



Liberia REDD+ Strategy Options

Technical Annex D

Final Report

Consulting Services Contract For the Development of A National REDD+ Strategy for Liberia

November 2016

Technical Annex A – Draft REDD+ Strategy

Technical Annex B – REDD+ Roadmap

Technical Annex C – Forest cover and land use analysis

Technical Annex D – REDD+ Strategy Options

Technical Annex E – Cost-benefit analysis

Technical Annex F – Policy, Legal and Institutional Framework

Technical Annex G – Consultation Report

This Technical Annex is part of a set of reports produced by LTS & NIRAS as part of the 'Consulting Services Contract For the Development of A National REDD+ Strategy for Liberia' commissioned by the Forestry Development Authority as part of its Readiness Preparation Proposal (R-PP) Implementation Grant from the Forest Carbon Partnership Facility.

The complete set of reports can be found here:

<http://www.ltsi.co.uk/projects/liberia-national-redd-strategy-consultation/>



LTS International Limited

Pentlands Science Park, Bush Loan
Penicuik, EH26 0PL
United Kingdom

Tel. +44 (0)131 440 5500

Web. www.ltsi.co.uk

Fax. +44 (0)131 440 5501

Twitter. @LTS_Int

Email.
mail@ltsi.co.uk



Registered in Scotland Number 100833



NIRAS A/S

Sortemosevej 19
DK-3450
Allerød, Denmark

Executive Summary

Liberia is participating in a global initiative to address climate change by reducing emissions from deforestation and forest degradation (REDD+) and hopes to benefit from results-based payments for REDD+. An evidence-based and inclusive national REDD+ strategy allows participating countries to set out how they will achieve a reduction in emissions from forest degradation and loss. This and other preparations for REDD+ in Liberia are guided by a process of 'REDD+ Readiness' that is supported and assessed by the Forest Carbon Partnership Facility, administered by The World Bank.

This document presents preliminary work which provides the basis for Liberia's REDD+ strategy. It contains: i) an assessment of land use and forest cover which indicates the main causes of forest loss; ii) strategic priorities and options for addressing the main drivers of deforestation and; iii) a cost-benefit analysis of the strategy options and analysis of the barriers to implementation.

National data on land use, deforestation rates and the causes of deforestation are limited but the evidence on some key points is clear enough to shape priorities for the REDD+ strategy:

- An estimated 20% of Liberia's forested area was lost between 2000 and 2014.
- The principal cause of this was small-scale commercial and subsistence land uses: chainsaw milling of timber (pit sawing), charcoal production and shifting agriculture.
- The threat to forest of these land uses will increase dramatically as population and consumption increases (projected doubling of population by 2050) and the amount of land available to communities is roughly halved as large tracts have been designated as concessions.
- Approximately 37% of all forested land in Liberia is contained within commercial concessions. Concessions for palm oil are likely to be the most significant source of emissions from deforestation in the short term. More than 150,000 ha of land is likely be cleared for plantations in the next decade. The threats are substantial and include mining and other land uses included in the analysis.
- The opportunities for conserving the carbon stocks in concessions are substantial. The proposed network of Protected Areas could, if established and managed, conserve an additional 15-30% of the total forested area. Forestry (logging) concessions cover almost 30% of the total forest area. If

managed sustainably, as national law intends, much of the carbon held by this forest will be retained. Together, the land designated as Protected Areas and as Forest Management Contracts contains approximately 50% of the most dense and most biodiverse forest.

- Further opportunities lie in commercial concessions. For example more than 40% of the land in the palm oil concessions is high carbon stock and high conservation value forest which should be conserved and not cleared, if international standards are followed.

The strategic priorities for REDD+ that emerge from this evidence are:

1. Reduce emissions from deforestation and degradation by supporting the sustainable use of forest resources by communities, addressing shifting agriculture, charcoal production, pit sawing in particular.
2. Sustainably manage commercial forestry, to reduce impact of logging in areas conceded (or proposed) as Forest Management Contracts, Community Forest Management Agreements or other designations where commercial forestry may occur.
3. Conserve forest carbon stocks by completing and managing a network of Protected Areas, including existing and Proposed Protected Areas and proposed conservation priority areas.
4. Reduce emissions from deforestation by protecting high carbon stock and high conservation value forest in agricultural and mining concessions.

The vital role of forest as a source of food and income for the majority of Liberians, and the potential for conflict over rights to forest resources, means that great care must be taken to safeguard social interests. Thus a fifth strategic priority is:

5. Fair and sustainable benefits from REDD+. This is primarily about distributing the benefits from emission reductions fairly and investing REDD+ income in activities that can become self-sustaining.

Cost-benefit analysis of the REDD+ strategy options indicates that Protected Areas are highly effective at carbon stock conservation but costly to establish and manage. More permanent forms of agriculture, instead of shifting cultivation, will result in a clear net gain to farmers and investors, but also requires considerable public sector investment. Sustainably managed forests offer the most promising balance of private and public benefits. Profitability is sufficient to attract private sector involvement whilst sustainably logged forest can retain high carbon storage and many of the other public goods inherent in natural forest.

The feasibility analysis identifies numerous barriers to measures that aim to change land use practices through incentive or regulation. The main barriers to changing livelihood practices, such as shifting cultivation, are lack of access to capital and lack of experience and knowledge of alternative methods. Government has a limited ability to implement policies and enforce laws. Land use practices are difficult to change because of poverty, undefined land rights and other issues. There is a risk that REDD+ measures such as the expansion of Protected Areas may conflict with the priorities of communities, as highlighted in the preliminary results of the strategic environmental and social assessment. The REDD+ Strategy must recognize such risks and ensure that safeguards are built into REDD+ policies and measures.

Contents

1. PREPARATION OF LIBERIA'S REDD+ STRATEGY	10
1.1 THE FOREST CARBON FACILITY PARTNERSHIP PROCESS FOR REDD+ STRATEGY DEVELOPMENT	10
1.1.1 <i>Guidance on measuring, reporting and verifying emissions reductions</i>	11
1.2 LIBERIA'S REDD+ READINESS PREPARATIONS	13
1.2.1 <i>REDD+ Readiness activities</i>	13
1.2.2 <i>Liberia's REDD+ Strategy: Purpose, timescale and geographical focus</i>	15
2. FOUNDATIONS FOR A REDD+ STRATEGY	18
2.1 DEFINING FOREST TYPES AND FOREST LOSS	18
2.1.1 <i>Forest definition for Liberia</i>	18
2.1.2 <i>Thresholds for deforestation and degradation arising from the forest definition</i>	19
2.2 TRENDS IN DEFORESTATION AND DEGRADATION AND REFERENCE LEVEL	20
2.2.1 <i>Historic trends</i>	21
2.2.2 <i>Projection of trends into the future</i>	23
2.2.3 <i>Emissions from deforestation and forest degradation</i>	25
3. DRIVERS OF DEFORESTATION AND DEGRADATION	26
3.1 LAND USE AND FOREST COVER ANALYSIS	28
3.2 THE PRINCIPAL DRIVERS OF DEFORESTATION AND FOREST DEGRADATION	30
3.2.1 <i>Drivers affecting the largest area of forest</i>	30
3.2.2 <i>Drivers of deforestation and forest degradation resulting in the greatest emissions</i> ..	32
3.2.3 <i>Drivers with greatest short-term impact on forest cover</i>	34
4. PRELIMINARY STRATEGY OPTIONS	36
4.1 STRATEGIC PRIORITIES	37
4.1.1 <i>The role of Protected Areas in conserving forest carbon stocks</i>	40
4.1.2 <i>Equity and sustainability</i>	41
4.2 REDD+ STRATEGY OPTIONS	41
5. APPRAISAL OF REDD+ STRATEGY OPTIONS	44
5.1 COST-BENEFIT ANALYSIS	44
5.1.1 <i>REDD+ opportunity cost</i>	45
5.1.2 <i>Implementation cost</i>	52
5.1.3 <i>Potential REDD+ benefits</i>	54
5.1.4 <i>Conclusions from Cost-benefit analysis</i>	58
5.2 FEASIBILITY ANALYSIS	60
5.2.1 <i>The main barriers to changing livelihood practices</i>	60
5.2.2 <i>Barriers to the better regulation of forests</i>	63
5.2.3 <i>Liberia's experience of REDD+ pilots</i>	66
5.3 STRATEGIC ENVIRONMENTAL AND SOCIAL ASSESSMENT	67
5.4 APPRAISAL RESULTS AND IMPLICATIONS FOR STRATEGY OPTIONS	70

