseline Scenario 27
 - 2.2.5 Mitigation Scenario..... 29
- 3. Results 33
 - 3.1 Changes of I&FF and O&M 33
 - 3.2 Policy Implications 36
 - 3.3 Key uncertainties and methodological limitations..... 38
- 4. References 39

Acronyms

CAF-UL	College of Agriculture and Forestry – University of Liberia
CBD	Convention on Biological Diversity
CBO	Community Based Organization
CIF	Climate Investment Funds
COPAN	Consolidation of Protected Area Network
ECOWAS	Economic Community of West African States
ENDA	Environment and Development Action
EPA	Environmental Protection Agency
FDA	Forestry Development Agency
GDP	Gross Domestic Product
GEF	Global Environmental Facility
GHG	Greenhouse Gas
IPCC	Intergovernmental Panel on Climate Change
ITTO	International Tropical Timber Organization
IUCN	International Union of the Conservation of Nature
MDGs	Millennium Development Goals
NAPA	National Adaptation Programme of Action
NBSAP	National Biodiversity Strategy and Action Plan
NCSA	National Capacity Self-Assessment
NTFPs	Non-Timber Forest Products
PRS	Poverty Reduction Strategy
RIA	Robert International Airport
TAR	Third Assessment Report
UNFCCC	United Nations Framework Convention on Climate Change
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme
UNMIL	United Nations Mission in Liberia
WMO	World Meteorological Organization

Executive Summary

This project to review existing and future investment and financial flows needed to strengthen Liberia's capacity to develop and enhance policy options to address climate change in different sectors of the economy, started in Liberia after the National Inter-Ministerial Dialogue on Climate Change held June 24-26, 2009 in Monrovia, the dialogue brought together 84 participants including various stakeholders and policy makers.

Initial technical training for national experts to undertake the assessment was also held from October 13 to 15, 2009 with experts from line institutions like the Forestry Development Authority (FDA), Ministries of Agriculture, Lands, Mines, and Energy, Gender and Development, the Central Bank of Liberia (CBL), Environmental Protection Agency (EPA), University of Liberia, Liberia Electricity Corporation (LEC), the civil society and private consultants.

The I & FF workplan for Liberia's I&FF assessment was subsequently developed. However, due to technical difficulties in carrying out the assessment, there were delays in completing the work within the time set out in the workplan; this led to revision of the workplan and two more workshops in 2011, the workshops conducted by two consultants from Environment and Development Action (ENDA), a Regional Center of Excellence based in Senegal, ultimately led to the regrouping of the sectoral teams and the evaluation of Liberia's I&FF was concluded.

For this exercise, the Forestry and Energy sectors were identified as priorities for mitigation and the Agriculture Sector for adaptation; these were evaluated and Investment & Financial Flows (I&FF) assessments were carried out to study the impacts of climate change on these Sectors, specifically to assess the I&FF needed for adaptation in the agriculture sector and the I&FF for mitigation in the forestry and energy sectors.

This report is the assessment of I&FF needed for mitigation in the forestry sector; the following four mitigation measures were identified and the I&FF is given as:

- i. Sequestration of carbon by enhancing forest cover through afforestation/reforestation: \$88.61 million USD;
- ii. Enrichment of degraded forest: \$41.89 million USD;
- iii. Restoration of existing plantation: \$19.75 million USD;
- iv. Sustainable forest management through the 3 "C" approaches: \$444.36 million USD
- v. Substitution with alternative energy source to reduce consumption of wood energy: (the Energy Sector assessment has estimated I&FF needed for this activity).

In total, both historical and future I&FF needed (2005 to 2030) for forestry sector mitigation of climate change is a \$594.61 million U.S. dollars; this amount will cover the cost of reforestation/afforestation, enrichment planting and restoration of abandoned plantations and implementation of the 3C of the Forest Reform Law, 2006.

The I&FF evaluation team was comprised of seven national experts who worked according to the I&FF methodological guidelines contained in the UNDP User Guide and Guidebook for Assessing I&FF to Address Climate Change. The team agreed that the main entities to be assessed were households, corporations and government.

Data were collected mostly in documents of the draft national communication, the National Adaptation Programme of Action (NAPA), resource documents from the Central Bank of Liberia, National archives, forest inventories, Liberia Institute for Statistics and Geo-Information Services (LISGIS), the Forestry Development Authority (FDA) and the Environmental Protection Agency (EPA), the Ministry of Planning and Economic Affairs (MPEA) and from National and International non-governmental organisations and research institutions.

I. Introduction

The analysis of investment and financial flows (I&FF) for greenhouse gas mitigation and climate change adaptation is an important activity for the development of effective and appropriate national responses to climate change; it does not only strengthen policy making capacity in participating countries, but also enables those countries to know the actual costs of adaptation and mitigation of climate change in key sectors of their economy. The assessment also helps to produce analytical results that could serve as inputs to negotiating positions under the United Nations Framework Convention on Climate Change (UNFCCC).

Liberia contains approximately 4.3 million hectares of lowland tropical forest that comprises 43% of the remaining Upper Guinea forests of West Africa, which extend from neighboring Guinea to Togo (Bayol and Chevalier, 2004). According to Bakarr et al, (2001) these forests have been identified as one of 35 such critical areas for global biodiversity conservation. They are immensely important for their biological diversity which encompasses the last long-term viable populations of several endemic species, ecosystem service provisioning, and potential to contribute to the country's development goals.

Bayol and Chevalier, (2004) suggest that although the overall extent of the Upper Guinea Forest has dwindled to an estimated 14.3% of its original extent, Liberia still hosts two massifs of forest including evergreen lowland forests in the southeast and the semi-deciduous mountain forests in the northwest.

Forestry in Liberia has the potential to contribute 8–10 percent of GDP and contribute significantly to export revenue and fiscal receipts (Liberia SEA, 2010). However, in recent years, these forests have not been managed either to support biodiversity, sustainable forest based industry or to support the livelihoods of the forest dependent people.

Forest is one of the most important natural resource in Liberia, yet they have never been managed to delivered anywhere near their full potential because of the over-emphasis of wood production from the forests over other non-wood and intangible benefits. Forests have the potential to contribute to the long-term, sustainable economic growth of the nation; the livelihoods of local and rural communities; or the long-term conservation of the country's natural endowments. This situation is due in part to many years of mismanagement or no management of forests and its resources and lack of adequate investments in sustainable forestry, including afforestation/reforestation, restoration of degraded forestlands, and promotion of community and conservation forestry.

As the most forest-endowed country in West Africa, Liberia also has great potential in supporting the forest mitigation agenda of the UNFCCC (Blaser and Dagbe, 2006). The country could decide to commit existing forests to reduce emissions from deforestation and forest degradation and using the high growth potential of Liberia forest to sequester atmospheric carbon; carbon credits could be traded for much needed finance and the benefits shared with

local forest dependent communities as well as boost economic recovery. This approach has been used with much success in many countries, leading to improvement in the welfare of forest communities, while conserving natural resources and contributing to carbon capture and storage.

Carbon sequestration by forest has the potential to capture between 17 – 20 % of atmospheric carbon. REDD+ is a scheme to incentivize conservation, which is still being finalized in international climate change negotiations. Conservation has been practiced here in Liberia for a long time and is a part of the tradition of forest dwellers, but the legal regime and other issues to do with forest governance and forest tenure are yet to be fully resolved.

The mitigation potential of forests and the I&FF that comes with it cannot be harnessed without full resolution of these issues. Furthermore, it is time for the country to look into alternative uses of the forest other than for timber production and to legally commit protected areas for mitigation by putting in place the policy, monitoring and governance frameworks that could attract I&FF. REDD+ and other payment for ecosystem (PES) schemes could bring in I&FF for the forest sector.

In the draft initial national communication, GHG emissions from the forestry sector are also assessed, because forests are both sinks and sources of CO₂, contributing between 17 – 20% of GHG concentrations in the atmosphere. In this I&FF assessment, analyses of investment and financial flows (I&FF) for GHG mitigation in the forestry sector is an important activity for the establishment of effective national response to address climate change.

The Forestry sector is the best alternative to provide low-cost mitigation options for Liberia to make a significant contribution to global efforts to reduce greenhouse gases in the atmosphere (Koffa, 2009). From traditional conservation practices to recent trends in conservation like REDD+ and other schemes for payment for ecosystem services, forestry is well placed to help Liberians reduce GHG emissions and drive the country's development along a path to low – carbon, sustainable development.

1.1 Objectives of the I&FF Assessment

The overall objective of the I&FF assessment is to determine the amount and identify the sources of funds to address climate change concerns at the national level. Specifically, the following outcomes are expected:

- Concise information on investment and financial flows in key forestry sub-sectors;
- A projection of future I&FF in the business-as-usual scenario, that is, in the absence of national efforts to address climate change;
- Identification of measures to address climate change and projections of future I&FF needed to address these concerns;
- Projection of future I&FF in the mitigation scenario;
- Identification of incremental I&FF needed to implement measures and political implications;
- Policies needed to address the change in the mitigation scenario.

1.2 Background

Liberia is situated within the tropical rainforest belt on the West Coast of Africa. The country has a total land area of 9.6 million hectares, of which forest cover is about 4.4 million hectares or 46 percent of land area (Blaser and Dagbe, 2008). Table 1 provides a summary of the overall estimated land-use cover.

According to FDA (2007), an approximate area of 1 million ha of forest has been subjected to logging over the past 10 years and another 1.3 million ha of forest land has been seriously affected by agricultural pressure and now consists only of forest patches. Although the annual rate of deforestation is estimated to be approximately 12,000 ha (0.3 percent), the recorded planting of new forests since 1971 to date is estimated to be only approximately 11,000 ha in total. This poor reforestation/afforestation record of the FDA where annual deforestation rate is far higher than the average rate of replacement from 1971 to date is not even a statistics worth mentioning.

Table 1: Land use categories in Liberia

Landuse	Forest part in the class	Forest area in (ha.)
1 Urban area	0.5%	46,047
2 Predominant rural agricultural domain	4.6%	436,747
3 Agricultural area with small forest presence	31.7%	3,042,091
4 Mixed agricultural and forest area	13.7%	1,317,873
5 Agriculture degraded forest	9.9%	949,615
6 Open dense forest	10.6%	1,013,993
3.3 Closed dense forest	25.3%	2,424,078
5 Free water	0.1%	7649
6 Savanna or bare soil	0.1%	13,312
7 Littoral ecosystem complex	1.7%	161,390
8 Agro-industrial plantation	1.9%	178,294
Total Land Area	100%	9,591,089

Source: Bayol and Chevalier (2004)

Historically, the forestry sector has been a strong contributor to Liberia's economy. In 1980, the production of forest products accounted for approximately 5 percent of GDP, rising to 20 percent in the late 1990s. Forest products also accounted for 5–10 percent of export earnings in the 1980s, rising to over 50 percent in 2000. In 2002, it was estimated that 36 forest companies were operating in Liberia and producing timber exports valued at over US\$100 million (or 60 percent of Liberia's total export earnings) and employing up to 8,000 people (FDA 2007).