6. COMPLETING THE REDD+ STRATEGY..... ERROR! BOOKMARK NOT DEFINED.

ANNEX A: DETAILED RESULTS OF COST-BENEFIT ANALYSIS ERROR! BOOKMARK NOT DEFINED.

Figures

Figure 1 - Thresholds for degradation and deforestation.....	20
Figure 2 - Percentage of the total forest area in Liberia associated with designated land uses.....	32
Figure 3 - Drivers of deforestation identified in a global meta-review	35
Figure 4 - Approach for assessing opportunity costs and REDD+ benefits	45
Figure 5 - Profitability of land use vs carbon stock (1ha) over 25 years.....	47
Figure 6 - Employment generated in different land uses.....	57

Contents

Table 1 - IPCC Approaches and Tiers.....	12
Table 2 - Set of assignments under the R-PP Implementation Grant.....	14
Table 3 - Areas of three forest classes, Metria-GeoVille (2014) & Hansen (2000 – corrected).....	21
Table 4 - Deforestation rates by forest type	23
Table 5 - First order estimate of Liberia's emissions for deforestation and forest degradation	25
Table 6 - Drivers of deforestation and forest degradation identified in the R-PP	28
Table 7 - Area data for the 2015 Metria-GeoVille land cover layer	29
Table 8: Drivers of deforestation and degradation and proposed strategy options in Liberia's R-PP	36
Table 9 – Proposed Liberia REDD+ Strategic Priorities	37
Table 10 – REDD+ strategy options	Error! Bookmark not defined.
Table 11 - Cost and benefit of permanent agriculture	52
Table 12 - REDD+ program cost and potential emission reductions.....	53
Table 13 - Potential REDD+ benefits.....	56
Table 14 - Impact of REDD+ strategy options on environmental and social priorities...	68

Table 15 - Initial appraisal of REDD+ strategic priorities against results of CBA, Feasibility Analysis and SESA	71
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Acronyms

CFMA	Community Forest Management Agreement
CI	Conservation International
DEM	Digital Elevation Model
DTM	Digital Terrain Model
ENNR	East Nimba Nature Reserve
ESA	European Space Agency
ESIA	Environmental and Social Impact Assessment
FCPF	Forest Carbon Partnership Facility
FDA	Forestry Development Authority
FFI	Fauna and Flora International
FMC	Forest Management Contracts
GDEM	Global Digital Elevation Models
GFW	Global Forest Watch
IPCC	Inter-governmental Panel on Climate Change
LULC	Land Use / Land Cover
MDA	Mineral Development Agreement
OSM	Open Street Map
PA	Protected Area
PAN	Protected Area Network
PUP	Private Use Permits
RSPO	Roundtable of Sustainable Palm Oil
REDD+	Reducing Emission from Deforestation and Forest Degradation (with sustainable management of forests, conservation of forest carbon stocks and enhancement of forest carbon stocks)
RTWG	REDD Technical Working Group
SRTM	Shuttle Radar Topography Mission
TSC	Timber Sale Contract
UNHIC	United Nations Humanitarian Information Centre
USAID	United States Agency for International Development
WDPA	World Database on Protected Areas

1. Preparation of Liberia's REDD+ Strategy

The Government of Liberia, through the Forestry Development Authority (FDA) commissioned LTS International and NIRAS to prepare a draft national strategy for reducing emissions from deforestation and forest degradation (REDD+). Starting in 2014, the work was immediately suspended due to the Ebola outbreak, but resumed in June 2015 and is due to be completed in May 2016.

1.1 The Forest Carbon Partnership process for REDD+ Strategy Development

Liberia is following the Forest Carbon Partnership Facility (FCPF) framework for national REDD+ readiness. The FCPF is a global partnership that supports participating countries with the preparation and implementation of REDD+ through two funding mechanisms:

- The FCPF Readiness fund; for the preparation of strategy, reference levels, safeguards, measurement, reporting and verification procedures and institutional capacity building.
- The FCPF Carbon Fund; for piloting performance-based payment systems for emissions reductions achieved through national REDD+ programs.

Liberia is being supported by the Readiness Fund and its progress with developing the required planning and management tools will be guided by the FCPF Readiness assessment framework. This framework looks for the following attributes in a national REDD+ strategy:¹

- The REDD+ strategy should form the basis for the development of a set of policies and programs to reduce emissions from deforestation

¹ FCPF (2013) A guide to the FCPF readiness assessment framework. June 2013

and/or forest degradation, and to enhance carbon uptake from other REDD+ activities.

- The national strategy should support national priorities for sustainable development, be informed by Strategic Environmental and Social Assessment, Environmental and Social Monitoring Framework and safeguard issues, and be consistent with relevant UNFCCC guidance.
- An explicit assessment of risks, feasibility, cross-sector inconsistencies of REDD+ strategy options should have been undertaken and a timeline and process to integrate strategy options with broader development policies been identified.
- The rationale for countries to have engaged in any or all of the five eligible REDD+ activities must be clear, the five possibilities being:
 - i. Reducing emissions from deforestation;
 - ii. Reducing emissions from forest degradation;
 - iii. Conservation of forest carbon stocks;
 - iv. Sustainable management of forests;
 - v. Enhancement of forest carbon stock.
- Strategic options have been identified and analyzed during preparation to ascertain that actions taken on REDD+ are beneficial, feasible and cost-effective.

1.1.1 Guidance on measuring, reporting and verifying emissions reductions

The Inter-governmental Panel on Climate Change (IPCC) guidelines on how to measure, report and verify greenhouse gas emissions and removals use two inputs²:

- a) **Activity data**; which is the area of a specific forest classification and the change that is observed in this area as a result of deforestation or forest degradation. This is typically measured in hectares (ha) per year. For example, an annual decrease of 1,000 ha in the area of Liberia's forest that

² From inception report of Reference Level study, referring to guidance from The IPCC (Good Practice Guidance 2003, and Guidelines for National Greenhouse Gas Inventories Agriculture, Forestry, and Other Land Uses [AFOLU] 2006).

is of 30-80% canopy cover would represent the extent of deforestation in that year.

b) **Emissions factors**; refer to the amount of carbon dioxide (or equivalent) that is emitted from each hectare of land that is deforested or degraded; or, alternatively, the reduction in emissions that results from successful measures to prevent deforestation or forest degradation (emissions avoided). This is typically measured in tons of carbon dioxide equivalent per hectare of deforestation.