Before the civil crisis, timber was a major export, surpassed only by iron ore and rubber. Liberian forests have also provided a number of environmental goods and services including habitat for a wide range of wild-life which, has been a source of protein not only for the rural masses but a huge delicacy for the urban populace. As Koffa, 2009 observed citing Bowen-Jones & Pendry, 1999, the trading of bushmeat from Liberia in the export market, generated USD 42 million per annum (including subsistence), but no such reliable information on plant-based NTFPs is available.

During the war years, the high number of logging companies meant that forests were unsustainably harvested to generate capital to fuel the conflict. This led to the imposition of a ban on Liberian timber by UN Resolution 1478 of July 2003. There have been varying estimates of rates of deforestation in Liberia. A study by FAO showed that between 1980 and 2005, forest area declined by 22 percent (FAO 2006).

The sanction has been lifted, and Liberia is now instituting the necessary policies for sustainable forest management (SFM) which is strongly rooted in the National Forest Reform Law of 2006 therefore, investment for timber in this sector is on the increase. Recent estimates put the number of firms with Forest Management Contracts (FMCs) to seven and ten Timber Sales Contract (TSCs), this is expected to decrease forest cover, undermine mitigation potential of forests and increase the amount of investment and financial flows required to put in place appropriate mitigation measures to address climate change.

1.3 Previous analysis used

This assessment is based on Government of Liberia (GoL) previous policies, strategies, plans and programs, which include:

a. Poverty Reduction Strategy Paper (PRSP)

The PRSP is the government's five year development strategy that is intended to form the basis for the economic recovery of the country after years of civil conflict. It came into force in 2005 and is expected to be replaced by the Liberia Vision for Accelerating Economic Growth in June of 2011. The PRS have been a strong pillar of the government development agenda over the years.

The PRS II is being drafted by several sectoral working groups from different government agencies, development partners and consultants. It is expected to mainstream environment

and climate change as a cross-cutting issue in all sectoral programs more than the PRS I did. Consequently, the next five years 2012 – 2017 is expected to see greater emphasis on sustainable management of the nation's natural assets, climate change and environmental governance and monitoring.

b. National Biodiversity Strategy and Action Plan (NBSAP)

The NBSAP comprises two components: the vision statement, the guiding principles, the goals and objectives on one hand and the Actions for Biodiversity conservation, sustainable use and benefit sharing on the other. The goals and objectives are developed in consonance with the guiding principles. Six goals are developed upon which all the actions are based. Priority areas for immediate actions are Land Rehabilitation, Forestry Sector Reform, Timber Management, Poverty Alleviation, Food Security, Addressing Bush meat Crisis, Restoration of Electricity, Environmental Impact Assessment, Addressing Coastal Erosion and Mangrove Destruction and providing alternative sources of Protein.

c. National Adaptation Programme of Action (NAPA)

The NAPA explicitly accounts for synergies between adaptation and national development plans, such as the National Reconstruction and Development Plan (NRDP) and the National Biodiversity and Strategy Action Plan, as well as with multilateral initiatives such as the Millennium Development Goals (MDGs).

d. National Capacity Self Assessment (NCSA)

This is an analysis across the three Rio Conventions (UNCCD, UNFCCC, UNCBD), that identifies capacity needs to fully implement the conventions.

e. The National Forest Reform Law

The NFRL of 2006 identifies three categories of forest: Conservation Forest includes biodiversity conservation (at the landscape, site and species levels) and maintenance of the other environmental functions of forests (e.g. soil and water protection). It includes protection of specific forest areas as well as measures to enhance the environmental quality of other forest areas (e.g. through rehabilitation of secondary forests). The aim of forest conservation is to sustain and enhance these functions for current and future generations.

f. Initial National Communication (INC) (draft)

Liberia is in the process of finalising her initial National Communication. As part of the exercise, inventories of greenhouse gas (GHG) emissions were done for the following key sectors:

- (i) Land Use, Land Use Change and Forestry (LULUCF);
- (ii) Agriculture;
- (iii) Energy and;
- (iv) Waste.

g. CBD 4th National Report

Liberia signed up to the United Nations Convention on Biological Diversity (UNCBD) in 1998. Liberia is said to be one of the biodiversity hotspots in the world (NBSAP). As part of her

obligation under the UNCBD, the Country has been submitting reports detailing country circumstances and activities to do with biodiversity and protected areas issues. Article 26 of the CBD obligates Parties to develop and submit national reports at the request of the Conference of the Parties. The Government of Liberia through the Environmental Protection Agency undertook the task to complete the Fourth National Report. This report confirms the important contribution by stakeholders to the elaboration of environmental policies in the country, by allowing the evaluation of all national actions undertaken in the various environment and natural resources sectors for the conservation of biological diversity.

1.4 Institutional Arrangement and Collaborations

Climate change cuts across all sectors, regions and affects everyone. Consequently, actions to combat this phenomenon should be concerted, holistic and inter-sectoral. For this reason climate change going forward will have to be tackled firstly as a national priority with significant resources of relevant ministries and agencies devoted to combating climate change, including financial, material and human resources.

To demonstrate this need and urgency for collaboration and inter-sectoral cooperation to address climate change, the I&FF Team for Forestry Mitigation includes experts from the Forestry Development Authority, the Environmental Protection Agency, Civil Society Groups: Sustainable Development Institute (SDI) , Central Bank of Liberia (CBL) and the Ministry of Gender and Development (MoDG). Other sectoral teams include experts from the Liberia Electricity Corporation, the Ministry of Lands, Mines and Energy, the Center for Sustainable Energy Technology, the Ministry of Agriculture, and University of Liberia, Skills and Agriculture Development Services (SADS) and the private sector.

The Forestry I&FF Team comprised of the following experts:

Name	Position	Institution
1. John D. Kantor	Forestry Expert	FDA
2. Jonathan Yiah	Forestry Expert	SDI
3. Shadrach Kerwillain	Mitigation Specialist	Private Sector
4. Jefferson Dahn	Statistician	EPA
5. Luther Harmon	Finance Expert	MoDG
6. Siamma Kroma	Finance Expert	CBL
7. Kumeh S. Assaf	Forestry Expert	UNDP (provided inputs while with EPA in 2009-2010)

The UNFCCC National Focal Person for Climate Change is housed in the EPA, and his office coordinates together with the National Climate Change Secretariat, climate change activities in the country. The I&FF assessment, funded by the UNDP with technical guidance from Environment and Development Action (ENDA) is being coordinated in-country by the National Focal Person, the UNDP Country Office through the Energy and Environment Unit also provides some administrative support on the request of the National Focal Person. ENDA is a Regional Centre of Excellence based in Senegal.

ENDA has been working with the National Coordinator and together they have organised three workshops, all geared towards capacity building of sectoral teams for assessing I&FF for climate change. The first workshop was to recruit the various team members and introduce the I&FF methodology, thereafter a work plan was developed and approved, but lack of clarity of the methods of assessment and institutional cooperation lead to the call for a second workshop. This workshop which lasted for five days was judged as successful in all regards because it led to the completion of the first drafts of the report from all sectors. The third workshop was scheduled to conclude the entire exercise.

The institutional arrangement for climate change in the country is proposed to be headed by the National Climate Change Secretariat (NCCS). The NCCS was launched in October, 2010. The NCCS is the operational arm of the National Climate Change Steering Committee which is responsible for all policies and strategies for climate change in the country. In preparation for the Conference of the Parties to the UNFCCC in Bali, a Carbon Consultative Group (CCG) was formed in 2007. Since then, the CCG has transformed into the multi-stakeholder REDD Technical Working Group (RTWG) which is chaired by the Forestry Development Authority (FDA) and co-chaired by the EPA.

Each relevant government body has nominated a representative or two to the RTWG and these individuals are the focal persons for climate change in their respective institutions. The current effort to do an assessment of investment and financial flow (I&FF) for climate change is purely driven by the Government of Liberia and is spearheaded by the EPA.

These entities and sources played an important role in the assessment and will be important in addressing climate change across the three (3) I&FF sectors:

- Forestry Development Authority;
- Environmental Protection Agency;
- LEITI Secretariat;
- LISGIS;
- Ministry of Planning and Economic Affairs;
- Central Bank;
- FAO/ITTO reports;
- Ministry of Finance;
- Guidelines for Forest Management Planning in Liberia;
- Community Forestry Law of 2006;
- National Forest Reform Law of 2006;
- National Forest Policy of 2006;
- Environmental Protection Agency Act of 2002;
- National Environmental Policy of Liberia;
- Liberia Extractive Industry Transparency Initiative (LEITI) Act.

1.5 Basic Methodology and Key Terms

1.5.1 Methodology

The methodological approach of the national assessment of the I&FF for forestry mitigation followed the nine steps outlined in the UNDP methodological guide. These steps are:

1. Establish key parameters of assessment
 - Define detailed scope of the sector;
 - Identify preliminary mitigation (or adaptation) measures;
 - Specify assessment period & base year;
 - Select analytical approach.

2. Compile historical I&FF data and other input data for scenarios
 - Compile annual I&FF data, disaggregated by investment entity, source, & investment flow versus financial flow;
 - Compile annual historical O&M data, disaggregated by investment entity & source;
 - Compile other input data for scenarios.

3. Define baseline scenario
 - Socioeconomic trends;
 - Technological change/advances;
 - Business-as-usual investments;
 - Define model/spreadsheet to be used for the assessment.

4. Derive I&FF for baseline scenario
 - Derive annual IF & FF estimates, disaggregated by investment entity & source;
 - Derive annual O&M estimates, disaggregated by investment entity & source.

5. Define Mitigation scenario
 - Sector is selected for Mitigation;
 - A baseline scenario & a mitigation scenario will be developed for that sector.

6. Derive I&FF for Mitigation Scenario
 - Derive annual IF & FF estimates, disaggregated by investment entity & source;
 - Derive annual O&M estimates, disaggregated by investment entity & source.