Countries such as Liberia currently lack country-specific data for the development of emissions factors for different forest classes and detailed national inventory of carbon stocks. As a result, Liberia will adopt an approach to activity data that is based on the total area under each land cover category and the tracking of conversion from one land use to another. This approach relates to Level 1 and Level 2 according to Table 1. For emissions factors, it will rely on default values – a Tier 1 approach – based on international standards, until a data-base on Liberia's distinct emissions values is established through research.

Table 1 - IPCC Approaches and Tiers

Level	Approach for activity data	Tier for emission factor
1	Total area for each land use category, but no information on conversions (only net changes)	IPCC default factors
2	Tracking of conversions between land-use categories	Country specific data for key categories
3	Spatially explicit tracking of land-use conversions	Detailed national inventory of carbon stocks for key categories, repeated measurements of through time or modeling

Source: Reproduced from Reference Level Inception Report, January 2016.

N.B. It is not necessary to use the same level for activity data and emission factors

This understanding of how emissions reductions are measured and the approaches that can be taken help in considering the strategy options for achieving REDD+ in Liberia. For example, the REDD strategy options must reflect not only where there is the greatest loss of forest (activity data) but also the quality of those forests in terms of carbon (emissions factors).

Inclusion of forest degradation

The **Forest Carbon Partnership Facility (FCPF) Methodological Framework**³ states that Emission Reduction Programs are required to account for emissions from deforestation at a minimum, and emissions from forest degradation should be included where they are significant:

“Emissions from forest degradation are accounted for where such emissions are more than 10% of total forest-related emissions in the Accounting Area, during the Reference Period and during the Term of the emission reduction purchase agreement (ERPA). These emissions are estimated using the best available data (including proxy activities or data)”

The implication for the REDD+ strategy options is that deforestation must be addressed, and forest degradation activities should be included when at least one of the following conditions exist:

- 1) A specific forest degradation activity results in significant emissions (>10%);
- 2) Capacity and resources exist to measure and monitor those emissions reliably and cost-effectively;
- 3) Interventions could potentially reduce such emissions.

1.2 Liberia's REDD+ readiness preparations

1.2.1 REDD+ Readiness activities

Liberia first engaged in the REDD+ readiness process in 2007 when the national REDD+ Technical Working Group (RTWG) was established. The RTWG was the institutional platform for stakeholders to engage in the preparation of the Readiness Program Idea Note (R-PIN) which was submitted to the World Bank-led Forest Carbon Partnership Facility (FCPF) in May 2008⁴. This was followed by the draft Readiness Preparation Proposal (R-PP), submitted in 2011 and finalized in April 2012.

³ FCPF Carbon Fund Methodological Framework, December 20, 2013, Criterion 3: <https://www.forestcarbonpartnership.org/carbon-fund-methodological-framework>

⁴ Details and documents on Liberia's engagement in the REDD+ process may be found on the FCPF website, which also provides materials, guides, publications and other resources: <https://www.forestcarbonpartnership.org/liberia>

From 2012, the FDA and Environmental Protection Agency (EPA) have led work to develop and complete the REDD-Readiness phase of the FCPF process. The preparation of a REDD+ strategy is just one of several required outputs from the readiness phase, the others being⁵:

- Definition of a Reference Emissions Level/Reference level (REL/RL)
- Design of a Monitoring, Reporting and verification system (MRV).
- Preparation of an Strategic Environmental and Social Assessment (SESA) and Environmental and Social Management Framework (ESMF)
- Establishment of a Feedback and Grievance Redress Mechanism (FGRM)

The work to prepare the REDD+ Strategy was conducted at the same time as four other contracts that contribute towards the above. These work streams are closely related and inform one another. An outline of each is provided in Table 2.

Table 2 - Set of assignments under the R-PP Implementation Grant.

Assignment (contract holders)	Contribution	Timing to completion 2015-2016					
		Dec	Jan	Feb	Mar	Apr	May
Forest Cover (Metria-GeoVille)	• New forest cover data/maps from hi-resolution remote sensing. Training for FDA staff.						
Reference Scenario (Winrock & CI)	• Baseline and projection for emissions from forest. • Definition of forest (D&D thresholds)						
Strategic Environmental and Social Assessment (Tetra-Tech)	• Framework for identifying & managing socio-env opportunities and risks from REDD strategy options.						
REDD+ Communications (PCI & FFI)	• Raises general awareness of REDD+ so that decision makers at all levels can influence REDD+ strategy.						
REDD+ National Strategy (LTS & NIRAS)	• Produce Strategy and Road Map, informed by other contracts.						

*Timelines are based on work plans and timing of REDD+ contracts as of April 2016.

⁵ FCPF (2013) A guide to the FCPF readiness assessment framework. June 2013

A sixth contract, to establish a Feedback Grievance and Redress Mechanism (FRGM), is currently out for tender with an expected duration of six months. Completion of this is not essential for the development of the REDD+ strategy but it will be an important part of the subsequent implementation plan.

1.2.2 Liberia's REDD+ Strategy: Purpose, timescale and geographical focus

Purpose of REDD+ strategy

The purpose of the REDD+ strategy is to guide Liberia in its efforts to reduce emissions from deforestation and forest degradation. The key questions the REDD+ strategy should address are:

- 1) What is the estimated carbon value of Liberia's forests and the potential value in terms of emission reductions from avoided deforestation and/or enhancement of carbon stocks?
- 2) What strategy options would be most effective to achieve emissions reductions from deforestation and forest degradation, considering:
 - Expected emission reductions;
 - Financial costs and benefits of the options, including opportunity costs;
 - Social and environmental costs and benefits; and
 - Barriers to implementation which affect the feasibility of interventions.

During its recent past, Liberia's natural resources were used to fuel conflict rather than development. Liberia has since taken steps to break with this past and establish a natural resource economy that supports equity and sustainability. Therefore, the REDD+ strategy should also address two further questions:

- 3) How will the benefits from emission reductions be distributed fairly?
- 4) How can REDD+ policies and measures help Liberia to establish a low-carbon economy that is sustainable in the long term?

Timescale for the REDD+ Strategy

The REDD+ process does not prescribe a certain number of years that should be covered by a REDD+ strategy. However, a strategy should enable decision

makers to prioritize the various REDD+ strategy options before them. To that end, the analysis presented in this document includes identification of the most immediate and significant causes of deforestation. Attention is also paid to the longer term, so that the strategy can establish a direction of travel that is appropriate beyond the near-future.

A guide to what 'short-term' and 'long-term' means is given by the timescale envisaged for implementation of the 2014 bi-lateral agreement between the Governments of Liberia and Norway to cooperate on REDD+ and developing Liberia's agricultural sector. The Liberia Forest Sector Program that resulted from this agreement will be the main vehicle for implementing REDD+ in Liberia. It consists of three overlapping phases.

- The first 'preparation' phase is to support the completion of Liberia's REDD+ Readiness activities by approximately 2017-2018 (complementing the FCPF).
- The second 'transformation' phase is from 2015 to 2020 and is to establish the plans, the institutional capacity, the legal and policy framework, the monitoring and reporting processes, and the social and environmental safeguards required to implement REDD+.
- The third phase is 'contributions for verified emissions reductions'. This introduces a results-based benefit sharing mechanism that will reward Liberia for independently verified emissions reductions with financial contributions, channeled through the World Bank and to support a low carbon development path⁶. The stated intention is to begin this phase in 2018, yet there is no fixed end-point.

Thus, 'short term' for the REDD+ strategy can be taken to be the period up to 2025, within which strategy options should be implemented and delivering results.

Geographical focus

The geographical scope of the REDD+ strategy is national and as such it serves as a comprehensive and unifying guide to REDD+ activities in Liberia. Likewise, the Reference Level will be defined first and foremost at a national level.

⁶ Letter of intent between the Government of the Republic of Liberia and the Government of the Kingdom of Norway on "cooperation of reducing greenhouse gas emissions from deforestation and forest degradation (REDD+) and developing Liberia's agricultural sector" New York, 23 September 2014.

Depending on the activity, the implementation of REDD+ may occur either nationally or sub-nationally. There has been growing consensus at international REDD+ meetings that a landscape approach to REDD+ – also known as ‘Jurisdictional REDD+’ – is most effective for achieving the desired impact in a permanent way by addressing drivers of deforestation and forest degradation ‘outside of the forest’⁷. The Liberia Forest Sector Project, which will be the main vehicle for preparing an emissions reduction capability in Liberia, has adopted this landscape approach by targeting several landscapes where there is a concentration of high carbon-value forest and threats to that forest.

The national REDD+ Strategy needs to recognize the emerging jurisdictional approach to REDD+ implementation in Liberia, by placing sub-national activities in the context of overall national priorities and strategy options. This is what is termed a ‘nested’ approach: local action within a national strategy and reporting framework.

⁷ Fishbein, G and Lee, D (2015) Early lessons from Jurisdictional REDD+ and low emissions development programs. The Nature Conservancy and World Bank Group. Arlington January 2015

2. Foundations for a REDD+ Strategy

This section presents the foundations of a national REDD+ strategy, which includes how forests are defined and the basis for measuring change in forest cover and deforestation and degradation. This helps to focus the strategy on what will be measured and hence what it must deliver. An overview of historic trends in deforestation and expected future trends is given, drawing on the Winrock and Conservation International Reference Level study. This provides for the REDD+ strategy an understanding of causes of deforestation and forest degradation and hence where the main opportunities for reducing emissions are to be found.

2.1 Defining forest types and forest loss

2.1.1 Forest definition for Liberia

How a country defines its forest will affect the total area of the country that is considered forest, and the level of forest loss that is considered as deforestation or forest degradation.

In January 2016, Liberia adopted the following forest definition:

- 1) Minimum area 1 hectare
- 2) Minimum canopy cover 30%
- 3) Minimum height at maturity 5 meters
- 4) Industrial agricultural plantations are not considered as forest

This follows the definition proposed in Liberia's R-PP and it is the narrowest definition of forest that is available within the UNFCCC guidance. It means that a group of trees needs to be equal or larger than one hectare, dense as 30% canopy cover or more and with tree height of five meters or over before it is considered 'forest'.

If Liberia had chosen the broadest definition available (minimum 0.05 ha. area, 10% canopy cover and 2m. tree height) most of the country would be classed as forest. Hence the loss of low-grade forest and scrub would be counted as deforestation or degradation. In keeping with other heavily forested countries, Liberia has adopted a definition that recognizes its more valuable forest (most valuable from a carbon, biodiversity and natural resource perspective) whilst also allowing a substantial proportion of land to be classed as non-forest. On this "non-forest" land, clearance of remaining trees and scrub can take place without it counting as deforestation or forest degradation.

2.1.2 Thresholds for deforestation and degradation arising from the forest definition

The chosen definition of forest determines what is deforestation, forest degradation and reforestation. It therefore determines the thresholds that will be used to establish whether Liberia is succeeding in preventing deforestation and forest degradation and hence whether it is effectively implementing the REDD+ strategy.

The loss of forest from land that still retains at least 30% canopy cover is considered forest degradation. Where tree cover is reduced to below 30% canopy cover, this is considered deforestation (the forest is converted to another land use). Reforestation or afforestation of land that restores it to a canopy cover of at least 30% would be considered to be enhancement of carbon stocks, and would result in a credit to the national carbon account.

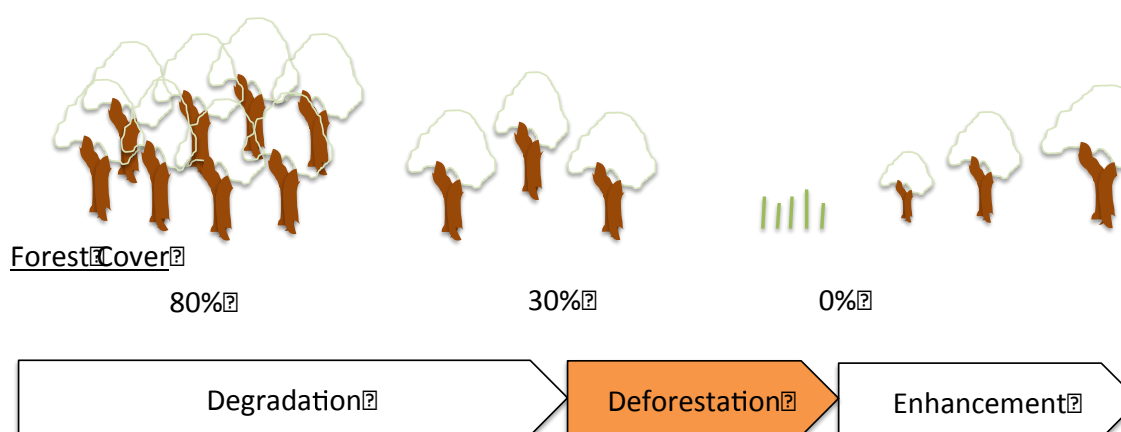


Figure 1 - Thresholds for degradation and deforestation

Source: Figures and concept from Reference Level Inception Report 2016 and FDA Forest Definition 2016.

The REDD+ strategy therefore has three basic options for how to achieve its aim to reduce emissions from deforestation and forest degradation: by tackling deforestation, by preventing degradation or by generating forest cover on deforested land.

2.2 Trends in deforestation and degradation and reference level

The REDD+ strategy is informed by an understanding of the trends in deforestation and forest degradation in recent history and the current status of Liberia's forest. The task of establishing a reference level⁸ has been undertaken by a separate team of Winrock International and Conservation International (CI). The analysis below is largely based on the draft, interim findings from this Reference Level study and will be reviewed for the final REDD+ Strategy in the light of the final figures and conclusions.

⁸ For standards or initiatives focused on carbon accounting or reporting, reference levels provide a quantitative way to measure the performance of a country, programme, or project in reducing emissions or increasing removals. (The REDD Desk, 2016)

2.2.1 Historic trends

The method used in the Winrock/CI Reference Level study to establish recent trends in forest was to measure the area of land under each of the forest classifications established by the 2015 forest cover and mapping assignment – completed by Metria and GeoVille for the FDA – and compare this to data from 2000⁹.