7. Calculate changes in annual I&FF needed to implement mitigation
 - Estimate changes in cumulative I&FF;
 - Estimate changes in annual I&FF.

8. Evaluate Policy implication
 - Determine policy instruments & measures to encourage changes in I&FF;

- Identify the entities that are responsible for the significant incremental changes in I&FF;
- Determine the predominant sources of their funds, important to distinguish between public & private sources of finance.

9. Synthesize results and complete report

- Integrate I&FF results, & evaluation of policy instruments & measures, across sectors, & across mitigation & adaptation;
- Summarize objectives of study, methodology, inputs, & results in report;
- Complete reporting templates.

It is therefore expected that this I&FF assessment for climate finance will increase greater awareness and understanding of future investment that address climate change as well as influence national development priorities to take into consideration climate variability.

ENDA was very helpful in clarifying the I&FF methodology, including information on how to collate data and information including those contained in the draft first national communication of Liberia, the National Adaptation Plan of Action (NAPA), the NBSAP and records of LISGIS and the CBL.

1.5.2 Definitions of key terminologies

Mitigation

It is the modification and substitution techniques used in order to reduce the resources used and emissions per unit of production. Mitigation means implementing policies to reduce emissions of Greenhouse Gases (GHG) emissions from the consumption of wood energy (conversion of forest and meadow) and to enhance carbon sinks through operations reforestation (changes in forest).

Investment Flows

The "Investment flows" (IF) is the capital cost of new physical assets with a lifespan of more than one year, such as the capital cost of solar PV kits, equipment for the work of conservation soil water / defence and soil remediation.

Financial Flows

The Financial flow" (FF) is the ongoing expenditure on programmatic measures; the FF covers expenditures other than those for the expansion or installation of new physical assets.

Investment Entity

An "investment entity" is an entity responsible for an investment. These are the entities that decide to invest in, for example: a photovoltaic park, a program of reforestation, national parks, a program for stabilizing sand dunes. This methodology uses three types of investment entities: households, corporations and government.

Sources of I&FF Funds

The "sources of I&FF funds" are the origins of the funds invested by investment entities, e.g. domestic equity, foreign debt, domestic subsidies, foreign aid.

Households

Households are individuals or groups of people (e.g. families) acting as one unit financially. Households invest in assets such as houses, farms, crop fields. It is assumed that all their investment funds, including capital (savings), debt (borrowing from friends, family, financial institutions) and government support in form of grants (that is to say-refundable deductions tax, tax credits on purchases) are national funds, to simplify the estimation of I&FF.

Corporations

The corporations include both financial firms as non-financial businesses, and organizations may be profit or non-profit. Financial firms are entities such as banks, credit unions and insurance companies that provide financial services to non-financial business, households and governments. The non-financial firms produce goods (such as fossil fuels, electricity, food or wood).

The non-governmental organizations are a kind of non-profit company. Firms invest in physical assets and programs. Their sources of investment funds are from domestic sources and external sources and can be in the form of shares (shares in domestic capital markets and Foreign Direct Investment (FDI), debt (loans from commercial banks and bonds sold in capital market), national government support (subsidies) or public foreign aid (in the form of grants and loans conditional preference, known as overseas development assistance (ODA).

Governments

Governments are the national, provincial, county and local governments of a country. Financial and non-financial corporation owned wholly or in part by governments, such as public universities, research institutions and publicly held oil companies, utilities and management of waters and forestry authorities belong to this category. Government entities invest in physical assets and long-term programs and services that provide public benefits.

Scenario

A scenario is an internally consistent and plausible characterization of future conditions over a specified period. For each sectoral assessment of I&FF for mitigation, it must develop a baseline scenario and a mitigation scenario for this sector.

In both cases, the baseline scenario describes the conditions of the status quo, that is to say, this is a description of what will probably happen if no new policy measure to address climate change is put in place.

Baseline Scenario

The baseline scenario describes the conditions of the status quo, that is to say, this is a description of what will probably happen if no new policy measure to address climate change is put in place.

Mitigation Scenario

The mitigation scenario includes measures to mitigate GHG emissions. It should describe the expected socio-economic developments, technological change, new measures to mitigate GHG emissions and the expected investment in any sector in the climate change scenario.

Assessment Period

The assessment period is the time horizon for assessment i.e. the number of years the assessment has covered, in this assessment 2005 – 2030.

Base Year

The base or reference year is the first year of the assessment period, that is to say the first year of baseline, mitigation and adaptation. The base year should be a recent year for which information on the I&FF and O&M is available so that the IF, FF and O&M costs for the first year of these scenarios are all historical data. In fact, the reference year is the starting year on which each scenario is based. The reference year 2005 is recommended.

For externalities it should be noted that mitigation in the forestry sector contributes more to environmental protection through various afforestation and reforestation and recovery of degraded lands. These mitigation measures are implemented at community level to benefit vulnerable populations facing the effects of climate change contributing to the fight against poverty in these populations.

2. Scope, Input Data and Scenarios

2.1. Sectoral Scope

Liberia is considered as one of the countries almost entirely covered with forests; in the 1950s the total percent of the country that was forested was an astounding 90%. However, this figure has reduced significantly, with latest estimates ranging from 45-50%. However, to date the country has the greatest percentage of the remaining blog of the Upper Guinea Forest, accounting for approximately 43% of this vast spread of tropical rainforest (Bayol and Chevalier, 2004).

The forest of Liberia is geographically divided into two large blocks located in the northwest and the southeast regions, between Monrovia and Ganta development corridors. The Government of Liberia has further divided the forest based on a progressive national forest management framework called the “3C” approach that integrates conservation, community, and commercial uses while emphasizing job creation and community incentives (National Forest Reform Law, 2006).

Forests as one of the country’s greatest natural assets and source of major export earnings is under threat of being exploited beyond its natural ability to regenerate; this will undermine global and national efforts to mitigate climate change in the forestry sector. I&FF is needed to reverse this trend by boosting and in some cases initiating investments and financial flows in the following sub-sectors. Consequently, the scope of this project covers activities in the following:

- I. Sequestration of carbon by enhancing forest cover through afforestation/reforestation;
- II. Enrichment of degraded forest;
- III. Restoration of existing plantation;
- IV. Sustainable forest management through the 3 “C” approaches;
- V. Substitution with Alternative Energy Source to reduce consumption of wood energy (Use of eco-stoves to reduce wood and charcoal consumption, use of solar energy for lighting).

This last activity is mentioned as a forestry mitigation option because it is an alternative source of energy to fuel wood and charcoal which is a major deforestation activity and source of green house gas emissions. The Center for Sustainable Energy Technology (CSET, 2004) puts annual fuel wood harvest at 10.8 metric cube of wood. However, investment needed to provide alternative energy sources to address climate change have not been calculated in this report, as it is consider in the Energy Sector report.

Liberia has experienced relatively low average deforestation rates over the past few decades (0.3 – 0.7%); the civil war between 1990 and 1997 slowed international timber and agricultural exports, consequently reducing deforestation and forcing much of the population to abandon the hinterland for Monrovia and elsewhere. After 1999, logging was again intensified until UN

sanctions (UNSC Resolution 1478) were imposed in 2003 to prevent logging revenue from further funding conflict.

Given that peace has been restored, Liberia begins economic recovery by implementing policies such as the Poverty Reduction Strategy (PRS) that focus on natural resource extraction, agricultural expansion, and infrastructure restoration and development. The subsequent return of the population to rural areas combined with a potential global market trade in tropical agricultural products, bio-fuels and timber, will likely increase pressure on forest resources beyond historical trends. Therefore, the immediate and future pressures on forest conversion to alternative land use types is a key significant technical challenge in measuring Liberia's emissions from deforestation and degradation and must be reflected in Liberia's reference scenario by modeling the future changes in forest cover and carbon density.

A recent update to the Liberia forest reassessment (LFR) study was conducted by a partnership between the FDA, Conservation International (CI), and South Dakota State University (SDSU), this study reported an increase in the deforestation rate to 0.35% between 2000 and 2005. An FAO, 2007 study however puts the rate of deforestation at 0.6%.

This shows a growing trend that could increase if deforestation is not checked and this could also increase significantly the rate of emissions of greenhouse gases. The unpublished results of these studies report 3.7 Mt CO₂e between the years of 1990 and 2000 and 4.8 Mt CO₂e between the years of 2000 and 2005. These figures relate to an IPCC Tier 1 estimates and do not include additional emissions from degradation or future emissions from deforestation and degradation. Hence, there is a genuine reason for choosing the forestry sector for mitigative activities in Liberia (Koffa, 2009).

I. Afforestation and Reforestation

Afforestation is the establishment of forest on bare land where there has been no vegetation for the last 50 years. Afforestation of grassland on a limited extend has been practiced by private land owners in Liberia in Maryland and Sinoe Counties. On the national scale, afforestation program in Foya District of Lofa County, coincided with the advent of the civil conflict and has not resumed since.

Reforestation is the establishment of forest or plantation on land that has carried forest within the last 50 years, but where replacement forest is entirely of different species usually a single tree species. An example is where rainforest is logged, cleared and then replanted with monoculture plantations of very valuable timber species. There has been little example of this in the history of this country, because of the natural regeneration potential of the forest. What has often been the case and is increasing likely to happen with government policies favoring agriculture concessions is that more forests are likely to be converted to monoculture tree crop plantations like rubber and palm.

Sixty forest tree species are frequently harvested in Liberia, and ten of them accounted for 67

percent of the total harvested volume in 2001; *Heritiera utilis* (Niangon) alone constituted 12 percent of the total production. The extent of forest cover removal does not match replacement. Up to about 480,000 acres (192,000 hectares) of forestland is lost annually due to logging, shifting cultivation and other activities, while government has replanted less than 27,000 acres (10,927 hectares) since the inception of its reforestation program in 1971 (FDA, 2007). Reforestation has not been successful in Liberia; it was only partially successful on a very small scale in River Gee, Bomi and Nimba Counties.

II. Enrichment planting of degraded forests

Enrichment planting is done by planting trees in partially opened forests or in gaps where seedlings present are not desirable or are insufficient or not well distributed over the regeneration period.

In Liberia, enrichment planting is not widely practiced by the FDA in natural forests and in the limited instances when it was done, trees were planted in areas that are over-logged by reintroducing valuable tree species in gaps created during felling operations.