Changes in forest cover

The results indicate that the greatest change in forest cover has been a loss of over one million hectares of land classed as >80% canopy cover. Approximately a third of the area has been lost from the 30-80% class, with a consequent increase of approximately half a million hectares in the area of land classed as less than 30% canopy cover. **Thus, deforestation of approximately 0.5 million hectares has occurred and around 1.5 million hectares has been degraded, over a fourteen year period from 2000 to 2014.**

Table 3 - Areas of three forest classes, Metria-GeoVille (2014) & Hansen (2000 – corrected)

Forest Class	GeoVille	Hansen (corrected)	Difference in area
<i>canopy cover</i>	<i>ha, 2014</i>	<i>ha, 2000</i>	<i>ha, 2000-2014, integrating deforestation, degradation and regrowth</i>
>80 %	4,583,778	5,778,415	-1,194,637
30 - 80 %	2,188,842	2,485,622	-296,780
1-30 %	1,462,931	953,070	509,861
Total	8,235,551	9,217,107	-981,557
Total >30%	6,772,620	8,264,037	-1,491,417

Reproduced from Winrock (2016) Reference Level Draft Interim Report (NB: Figures may be revised in final report)

The Reference Level study suggests that two main types of deforestation have occurred. First, there are large blocks of forest that have been converted for commercial operations in recent years, particularly along the coast. They contribute to an increase in the overall rate of deforestation from 2012 onwards. The second type of deforestation is a much more diffuse pattern of

⁹ Produced by Hansen et al (2013), with date extending back to year 2000, adjusted for compatibility with results of the Metria-GeoVille method.

deforestation and forest degradation, with forest loss happening at a low rate every year. This affects the 30-80% forest class in particular but also the more dense class of forest (>80% canopy cover).

Deforestation rates

The highest rates of deforestation are found in the 30-80% forest class.

Loss of forest cover is slowest in the >80% class. This pattern is supported by what is evident from forest cover maps; large blocks with high canopy forest cover remain in areas that are furthest from roads and settlements.

The comparatively low deforestation rate in the most dense forest could be seen as encouraging from a conservation perspective, but the total area deforested within the >80% forest class is similar to the area deforested from the 30-80% class (roughly 304,000 ha from each class 2000-2014). This is because the >80% forest cover class represents a much larger land area than the 30-80% forest. Furthermore, the carbon value of >80% forest is higher than 30-80% forest, hence the emissions from loss of dense forest will be much more than from forest with a thinner canopy cover.

Table 4 - Deforestation rates by forest type

Forest Class	Forest area 2000	Deforested 2000-2014	Deforestation rate per year
(corrected Hansen et al, year 2000)	ha, 2000	ha	%/year
>80 % canopy cover	5,778,415	303,798	0.376%
30 - 80 %	2,485,622	304,230	0.874%
10-30 %	953,070	93,991	0.704%
Total	9,217,107	702,018	0.544%
Total >30%	8,264,037	608,027	0.526%

Reproduced from Winrock (2016) Reference Level Draft Interim Report (NB: Figures may be revised in final report. This table reports deforestation only, not degradation)

Deforestation rates in Liberia have been relatively low, compared to neighboring countries. Between 1960 and 2010, forest cover in Côte d'Ivoire fell from 16 million hectares to less than 3 million hectares as agriculture, and cocoa production in particular, expanded. Deforestation rates in Côte d'Ivoire are reported as remaining extremely high at around 4%, posing a threat to the provision of environmental services and Côte d'Ivoire's agricultural economy¹⁰.

In Sierra Leone, the annual deforestation rate in 2010 was estimated to be 2.9% and the remaining forest cover is estimated at approximately 38% of the total land area¹¹. The national climate change abatement strategy states that 85 percent of the country's natural rainforest has been lost as a result of the various drivers of deforestation such as illegal logging, legal logging for export, expansion for resettlement, agriculture and wild fires¹².

2.2.2 Projection of trends into the future

The FCPF methodological framework offers little flexibility for countries who wish to make a case for departing from historic trends when defining its reference level. It is therefore likely that the reference level for Liberia will be based on a projection of historic trends¹³. In any case, it is prudent for the

¹⁰ EU REDD web-site. Progress Report on Côte d'Ivoire, 2016

¹¹ UN REDD Desk <http://theredddesk.org/countries/sierra-leone> (citing figures from FAO, 2010 and GoSL, 2010)

¹² Sierra Leone Government (2010) Strategy for the development of a climate change abatement economy. Concept Note July 2010.

¹³ The decision on whether to make an exceptional case to depart from the historic deforestation rates is one that the Government of Liberia must take, if it wishes, and will not be determined by the current Reference Level study.

strategy to be based on consideration of prevailing and potential land use changes.

Historic trends in deforestation are a poor guide to future trends because the conflict and unrest that prevailed for several decades hindered land use and development of all sorts up to the cease-fire in 2003. An intense and largely unquantified amount of logging occurred in the 1990s. It was the mis-use of this industry to fuel conflict that led to the imposition of sanctions on timber exports by the UN Security Council in 2003.

The general effect of the conflict was however to destroy the development, prosperity and infrastructure that Liberia had previously established. The development of roads and settlements was set back and population growth was greatly suppressed by killing and the flight of refugees. It is very likely that the conflict period played a part in reducing deforestation rates. Hence Liberia is an unusual case in West Africa because it is still heavily forested.

In the post-conflict period, approximately half of the land in Liberia has been allocated for concessions for logging, agriculture, mining and conservation. Most of this has not yet been developed and so future deforestation and forest degradation depends heavily upon:

- i) How these conceded areas are developed; and
- ii) The growth of household-level forest use as population and consumption rises in the post-conflict era.

The combination of traditional and new forest uses that characterizes Liberia was recognized in Liberia's initial REDD+ Readiness Plan (R-PP, 2012). The R-PP identified drivers that are currently affecting Liberia's forests (such as chainsaw logging and charcoal production) and drivers that are expected to have a major impact in the near future (such as plantation agriculture).

2.2.3 Emissions from deforestation and forest degradation

Estimates of Liberia's emissions from forests have been made in the Reference Level study, based on data from the World Bank REDD+ Decision Support Toolbox¹⁴ (Table 5).

Table 5 - First order estimate of Liberia's emissions for deforestation and forest degradation

Activity	tCO ₂ emissions per year	Percent of total emissions
Deforestation	18,946,559	91.3%
Degradation (total)	1,811,105	8.7%
Logging	1,320,835	6.4%
Fuelwood	217,835	1.0%
Fire	272,436	1.3%
Total Emissions	20,757,665	100%
Enhancements	-378,136	--

Source: Winrock (2016) Reference Level Study Draft Interim Report (NB: Forest degradation is comprised here of logging, fuelwood and fire.)

These estimates indicate that deforestation is the source of the vast majority of Liberia's emissions from the forest sector and on this basis the (Draft) Reference Level report recommends that Liberia focuses on reducing emissions from deforestation. However, a warning as to the reliability of this finding is given in the study, because the figures provided in Table 5 are based on global datasets and while it is possible to obtain a reasonable initial estimate of deforestation from such sources, it is much more difficult to achieve an accurate picture of forest degradation.

Other indicators of the relative importance of deforestation and degradation considered in this study suggest that forest degradation is more important than these first order estimates suggest. For example, the area of forest that is being degraded is approximately three times that which is being deforested, and the carbon stock of the degraded forest is higher because it is more dense. This is an important point for the REDD+ strategy because it determines whether the FCPF criteria for including degradation are met and hence if it is to be included

¹⁴ Sidman, G., L. Murray, T.R.H. Pearson, N.L. Harris, M. Netzer. 2014. World Bank REDD+ Decision Support Toolbox Methods. Online DST available at <http://redd-dst.ags.io>.

in the strategy (criteria in 1.1.1). It needs to be checked in the light of the completed Reference Level study and consultation on this Strategy Options report.

3. Drivers of deforestation and degradation

After more than a decade of peace and stability, the economy of Liberia has been growing and large amounts of foreign investment have been attracted into agriculture, mining and other commodities. The economy was growing by 6% of GDP per annum up to 2014 when the outbreak of Ebola and depressed commodity prices caused a slow-down from which the country is still recovering¹⁵.

Approximately 50% of the total land area had been allocated for commercial concessions of various sorts, most for a period exceeding 25 years, and for Protected Areas. This planned use for large tracts of land overlays a history of community-based land use which is largely responsible for producing the pattern of forest cover seen at the start of the post-conflict period.

Evidence for identifying and quantifying the various drivers of deforestation and degradation forms an important part of the foundations of a REDD+ strategy. It determines the strategy options that are to be prioritized for tackling the main causes of deforestation and degradation. Under the REDD+ process, each identified driver of deforestation and forest degradation is required to be included in one or more of the reference levels. The reference levels are themselves directly related to the eligible activities to be implemented in national REDD+ programs (Section 1.2.1).


Liberia's Readiness Preparation Plan (R-PP) made an initial attempt to define the direct drivers and underlying causes of deforestation and forest degradation¹⁶, using the data available at the time (2012).

¹⁵ The World Bank Group. The economic impact of the 2014 Ebola epidemic. October 7 2014.

¹⁶ A driver, or cause, of deforestation or forest degradation can be explained as something that is causing the clearing of trees, transforming a forest into cleared land and leading to deforestation and forest degradation. A

proximate driver is defined as human activities or immediate actions at the local level, such as agricultural expansion or charcoal production, which originate from intended land use and directly impact forest cover. An **underlying driver** is a fundamental force that underpins one or many proximate causes.

Table 6 - Drivers of deforestation and forest degradation identified in the R-PP

Sector	Direct Drivers	Underlying causes (cross-cutting)
Forestry	1. Commercial logging	 <ul style="list-style-type: none"> • Policy & governance failures • Economic and market forces • Landlessness and unclear land rights • Population growth and pressure on resources • Social-Cultural factors (conflicting social groups)
	2. Chainsaw logging	
Agriculture	3. Shifting cultivation	
	4. Plantations and permanent agriculture	
Energy	5. Charcoal production	
	6. Oil (fossil fuel)	
Mining	7. Industrial and artisanal mining	

Source: R-PP 2012

It is acknowledged in the R-PP that there is limited evidence with which to quantify and judge the relative importance of these different drivers. This remains a serious constraint in 2016, although the development of the REDD+ strategy is underpinned by more recent research undertaken by the various R-PP components (e.g. Reference Level, forest cover mapping). The following section provides a summary review of the current state of the evidence on drivers of deforestation and forest degradation in Liberia, and serves as a basis for developing the strategy and prioritizing interventions.

3.1 Land use and forest cover analysis

A detailed analysis of land use in relation to forest cover was conducted as part of the work to prepare a REDD+ Strategy. This used the 2015 Metria-GeoVille land cover maps and data commissioned by the FDA which provides an up-to-date and much improved source of information on the extent of various forest and land classes.

Table 7 - Area data for the 2015 Metria-GeoVille land cover layer

Land cover class	Hectares	% of mapped area
Forest > 80%	4,389,270	45%
Forest 30 - 80 %	2,186,495	23%
Forest < 30%	1,529,949	16%
Mangrove & Swamps	37,158	0.4%
Settlements	44,595	0.5%
Surface Water Bodies	60,374	0.6%
Grassland	625,332	6%
Shrub	606,928	6%
Bare Soil	173,690	2%
Ecosystem complex (rocks & sand)	2,271	<0.05%
Clouds (unmapped)	14,336	<0.2
Total mapped area (land and inland water)	9,656,062	100%

Data on land use came primarily from Government of Liberia concessions for forestry, agriculture and mining industries. These provide the best available information on the scale and location of particular land uses. Also available are data on the land area that the Government has designated for conservation, as Protected Areas.

In total, approximately 50% of the forest land in Liberia is allocated for government concessions or designated for conservation as Protected Area. Most of the concession land is yet to be developed, and most of the Protected Areas are yet to be established, so the available land uses data, based on concessions, and are more of an indication of planned land use changes than a measure of current land use.

A detailed analysis of the area of each forest class (30-80% and >80%) that is to be found in land allocated to particular land uses was conducted. The results of this are included in the Land Use Analysis Draft Report (DR-2a). The land uses covered are:

- Forestry concession; Forest Management Contracts (FMCs), Timber Sale Contracts (TSCs) and Community Forest Management Agreements (CFMAs)
- Agricultural concessions, including oil palm plantations and rubber plantation concessions

- Mining, including large scale mineral development concessions and small-scale 'artisanal' mining.
- Protected areas, where forest is to be used primarily or exclusively for biodiversity conservation
- A variety of smallholder, subsistence uses of land at community level, including shifting agriculture, chainsaw logging ('pit sawing') and charcoal production.

3.2 The principal drivers of deforestation and forest degradation

There is a lack of evidence with which to quantify and fully understand drivers of deforestation and forest degradation in Liberia. Research to fill this gap will be an important part of Liberia's work on REDD readiness and implementation going forward.

The available evidence does however provide some basis for assessing and prioritizing drivers. The analysis of forest cover in relation to land uses summarized above produces a number of findings which help in this respect. These are drawn together in this section in terms of:

- a) Which drivers are most significant in terms of forest area?
- b) Which drivers are most significant in terms of emissions?
- c) Which drivers will have most impact on forest cover and emission levels in the short-term?

3.2.1 Drivers affecting the largest area of forest

Community land uses affect the largest area of forest land. They are the principal land uses in the 43% of the total forest land that is not formally designated by the Government of Liberia for commercial or conservation purposes. Community land uses, of which there are many types, extend also over the concession areas (most of which are to be developed) and even intrude into Protected Areas (most of which are yet to be established).

There are no robust data with which to quantify the different community land uses. The information that is available does however indicate that shifting agriculture, pit sawing and charcoal production are all drivers of deforestation and forest degradation that threaten a larger area of forest.