As a mitigation measure, enrichment planting has the potential to increase carbon intake by degraded forests and areas where the land use is being changed to forestland, as was the case during the civil conflict when due to flight of people from forested areas, many degraded farmlands and settlements were converted to forestland through natural succession thereby increasing carbon capture capacity of the re-growths.

As a deliberate measure to increase carbon sinks with desirable species, massive I&FF will be needed to carry out a nationwide replanting of degraded land, the FDA puts the current costs of enrichment planting at about \$100 per hectare, however, the I&FF study puts the cost of mitigation to be tenfold by 2030.

III. Restoration of existing plantation

Prior to 1989, the FDA in collaboration with the University of Liberia and the Forestry Training Institute (FTI), developed huge tracts of plantation forest in Bomi and Lower Lofa (currently Gbarpolu) counties for research and commercial purposes, but the years of civil strife means that these plantations now stand at less than 30% of their original sizes. The FDA in collaboration with international environmental NGOs is working on a plan for the full restoration of these plantations.

IV. Sustainable Forest Management (SFM)

The Forest Reform Law of 2006 addresses many challenges of the forest sector in Liberia and promotes compliance with SFM principles which centers on these practices: 25-year felling cycle, 5-year management plan, an annual coupe system (1-year management plan) selective felling, and sustained yield for commercial forestry. There is also the New Code of Harvesting

Practice and the Consolidated Forestry Tax Collection System. The Law is based on the “3C” philosophy: commercial, community and conservation forestry.

Specifically, the “3C” policy outlined within the 2006 National Forest Policy of Liberia provides for the following:

1. Commercial forestry - includes the production and processing of wood and non-wood forest products for profit. The aim of commercial forestry is the sustainable production of forest products and the development of viable forest-based industries. Revenues from forest taxes and charges can be used to finance public sector administration of the sector and government expenditure on public goods and services.
2. Community forest management - includes the production of wood and non-wood forest products, plus the use of forest for other purposes such as cultural rituals; future farmland and settlement areas; and the protection of sacred sites. Community forest management focuses more on the interests of people who live in and on the fringes of forest areas.
3. Forest conservation - includes biodiversity conservation (at the habitat, species and gene level) and maintenance of the other environmental functions of forests e.g. soil and water protection. It also includes protection of specific forest areas as well as measures to enhance the environmental quality of other forest areas through rehabilitation of secondary forests. The aim of forest conservation is to sustain and enhance these functions for current and future generations.

The Reform Law also establishes several monitoring programs like the chain-of-custody system which is meant to ensure SFM. However, traditional forestry practices still dominate and there are efforts on the part of GoL to monitor and enforce the Forest Reform Law.

2.2 Input Data and Scenario

2.2.1 Period of Assessment and Costing Parameters

Based on the methodology of the UNDP on the forestry sector, the base year of the assessment is 2005 and it extends to 2030, which makes for a period of 25 years.

All monetary values in the report are expressed in constant 2005 United States dollars. The United States Dollar serves as a legal medium of exchange in Liberia. National budgets are usually in United States Dollar (except otherwise) and bank payments are in USD in this country.

Table 2: Data on forest use area

Activity	Areas affected per year in hectares
Regression of Forest (illegal logging, charcoal, etc)	10,560
Natural regeneration	4,224
Management efforts	1,700,000
Plantation effort	10,158
Total forest cover	4,512,767

Source: Forestry Development Authority (FDA)

Table 3: Cost per hectare of mitigation measure

Actions	Cost per hectare (\$USD)
Sustainable Forest Management (3Cs)	2.50
Enrichment of degraded forest	100
Restoration of existing plantation	250
Afforestation and reforestation	150

Source: Forestry Development Authority (FDA)

Taking into consideration climate change, the calculation of the mitigation scenarios is made on the following basis:

- The mitigation period is for 25 years, commencing in 2005;
- The cost per hectare for Sustainable forest management is USD\$2.50;
- The cost per hectare for enrichment is USD\$100.00;
- The cost per hectare for restoration of an existing plantation is USD\$250.00;
- The cost per hectare for Afforestation and Reforestation is USD\$150.00.

In deriving the cost for Operation and maintenance (O&M) a rate of 25% of the amount for the I&FF was applied; this is the standard rate applied across projects in the country.

2.2.2 Analytical Approach

An excel spreadsheet was used in the analytical approach, due to the absence of adequate data, including the unavailability of a model developed exclusively for the I&FF Assessment. These spreadsheets were developed based on those provided in the methodological guide.

For the baseline scenario, the data available for each of the four mitigation activities as of 2005 and/or 2006 were considered and extrapolated up to 2030.

The mitigation scenario was developed based on the objectives and recommendations in the National Forestry Issue Paper of 2009.

2.2.3 Historical Data on I&FF and O&M

a. Demography

According to the result of the national census conducted in 2008, the country total population was put at 3,476,608 at midnight March 20, 2008. This total falls slightly above the estimated 3,442,000 by the UNDP Human Development report for the same period.

The country has a population growth rate of 2.1 making it one of the highest growth rates in the region after Nigeria. The population increased from 2,101,628 in 1984 to 3,476,608 in 2008. This means that the population increased by more than a million people over 24 years. (LISGIS 2008).

Table number 4: Population trend, (1962-2008)

Index	1962	1974	1984	2008
Population	1,016,443	1,503,368	2,101,628	3,476,608
Population Change	-	486,925	598,260	1,387,444
Ave. Annual Increase	-	40,577	59,826	57,810
Percentage increase	-	48	40	66
Annual Rate of Growth	-	3.3	3.4	2.1

Source: LISGIS 2008

If the population growth rate is maintained, the population of Liberia is expected to double within 34 years, which is by 2042. With the expected doubling of the population there will be an increase in the demand of fuel wood (charcoal), timber, local construction materials, and other non-timber forest product. As a majority of farmers practice shifting cultivation, there will also be an increase in the demand for farmland which will inadvertently increase the destruction of the forest. Increase hunting of wildlife for food and commercial purposes will lead to a decrease in the number of biodiversity and in the extreme cases lead to the extinction of already endangered animal species including a few species endemic to Liberia.

The number of persons per household size is an important index for planning in Liberia since more people can be found in such social arrangements. The main household size declined from 6.2 in 1984 to 5.1 in 2008. It implies that there are now fewer people living and eating together than before due partly to urbanization and modernization. This also mean that many people are moving from rural to urban sectors in the country (LISGIS 2008).

b. Population distribution

The population of Liberia is not evenly distributed among the fifteen counties. Since 1984, the population count favors the five big counties in Liberia: Montserrado, Nimba, Bong, Lofa, Grand Bassa and Margibi. Together these counties account for about 75.2% of the population count (LISGIS, 2008). Out of the six counties, three counties: Montserrado, Nimba and Bong account for up to 56% of the population.

Table number 5: County population, growth rate and average household size

County	Pop 1984	Pop 2008	Annual Growth (%) 1984-2008	Ave. Household size in 1984	Ave. Household Size in 2008
Bomi	66,420	82,036	0.9	4.0	3.4
Bong	255,813	328,919	1.0	4.9	4.7
Gbarpolu	48,399	83,758	2.3	4.6	5.6
Grand Bassa	159,648	224,839	1.4	4.0	5.4
Grand Cape Mount	79,322	129,055	2.0	4.5	4.8
Grand Gedeh	63,028	126,146	2.9	5.2	7.6
Grand Kru	62,791	57,106	-0.4	4.9	5.3
Lofa	199,242	270,114	1.3	5.2	4.4
Margibi	151,792	199,689	1.1	4.5	4.8
Maryland	69,267	136,404	2.8	5.8	7.8
Montserrado	491,078	1,144,806	3.5	5.4	4.7
Nimba	313,050	468,088	1.7	5.8	5.9

RiverCess	37,849	65,862	2.3	5.9	4.5
River Gee	39,782	67,318	2.2	5.4	7.0
Sinoe	64,147	104,932	2.1	6.6	5.8

Source: LISGIS 2008

c. Forestry Production & Revenue

Commercial forestry has differed from the past in many ways. The Government has committed itself to what it calls 'balance competitive' returns for the investors with the need for sustained revenue to benefit the people of the country. Revenue received by Government has been used for the construction of new roads, building hospitals and schools, etc.

The table below gives a projection made by the Government of Liberia and the IMF for the forestry sector for the period shown.

Table 6: Production and revenue figures for the forest sector

Production & Revenue	2007-08	2008-09	2009-10	2010-11	Total
Production (in '000 M3)	44	809	1,055	1,419	3,329
Revenue (in '000 USD)	526	24,283	36,683	46110	107,607

Source: Central Bank of Liberia, 2008

As a result of the years of civil strife, there is limited data related to the forestry sector; as these data were lost or destroyed during the conflict and record of forest activities during the conflict years were not collected or accurate. In the few instances that data are available prior to 2006, it is at best scanty and present only a part of the full picture. However, with the return to civil rule, the government has identified data compilation as a key part to aid in its effective response to issues arising now and in the future.

Table 7: Base-year (2005) across sectors (constant 2005 million USD)

Categories of Investment Entity	Sources of I&FF Funds		Sustainable Management			Forest			Enrichment of degraded forest			Restoration of existing			Afforestation & Reforestation			Total I&FF	
			IF	FF	Total	IF	FF	Total	IF	FF	Total	IF	FF	Total	Total IF	Total FF			
Household	Domestic	Equity & debt	000	000	000	000	000	000	0000	000	000	000	000	000	000				
	Total household fund		1.3536	0.9024	2.256	0.1606	0.0534	0.214	0.0832	0.0208	0.104	0.27	0.18	0.45					
Corporation	Domestic	Domestic equity (including external cash flow)	000	000	000	000	000	000	000	000	000	000	000	000					
		Domestic borrowing (bonds & loans)	000	000	000	000	000	000	000	000	000	000	000	000					
		Total Domestic Source		000	000	000	000	000	000	000	000	000	000	000	000				
		Foreign	Foreign Direct Investment (FDI)	000	000	000	000	000	000	000	000	000	000	000	000				
	Foreign borrowing (loans)		000	000	000	000	000	000	000	000	000	000	000	000					
	Foreign Aid (ODA)		000	000	000	000	000	000	000	000	000	000	000	000					
	Total Foreign sources		000	000	000	000	000	000	000	000	000	000	000	000					
	Total Corporation funds		2.3688	1.5792	3.948	0.28105	0.09345	0.3745	0.1456	0.0364	0.0819	0.212625	0.14175	0.354375					
Government	Domestic	Domestic funds(budgetary)	000	000	000	000	000	000	000	000	000	000	000						
	Foreign	Foreign borrowing (loans)	000	000	000	000	000	000	000	000	000	000	000	000					
		Bilateral foreign aid (bilateral ODA)	000	000	000	000	000	000	000	000	000	000	000	000					
		Multilateral Foreign aid (multilateral ODA)	000	000	000	000	000	000	000	000	000	000	000	000					
		Total foreign sources		000	000	000	000	000	000	000	000	000	000	000	000				
Total Government Funds		3.0456	2.0304	5.076	0.36135	0.12015	0.4815	0.1872	0.0468	0.234	0.6075	0.405	1.0125	4.203	2.601				
Total			6.768	4.512	11.28	0.803	0.267	1.07	0.416	0.104	0.52	1.35	0.9	2.25	9.34	5.78			

Source: Authors' calculations

2.2.4 Baseline Scenario

The baseline scenario shows the trend expected from 2005 to 2030, in the absence of additional investment to address changes related to the climate, based on historical data.