- Based on the area of land that is easily accessible to settlements, a rough estimate of the area of forest land affected by shifting cultivation is 34% of the >80% canopy forest and 67% of the 30-80% Forest.
- Based on the volume of timber that is thought to be consumed by the pit sawing industry, it can be estimated that this affects an area at least as large as the total area that is subject to FMC logging concessions (24% of total forest).
- The volume of timber consumed for charcoal production is estimated at around double that by pit sawing, but a significant (if unknown) proportion of this comes from by-product timber cleared from rubber plantations that are being replanted, or new agriculture plantations that are being cleared. A rough and possibly conservative estimate of the area of forest affected by charcoal production is therefore the same as that for pit sawing; in other words, it is greater than the area affected by all existing and proposed logging concessions.

Forestry concessions are the second largest category of land use by area. If all existing and proposed FMCs were exploited this would affect 24% of the total forest area. FMCs account for 29% of the most dense forest (>80 canopy cover). Furthermore, the scale and positioning of FMCs, often between Protected Areas or Proposed Protected Areas and covering large blocks of dense forest, suggests that they are an important part of a REDD+ strategy.

Palm oil is the third largest land use, based on the maximum area that is permitted for development by concession agreements. It accounts for 5% of the total forest area.

The remaining land uses, in order of potential forest area affected, are Timber Sales Contracts (3% of total forest), Community forestry agreements (2%), Mining (2%) and then rubber and other plantations (1%).

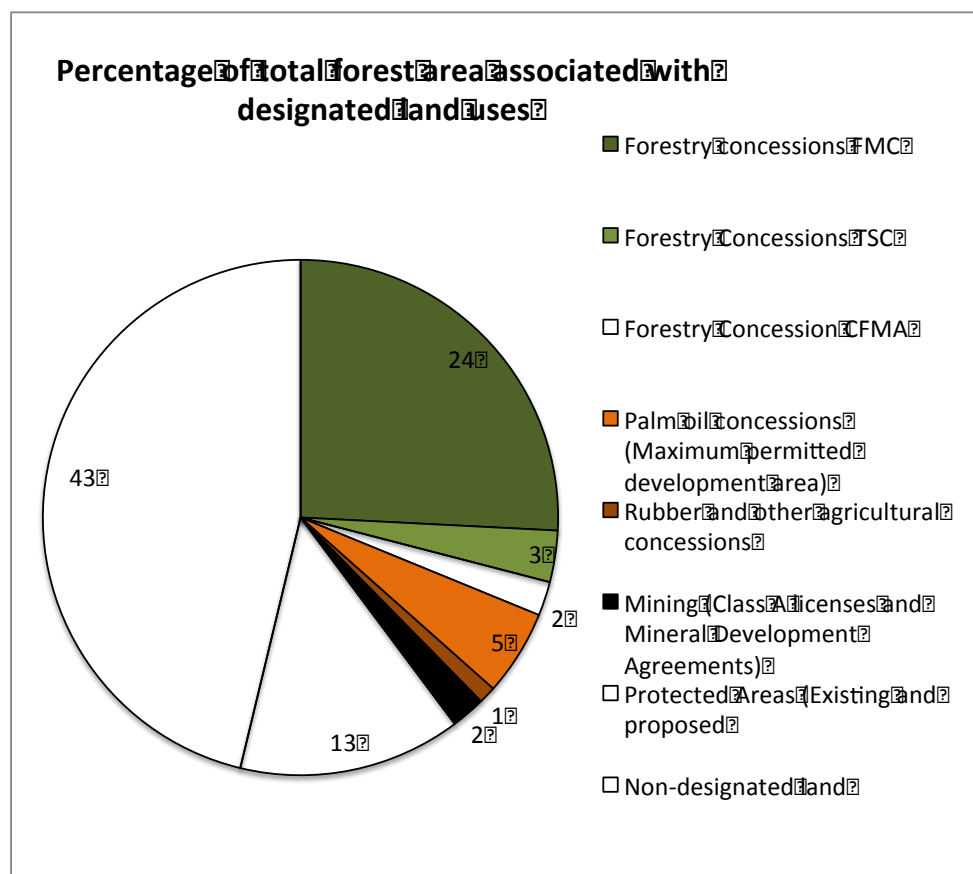


Figure 2 - Percentage of the total forest area in Liberia associated with designated land uses

3.2.2 Drivers of deforestation and forest degradation resulting in the greatest emissions

The area of forest affected by drivers of deforestation or forest degradation does not directly equate to the level of emissions. For example, a large area experiencing gradual forest degradation could result in fewer CO₂ emissions than a smaller area that is completely cleared, assuming that both areas have the same carbon stocks.

In the absence of country-specific emission factors to apply to the various drivers of deforestation and forest degradation, a rough indication of the main sources of emissions can be gained by identifying the land uses that most clearly result in the conversion of dense natural forest to "no-forest".

Of the drivers reviewed above, two in particular are obvious potential causes of substantial deforestation. The first is oil palm because the recent concessions

are large and are heavily forested. The development of plantations will likely result in the clearance of between a minimum of 160,000 ha of forest, and a possible maximum of 352,000 ha of forest.

The second is Timber Sales Contracts because they involve the complete clearance of forest. Existing and proposed TSC cover 190,000 ha or 3% of the total forest area in Liberia. The majority of this is dense (>80% cover) forest.

Together, conversion for palm oil plantations and Timber Sales Contracts may amount to approximately 500,000 ha of forest; a similar area to that which was deforested between 2000 and 2014, according to the estimates cited in section 2.2.

Historic trends indicate that a roughly equal amount of deforestation has occurred from the >80% forest as from the 30-80% forest (see section 2.2). The area of dense forest in Liberia is large and the carbon stock for this dense forest is much higher, therefore drivers that result in the deforestation of >80% forest are more important in terms of causing emissions. The analysis presented in section 2.2 suggests that the conversion of >80% Forest to less than 30% non-forest has occurred largely as a result of dispersed and extensive deforestation events. This finding is supported by observation and references that show that large-scale clearance on agricultural concessions began late in this period and at a relatively small scale (and on the less forested areas), so is unlikely to account for a large proportion of the deforestation of dense forest that has occurred to-date.

It is therefore reasonable to assume that the principal driver of deforestation of the dense forest has been community-level small-scale uses; notably shifting agriculture, pit sawing and charcoal production. It follows that most of the emissions since 2000 have been the result of deforestation of dense forest by community land uses.

It is also reasonable to assume that this community land use (and hence deforestation) will continue in the future, at least at the historic rate and probably higher. At historic rates, this would result in approximately 300,000 ha of deforestation over the next 14 years. **Taking into account the higher carbon stock of the dense forest lost to small-scale activities, the emissions**

attributable to deforestation from community land use will probably be substantially higher than that from conversion to palm oil plantation.

3.2.3 Drivers with greatest short-term impact on forest cover

The various drivers of deforestation and forest degradation can be divided into those that are likely to have an impact on forest cover in the short term and those that will have a longer-term impact.