Table 8: Baseline scenario of I&FF and O&M disaggregated by years (in million US\$)

Year	Sustainable Forest Management			Enrichment of degraded forest			Restoration of Existing Plantation			Afforestation and Reforestation			Total
	IF	FF	O&M	IF	FF	O&M	IF	FF	O&M	IF	FF	O&M	
2005	6.768	4.512	2.82	0.8025	0.267	0.27	0.416	0.104	0.13	1.35	0.9	0.56	18.9
2006	6.666	4.444	2.8	0.795	0.265	0.26	0.408	0.102	0.126	1.332	0.888	0.55	18.64
2007	6.57	4.38	2.74	0.78	0.26	0.26	0.4	0.1	0.125	1.308	0.872	0.55	18.35
2008	6.468	4.312	2.7	0.765	0.255	0.25	0.392	0.09	0.123	1.29	0.86	0.54	18.10
2009	6.372	4.248	2.66	0.7575	0.252	0.25	0.384	0.121	0.121	1.272	0.848	0.53	17.80
2010	6.276	4.184	2.61	0.7425	0.247	0.25	0.384	0.12	0.120	1.254	0.836	0.52	17.52
2011	6.18	4.12	2.58	0.735	0.245	0.24	0.376	0.118	0.118	1.236	0.824	0.51	17.26
2012	6.09	4.06	2.54	0.72	0.24	0.24	0.368	0.116	0.116	1.218	0.812	0.51	17.01
2013	5.994	3.996	2.5	0.7125	0.238	0.24	0.368	0.114	0.114	1.194	0.796	0.50	16.744
2014	5.91	3.94	2.5	0.705	0.235	0.23	0.36	0.113	0.113	1.182	0.788	0.49	16.543
2015	5.82	3.88	2.42	0.69	0.23	0.23	0.352	0.111	0.111	1.164	0.776	0.48	16.241
2016	5.76	3.84	2.4	0.6825	0.227	0.23	0.352	0.11	0.110	1.146	0.764	0.48	16.10
2017	5.646	3.764	2.35	0.6675	0.222	0.22	0.344	0.107	0.107	1.128	0.752	0.47	15.757
2018	5.562	3.708	2.32	0.66	0.22	0.22	0.336	0.106	0.106	1.11	0.74	0.46	15.526
2019	5.478	3.652	2.28	0.6525	0.217	0.21	0.336	0.104	0.104	1.092	0.728	0.45	15.284
2020	5.394	3.596	2.25	0.6375	0.212	0.21	0.328	0.103	0.103	1.08	0.72	0.44	15.053
2021	5.316	3.544	2.21	0.63	0.21	0.21	0.32	0.101	0.101	1.062	0.708	0.44	14.831
2022	5.238	3.492	2.18	0.6225	0.207	0.21	0.312	0.099	0.099	1.044	0.696	0.44	14.619
2023	5.16	3.44	2.15	0.615	0.205	0.20	0.312	0.098	0.098	1.032	0.688	0.43	14.408
2024	5.076	3.384	2.12	0.6	0.2	0.20	0.304	0.097	0.097	1.014	0.676	0.42	14.167
2025	4.998	3.332	2.08	0.5925	0.198	0.19	0.304	0.095	0.095	0.996	0.664	0.42	13.945
2026	4.926	3.284	2.05	0.585	0.195	0.19	0.296	0.094	0.094	0.984	0.656	0.41	13.744
2027	4.854	3.236	2.02	0.5775	0.192	0.19	0.296	0.092	0.092	0.966	0.644	0.40	13.542
2028	4.782	3.188	1.99	0.57	0.19	0.18	0.288	0.091	0.091	0.954	0.636	0.39	13.331
2029	4.71	3.14	1.96	0.5625	0.187	0.18	0.288	0.089	0.089	0.942	0.628	0.39	13.149
2030	4.638	3.092	1.93	0.5475	0.18	0.18	0.28	0.088	0.088	0.924	0.616	0.38	12.928
Total	146.6	97.76	61.1	17.42	5.81	5.81	8.95	2.23	2.79	29.3	19.51	12.2	409.4

In the baseline scenario, calculation is done based on the cost per hectare of each activity, as stated in the reference of calculation with data extrapolated based on constant 2005 (for sustainable forest management) and 2006 (for all other activity) value in the sector.

Table 9: Baseline scenario of I&FF and O&M disaggregated by investment entity (In million US\$)

Investment Entity	Sustainable Forest Management			Enrichment of degraded forest			Restoration of Existing Plantation			Afforestation and Reforestation			Total
	IF	FF	O&M	IF	FF	O&M	IF	FF	O&M	IF	FF	O&M	
Corporation	51.32	34.22	21.38	6.09	2.033	2.03	3.128	0.782	0.98	10.24	6.828	4.27	143.31
Government	65.99	43.99	27.49	7.837	2.612	2.61	4.024	1.006	1.26	13.16	8.776	5.48	184.24
Household	29.32	19.55	12.21	3.48	1.16	1.16	1.784	0.446	0.55	5.85	3.9	2.45	81.86
Total	146.6	97.76	61.1	17.42	5.81	5.81	8.95	2.23	2.79	29.2	19.51	12.2	409.4

In Liberia, the Government is the major investor in the forestry sector, followed by businesses and household, as a result, Government received 45% of total investment and 35% for corporation and the other 20% goes to household.

Figure 1: Investments by investment entities

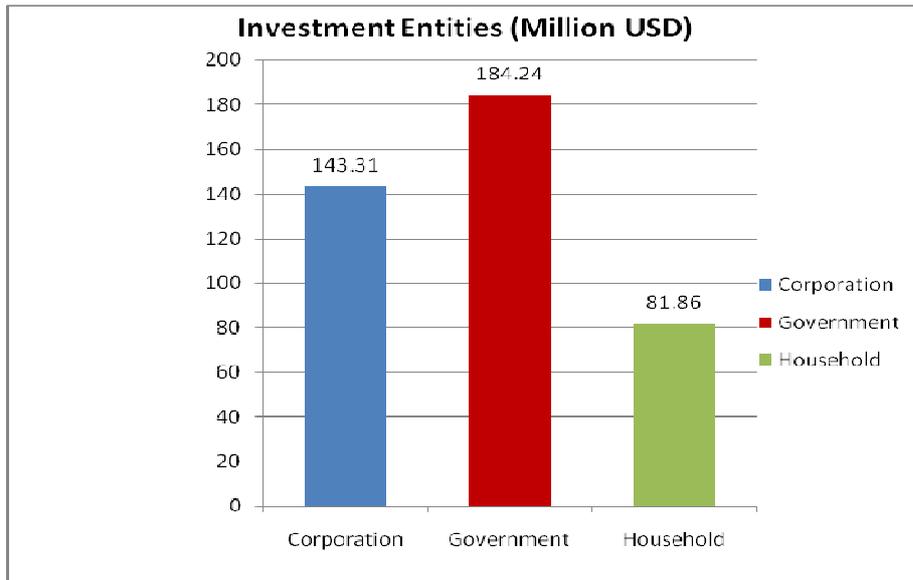


Figure 2: Investment entities baseline scenarios in percentages

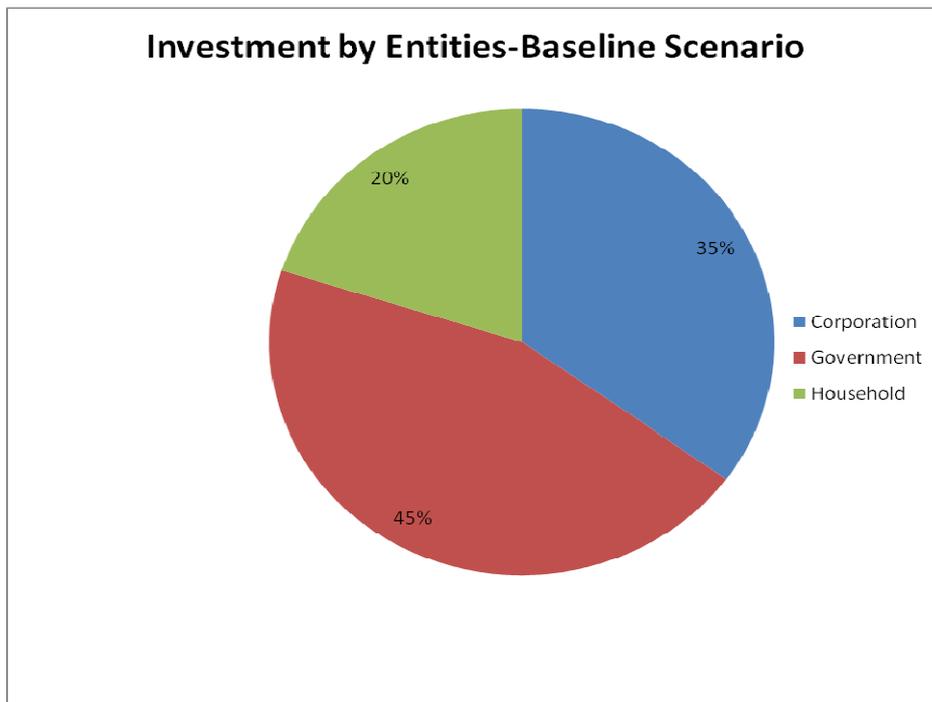
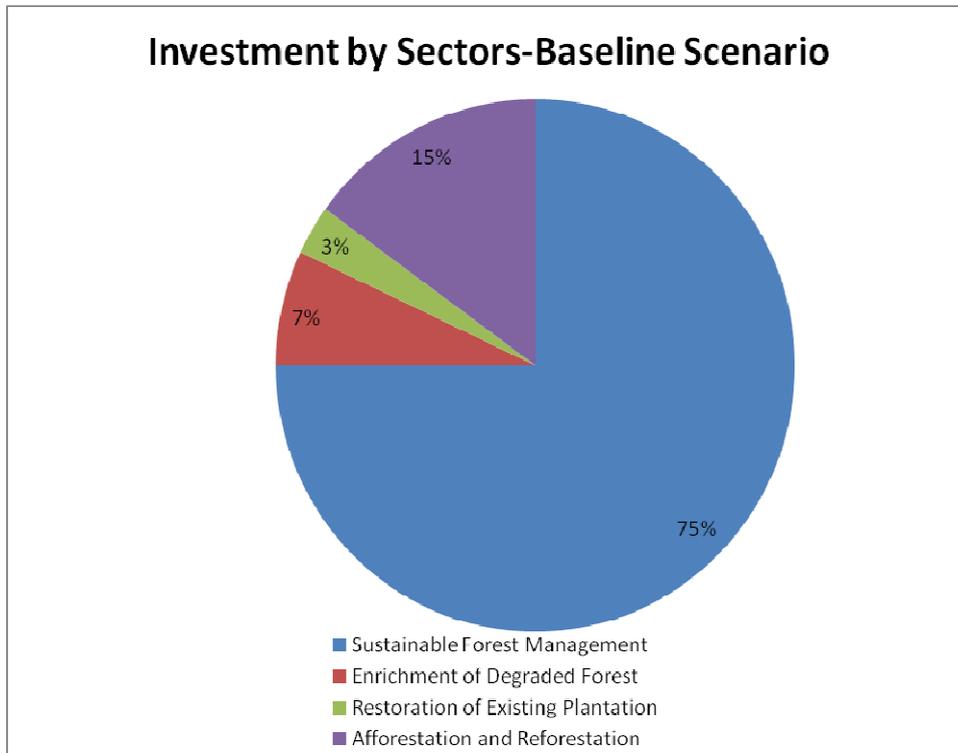


Figure 3: Percent investment by sector



2.2.5 Mitigation Scenario

Liberia has a vast expanse of tropical rainforest, which put it in a good position to participate in activities related to carbon capture and storage. Currently, the Government of Liberia through the Forestry Development Authority has submitted Liberia REDD+ readiness proposal (R-PP) to the Forest Carbon Partnership Facility (FCPF) of the World Bank. The R-PP is supposed to show the country’s readiness to take part in REDD+. REDD+ is making significant progress in the international climate change negotiations and promises to be the best mitigation option for Liberia to contribute to global efforts to reduce GHGs while at the same time deriving financial benefits and other co-benefits like bio-diversity conservation.

Under a more regulated and well governed forest governance structure, REDD+ could drive the mitigation and conservation agenda in the country. This could significantly reduce illegal logging activities in the country, scaling down to only those done through the Forest Reform Law leading to Sustainable Forest Management (SFM). A good SFM program could also boost mitigation by promoting “permanence” and avoiding “leakages” within designated forests set aside as carbon sinks.

Table 10: Mitigation Scenario of I&FF and O &M disaggregated by year (in million US\$)

Year	Sustainable Forest Management			Enrichment of degraded forest			Restoration of Existing Plantation			Afforestation and Reforestation			Total
	IF	FF	O&M	IF	FF	O&M	IF	FF	O&M	IF	FF	O&M	
2005	6.768	4.512	2.82	0.8025	0.2675	0.27	0.416	0.104	0.13	1.35	0.9	0.56	19.16
2006	6.87	4.58	2.86	0.81	0.27	0.27	0.416	0.104	0.13	1.368	0.912	0.57	19.47
2007	6.972	4.648	2.91	0.825	0.275	0.28	0.424	0.106	0.13	1.392	0.928	0.58	19.21
2008	7.074	4.716	2.95	0.84	0.28	0.28	0.432	0.108	0.13	1.41	0.94	0.59	20.04
2009	7.182	4.788	2.99	0.855	0.285	0.28	0.44	0.11	0.14	1.428	0.952	0.59	20.35
2010	7.29	4.86	3.04	0.8625	0.2875	0.29	0.448	0.112	0.14	1.452	0.968	0.6	20.64
2011	7.398	4.932	3.08	0.8775	0.2925	0.29	0.448	0.112	0.14	1.476	0.984	0.61	20.94
2012	7.512	5.008	3.13	0.885	0.295	0.29	0.456	0.114	0.14	1.494	0.996	0.62	21.28
2013	7.62	5.08	3.17	0.9075	0.3025	0.3	0.464	0.116	0.15	1.524	1.016	0.63	21.59
2014	7.734	5.156	3.22	0.915	0.305	0.31	0.472	0.118	0.15	1.542	1.028	0.64	21.91
2015	7.854	5.236	3.27	0.93	0.31	0.31	0.472	0.118	0.15	1.566	1.044	0.65	22.27
2016	7.98	5.32	3.32	0.945	0.315	0.32	0.488	0.122	0.15	1.59	1.06	0.66	22.59
2017	8.094	5.396	3.37	0.96	0.32	0.32	0.496	0.124	0.15	1.614	1.076	0.67	22.94
2018	8.214	5.476	3.42	0.975	0.325	0.33	0.504	0.126	0.16	1.638	1.092	0.68	23.26
2019	8.334	5.556	3.47	0.99	0.33	0.33	0.504	0.126	0.16	1.662	1.108	0.69	23.62
2020	8.46	5.64	3.53	1.005	0.335	0.34	0.512	0.128	0.16	1.686	1.124	0.7	23.95
2021	8.586	5.724	3.57	1.02	0.34	0.34	0.52	0.13	0.16	1.71	1.14	0.71	24.33
2022	8.718	5.812	3.63	1.035	0.345	0.35	0.528	0.132	0.17	1.734	1.156	0.72	24.69
2023	8.844	5.896	3.68	1.05	0.35	0.35	0.536	0.134	0.17	1.764	1.176	0.74	25.07
2024	8.982	5.988	3.74	1.065	0.355	0.36	0.544	0.136	0.17	1.794	1.196	0.74	25.43
2025	9.12	6.08	3.79	1.08	0.36	0.36	0.552	0.138	0.17	1.818	1.212	0.75	25.84
2026	9.252	6.168	3.86	1.1025	0.3675	0.37	0.56	0.14	0.18	1.848	1.232	0.76	26.22
2027	9.39	6.26	3.91	1.1175	0.3725	0.37	0.576	0.144	0.18	1.872	1.248	0.78	26.62
2028	9.534	6.356	3.97	1.1325	0.3775	0.38	0.584	0.146	0.18	1.902	1.268	0.79	27.01
2029	9.678	6.452	4.03	1.1475	0.3825	0.38	0.592	0.148	0.18	1.932	1.288	0.8	27.44
2030	9.822	6.548	4.09	1.17	0.39	0.39	0.6	0.15	0.19	1.962	1.308	0.82	18.9
Total	213.28	142.2	88.88	25.305	8.15	8.44	12.55	3.138	4.06	42.53	28.35	17.73	594.6

With the expected increase in population, there is a corresponding increase in the costs of the mitigative activities to address climate change. A 1.5% growth rate was used to determine the cost of the increase.

Table 11: Mitigation scenario of I&FF and O&M disaggregated by investment entities (million US\$)

Investment Entity	Sustainable Forest Management			Enrichment of degraded forest			Restoration of Existing Plantation			Afforestation and Reforestation			Total
	IF	FF	O&M	IF	FF	O&M	IF	FF	O&M	IF	FF	O&M	
Corporation	74.65	49.77	31.11	8.79	2.92	2.96	4.39	1.09	1.42	14.90	9.93	6.21	208.12
Government	95.97	63.98	39.99	11.29	3.76	3.8	5.64	1.41	1.83	19.13	12.75	7.98	267.57
Household	42.65	28.43	17.78	5.01	1.67	1.69	2.51	0.62	0.81	8.50	5.67	3.55	118.93
Total	213.28	142.2	88.88	25.09	8.15	8.44	12.55	3.138	4.06	42.53	28.35	17.73	594.6

Figure 4: Baselines vs mitigation scenarios

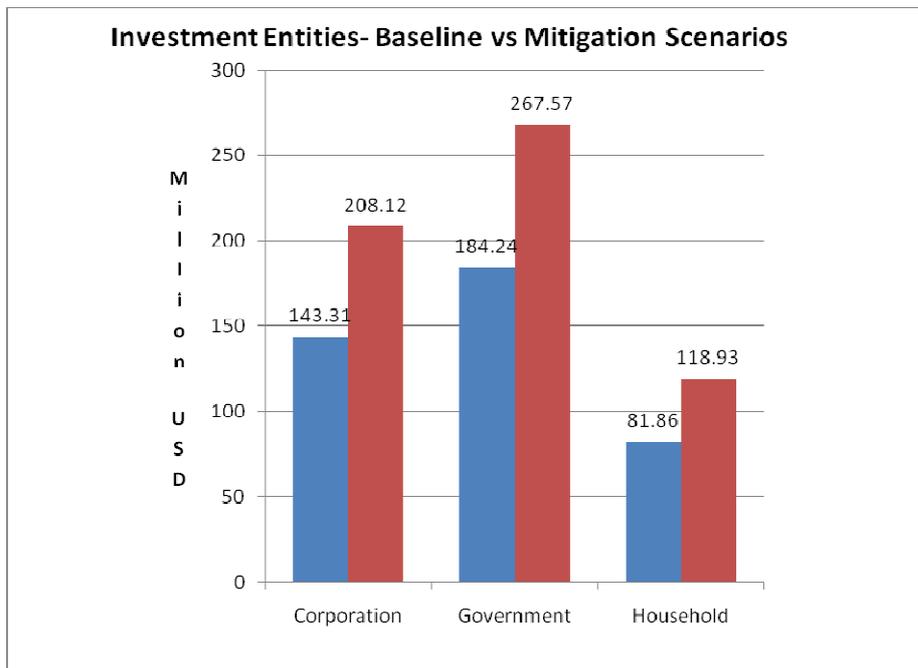


Figure 4 compares the baseline and mitigation scenarios by sector; clearly more investment will be made by the government in the forest sector, under a future mitigation scenario, investments will have to be scaled up also by the other sectors analysed in this report. Corporation is expected to have to make the next highest investments after the government.

Figure 5: Graph showing cost of mitigation by investment entities

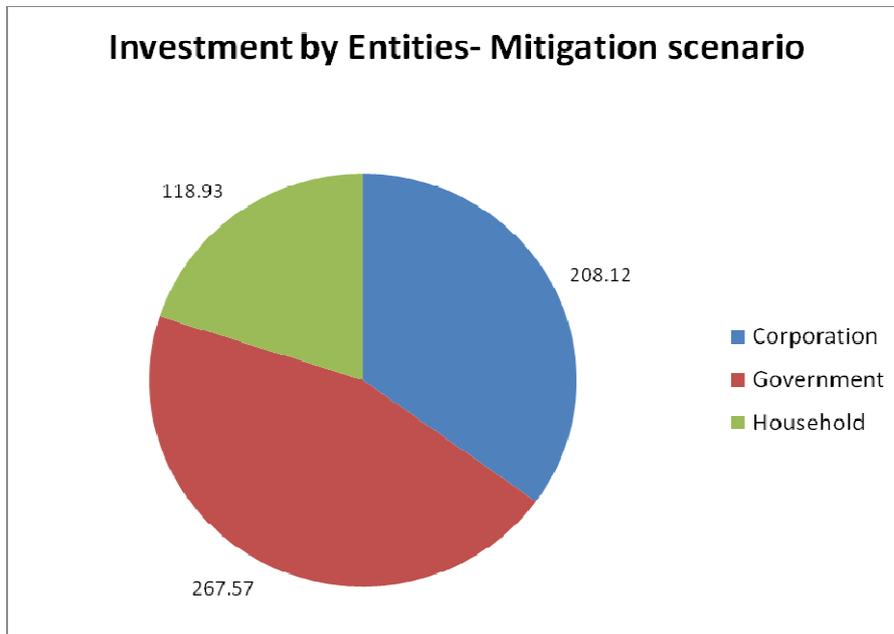
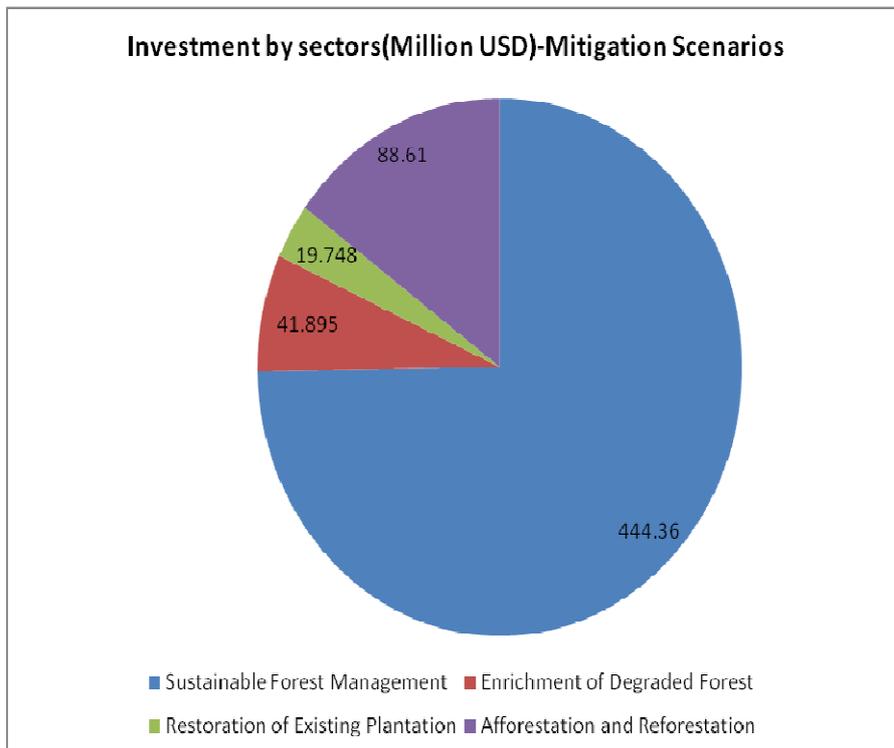


Figure 6: Cost of mitigation for the forest activities



SFM based on the “3C” policy of the Reform Law, 2006 is expected to attract the bulk of investments because it is a national level policy, regulatory as well as legal instrument that involves as well, site level sub-activities: inventory of forest resources, data management, monitoring and reporting.

3. Results

3.1 Changes of I&FF and O&M

The changes below represent the differences when comparing the baseline scenario with the mitigation scenario in all sectors and entities. While there is a noticeable steady rise in the mitigation scenario with cost rising along the years and peaking in 2030, there is most likely expected to be a peak in cost between 2017 and 2025 when most of the activities related to sequestration will be providing their fullest input and carbon credits could be at their highest. After this period however, there could be a drop in prices post 2025 in the global carbon market due to oversaturation of the market with credits. This projection cannot also predict the exact outcome of the post 2012 agreement on REDD or the Kyoto Protocol, which will be the main factor in determining the cost and value of carbon sequestration projects.

Table 12: Annual changes in I&FF and O&M disaggregated by year (million US\$)

Year	Sustainable Forest Management		Enrichment of degraded forest		Restoration of Existing Plantation		Afforestation and Reforestation		Total
	ΔI&FF	ΔO&M	ΔI&FF	ΔO&M	ΔI&FF	ΔO&M	ΔI&FF	ΔO&M	
2005	-	-	-	-	-	-	-	-	
2006	0.34	0.06	0.02	0.01	0.01	0.004	0.07	0.02	0.534
2007	0.67	0.17	0.06	0.02	0.03	0.008	0.13	0.03	1.118
2008	1.01	0.25	0.1	0.03	0.058	0.011	0.20	0.05	1.709
2009	1.35	0.33	0.13	0.03	0.045	0.015	0.27	0.07	2.24
2010	1.69	0.43	0.16	0.04	0.056	0.019	0.34	0.08	2.815
2011	2.03	0.5	0.19	0.05	0.066	0.023	0.40	0.10	3.359
2012	2.37	0.59	0.22	0.05	0.086	0.027	0.47	0.11	3.923
2013	2.72	0.67	0.26	0.06	0.098	0.031	0.54	0.14	4.519
2014	3.04	0.72	0.28	0.08	0.117	0.035	0.61	0.15	5.032
2015	3.39	0.85	0.32	0.08	0.127	0.038	0.68	0.17	5.655
2016	3.7	0.92	0.35	0.09	0.148	0.043	0.74	0.18	6.171
2017	4.08	1.02	0.39	0.1	0.169	0.047	0.81	0.20	6.816
2018	4.42	1.1	0.42	0.11	0.188	0.05	0.88	0.22	7.388
2019	4.76	1.19	0.45	0.12	0.19	0.05	0.95	0.24	7.95
2020	5.11	1.28	0.49	0.13	0.209	0.06	1.02	0.25	8.549
2021	5.45	1.36	0.52	0.13	0.229	0.06	1.09	0.27	9.109
2022	5.8	1.45	0.55	0.14	0.249	0.07	1.16	0.29	9.709
2023	6.15	1.53	0.58	0.15	0.26	0.07	1.23	0.31	10.28
2024	6.51	1.62	0.62	0.16	0.279	0.07	1.29	0.32	10.869
2025	6.87	1.71	0.65	0.17	0.291	0.08	1.37	0.34	11.481
2026	7.21	1.81	0.69	0.18	0.31	0.08	1.44	0.36	12.08
2027	7.56	1.89	0.72	0.18	0.332	0.09	1.51	0.38	12.662
2028	7.92	1.98	0.75	0.2	0.351	0.09	1.58	0.39	13.261
2029	8.28	2.07	0.78	0.2	0.363	0.09	1.65	0.41	13.843
2030	8.64	2.16	0.83	0.21	0.382	0.09	1.72	0.43	15.362
Total	111.1	27.8	10.5	2.72	4.64	1.26	22.16	5.54	186

Table 13: Change in I &FF and O&M disaggregated by Investment Entities (million US\$)

Investment Entity	Sustainable Forest Management		Enrichment of degraded forest		Restoration of Existing Plantation		Afforestation and Reforestation		Total
	ΔI&FF	ΔO&M	ΔI&FF	ΔO&M	ΔI&FF	ΔO&M	ΔI&FF	ΔO&M	
Corporation	38.885	9.73	3.675	0.952	1.624	0.44	7.76	1.94	65.006
Government	49.995	12.51	4.725	1.224	2.088	0.57	9.97	2.50	83.582
Household	22.22	5.56	2.1	0.544	0.928	0.25	4.43	1.10	37.132
Total	111.14	27.8	10.5	2.72	4.64	1.26	22.16	5.54	186

Figure 7: Changes in sectoral investment due to climate change

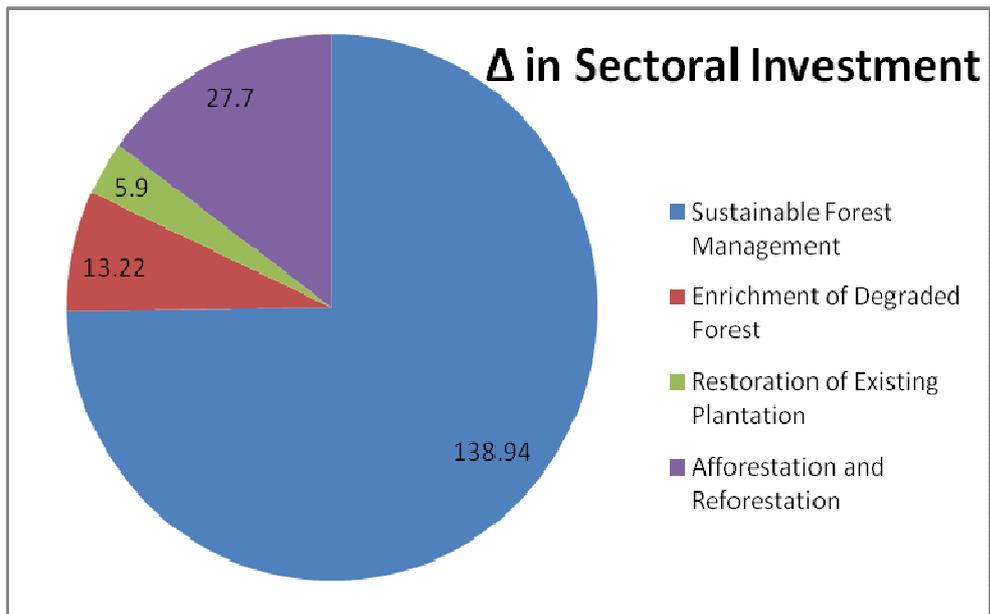
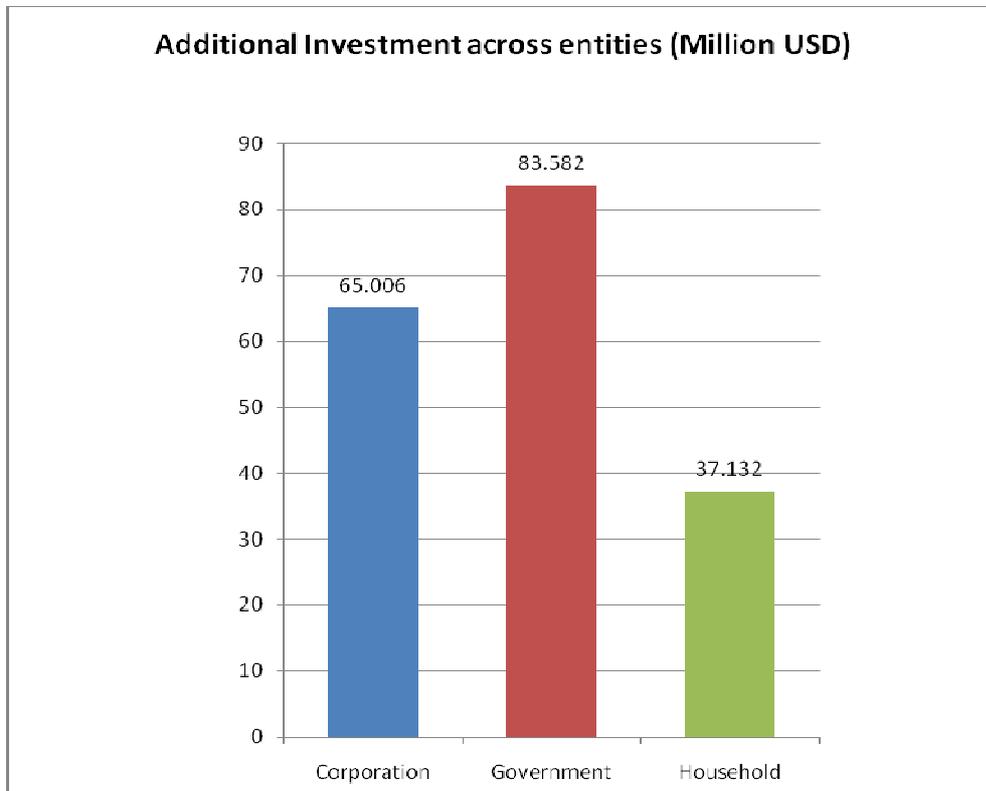


Figure 7 depicts the actual changes in investments that is additional investment required for doing these same activities in the climate change scenario from now until 2030. As expected sustainable forest management will take up to 75% of the additional investment; Enrichment of degraded forest 7%; Restoration of existing plantation 3%; and afforestation and reforestation 15%.

Figure 8: Change in investment across entities



With the government accounting for 45% of the new investment across sectors, the private sector with 35% of new investment will play an equally crucial role in this process. Households, with 20% of new investment will contribute the least in this process. However, with the increasing recognition of the rights of local communities and the prominence given to community rights in the Reform Law it is expected that the proportion of investment that will be attributed to household will rise very significantly. Households are involved in forest activities, but these are often not fully captured in statistical data by LISGIS, CBL or the Finance Ministry, this could account for the low figures being projected.

In Addition, according to the International Energy Agency (IEA), approximately 40% of the global investment needed to transform economies will need to come from households, 40% from businesses, and just 20% from government. In this context, if we are to generate volumes of finance at the scale required limited international public funds must be used to catalyze larger scale private and household investment.

With the peaking of investments in the economy expected around 2015 to 2025, there is expected to be an increase in activities in other extractives industries that will negatively impact gains being made in the forestry sector. Hence, there needs to be an upping of mitigative activities that will reduce the negative impact these activities will have on the forestry sector

and the environment, with emphasis been placed on monitoring of these activities to avoid leakages.

3.2 Policy Implications

The passage into law of the Forest Law in 2006 marked an important milestone in genuine forest reform in the country. Even before the complete breakdown of civil rule, it was clear that the forest sector needed some major reforms and even though there are still major issues to do with land and forest tenure and forest governance. The Forest Law gives a basis for those reforms provided the Law is followed with equal considerations given to community and conservation forestry as well as commercial.

The Law also calls for the establishment of refugia within commercial forest plantations. This is to conserve plant and animal species as well as habitat which are deemed to be of high conservation value. The reform law based on the 3C is the best mitigation option for the forest sector among all activities because it has short as well as long term implications for all sectors and that is why it will continue to attract much more investments.

The nation-wide Strategic Environmental Assessment (SEA), 2010 that was done for the Forest Reform Law revealed massive appreciation of the Law in all regions of the country. The SEA also identified capacity constraint in the forest sector. According to this study, there was a general recognition among participants of the need to increase capacity for all national stakeholders involved in the forest sector. The level of external experts' involvement in all matters suggests limited internal capacity. This underscores the need for capacity building to ensure that stakeholder outlook for the forest sector is an achievable target. Capacity building, the SEA predicts will ensure national ownership of sustainable forest management processes in Liberia and guarantee practicality of achieving this vision.

There is need for an increase in the training of staff that are responsible for the monitoring, verification and implementation of the law. Government in partnership with private companies and local communities can invest in programs that add value to the production of non-timber forest products, which will diversify the income of forest dependent communities and relieve the pressure on the forest as their sole source of income.

In partnership with logging companies and the local communities, government should 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 at regular intervals invite international rights and environmental groups (Amnesty International, Human Rights Watch, Greenpeace, etc) to review progress being made on the maintenance of high environmental and social standards and the distribution of the social funds from commercial forestry. These exercises could also verify actions to promote fair play, transparency, accountability and investments in the sector. In line with the independent findings of these bodies, punitive actions can be taken on companies and individuals that violate the Law.

In conclusion, some important activities that are needed for the successful implementation of the findings from this assessment are:

- Consultation with multi-stakeholder groups, taking into consideration the role each can play in influencing investment policies in the forest sector;
- Public participation fora that involves traditional rulers and with the full participation of local communities they represent; this would lead to policies that are culturally sensitive and respect the values and traditions of local communities;
- Conduct market assessment to determine other non-timber value of the forest;
- Revamping of relevant educational institutions to meet current challenges in the forestry sector and update of the forest curricula to meet current national needs as well as international best practice in the sector;
- Strengthening of inter-sectoral relationships between government agencies and NGOs that are engaged in forest conservation activity so as to avoid duplication of functions and wastage of resources;
- Enhancement of carbon sinks through good policies, governance and constructive cultural practices, including the involvement of local communities in the crafting of forest management plan, placing management and MRV in the hands of the forest communities;
- Publicize the procedures for forest certification;
- Train forest dwellers so that they become custodians of the forest, with full knowledge of sustainable harvesting of forest resources and alternative livelihood activities;
- Strengthen and intensify reforestation programs, making sure that logging companies reforest areas in which they operate and help communities establish community forests in accordance with the “3C” principles;
- Increase the rotational period for logging operations, from 25 years to 50 years for proper regeneration of logged forests, which will allow forests to fully regenerate before another cycle of logging;
- Effective coordination and involvement of policy makers from the highest level of government.

During the 2-day National Inter-Ministerial Dialogue held in August, 2011, to present to stakeholders the findings of the assessment of I&FF required to address climate change and to solicit inputs, participants made the following recommendations:

- Effective implementation of forest laws and regulations;
- Training and maintenance of adequate man power for forest monitoring;
- Conduct adequate awareness on forest policy;
- Harmonize Land Use Policy;
- Provide logistical support for forest management at the local level;
- Prevent the destruction of habitat through enforcement of rules and regulations;
- Intensify public awareness;
- Create an alternative livelihood opportunity for forest dwellers;
- Develop and introduce appropriate technology;

- There should be a clear defined penalties for conservation laws violators and sufficient education of the laws should be made;
- Campaigns and incentives to attract private investments in the forest sector;
- Promotion of payment for ecosystem services (PES) schemes in the forest sector.

3.3 Key uncertainties and methodological limitations

While the methodological guidelines for I&FF assessment were very useful, the limited amount of data in the forestry sector meant that a lot of the data were extrapolated based on professional insights. Though the team did its best to gather whatever data was available, the years of civil conflict, coupled with the UN ban on the forestry sector meant that data were at best limited, scanty and sometimes totally absent for some years.

Without certainty of the outcome of negotiations on the post 2012 climate regime, it is virtually impossible to determine the future of REDD+, which is fast becoming Liberia's options for forestry mitigation. Additionally, there is an urgent need for a software system that is exclusively created for the I&FF process to simplify the projections in the assessment.

4. References

- Bakarr, M., Bailey, B., Byler, D., Ham, R., Olivieri, S. & Omland, M. Eds., From the Forest to the Sea: Biodiversity Connections from Guinea to Togo. Washington, D.C.: Conservation International., 2001.
- Bayol, N. and J.-F. Chevalier. 2004. Current State of the Forest Cover in Liberia: Forest Information Critical to Decision Making. Final report to the World Bank. Forêt Ressources Management. Manguio, France.
- Blaser, J., and B. V. Dagbe. 2008: Assessment of the Current Status of the Forest Sector in Liberia and Identification of Priority Needs for Development Assistance through ITTO Project Activities. Monrovia, Liberia: ITTO.
- Center for Sustainable Energy Technology (CSET, 2004) Monrovia.
- FDA. 2007. Annual Report. January 1-December 31, 2008. Monrovia.
- Liberia: Forest Development Authority.
- Food and Agriculture Organization (FAO). 2006. Global Forest Resources Assessment 2005 (Food and Agriculture Organization of the United Nations, Rome) FAO Forestry Paper 147.
- Koffa S. 2009: Evaluating the Investment and Financial Flows of the Forestry Sector Issue in Climate Change Mitigation in Liberia. A report submitted to UNDP. 16 pp.
- Liberia Institute for Statistics and Geological Information Services, 2008.
- Strategic Environmental Assessment of the Forestry Sector in Liberia: the International Bank for Reconstruction and Development/The World Bank, 2010.

The work under this project was made possible through the generous donations from the Government of Norway, the Government of Finland, the Government of Switzerland as well as the UN Foundation and UNDP.