Short-term impact (0-10 years)	
Palm oil conversion	The major palm oil concession-holding companies aim to clear land and establish plantations within the next 10-15 years.
Timber Sales Contracts	Although most TSCs have the status of 'proposed', rather than 'active', once fully approved the forest within can be completely cleared.
Pit sawing and charcoal production	These forest uses already have a significant impact and can be quickly scaled-up as they require relatively little capital investment. Access to the resource is also particularly easy in the short-term because of lack of regulation of these activities in community forest areas, in forestry concessions areas and in Proposed Protected Areas.
Longer-term impact (10+ years)	
Shifting agriculture	Although rising population and prosperity is creating a strong demand for new farm land, the labor and capital investment required to clear new areas, especially of dense forest, is high for communities/smallholders. The complex land ownership/tenure system that prevails in Liberia also acts as a brake on the expansion of shifting agriculture into new areas.
Commercial logging	Logging operations are not yet fully up to scale and impact on forest should be gradual as extraction rates should be kept within sustainable limits. The road construction that accompanies forest operations will open up the forest to community land uses but the effect of this in terms of deforestation and forest degradation is likely to become visible after a decade or more.
Mining	There are few mines currently operating and the pace of expansion of the industry is currently slow, because of low commodity prices. It takes some years for exploration and mineral development licenses to progress into actual mining operations so a significant number of new mines are unlikely to appear within a decade. There is

insufficient data to judge the current and potential impact of small scale artisanal mining.

Overall, the findings for Liberia on drivers of deforestation and their relative importance are similar to those observed in other countries. A meta-review of evidence of drivers found that proximity to roads, proximity to urban areas, proximity to cleared land and the presence of agricultural activity were the most significant factors associated with deforestation¹⁷ (Figure 3).

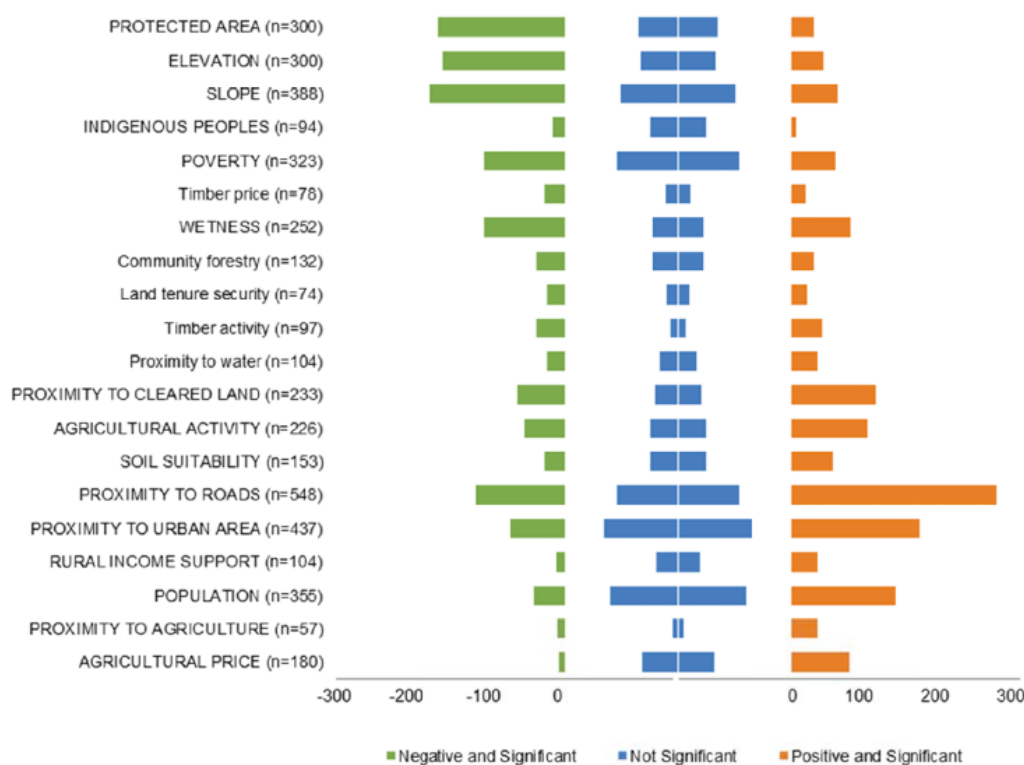


Figure 3 - Drivers of deforestation identified in a global meta-review
Source: Kalifi Ferretti Gallon and Jonah Busch (2014) [NB: the term "negative and significant" in the graphic means the variable is negatively associated with deforestation. E.g. Protected Area is "negative and significant, meaning it stops deforestation in most

¹⁷ Kalifi Ferretti Gallon and Jonah Busch (2014) "What Drives Deforestation and What Stops It? A Meta-Analysis of Spatially Explicit Econometric Studies." CGD Working Paper 361. Washington, DC: Center for Global Development. The article can be found [here](#).

cases. Note that in some cases it is "positive and significant", meaning it drives deforestation (presumably under changed conditions)].

4. Preliminary strategy options

The R-PP proposes a set of policy options, informed by an economic analysis of low carbon economy options conducted in 2009¹⁸. For the preparation of the REDD+ strategy in 2016 it is possible to develop these R-PP options, mainly by prioritizing them more clearly, using recent data and the recent knowledge of how the concession-based industries are developing.

This chapter looks firstly at the strategic priorities for REDD+ in Liberia that emerge from the analysis of land use and forest cover and consultations with a range of REDD+ stakeholders. The aim is to devise a strategy that focuses on the most significant drivers of deforestation and forest degradation, and on those that will have the most impact in the short term (present to 2025).

The second part of the chapter sets out REDD+ strategy options that address the most important drivers and which fit within the overall strategy.

Table 8: Drivers of deforestation and degradation and proposed strategy options in Liberia's R-PP

Forestry sector drivers	Agricultural sector drivers	Energy sector drivers
I. Commercial Forestry: extensive, over-intensive, & hi-impact II. Chainsaw logging	III. Shifting cultivation IV. Plantations and permanent agriculture	V. Wood energy production
Forestry sector strategies	Agricultural sector strategies	Energy sector strategies
1) Raising commercial logging standards; 2) Reducing logging area footprint; 3) Regulating and managing chainsaw logging 4) Integrating of Conservation and Protected Areas into REDD and acceleration of the timeline	6) Transforming shifting cultivation into permanent or semi-permanent agriculture to reduce land use and forest degradation 7) Ensuring that plantation and permanent agriculture development is located on degraded forest lands	9) Regulating and managing wood fuel energy 10) Introducing more efficient kilns and cooking stoves

¹⁸ Lawrence, Eduard Niesten, Eric Werker; Economic Analysis of a Low Carbon Economy for Liberia, Conservation International, 2009.

5) Enhancement of carbon loading in degraded forest areas, focusing on indigenous species / forest rehabilitation	8) Carbon stock enrichment of barren land through timber crop planting (tree crops instead of other agricultural products), including commercial tree species (linked to forest sector)	
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Source: Readiness Preparation Proposal for Country: Republic of Liberia. March 2012.

4.1 Strategic priorities

Because Liberia is a heavily forested country, the priorities amongst the eligible REDD+ activities should be conserving the carbon stocks that exist, reducing deforestation and degradation, and sustainable management of forests.

The strategic priorities for Liberia's REDD+ strategy and the rationale for these is set out below (Table 9).

Table 9 – Proposed Liberia REDD+ Strategic Priorities

Proposed Strategic Priorities	Rationale
1. Reduce emissions from deforestation and degradation by supporting the sustainable use of forest resources by communities, addressing shifting agriculture, charcoal production, pit sawing in particular.	Shifting agriculture, charcoal production and pit sawing is practiced widely across Liberia, including in proposed protected areas. The resulting level of deforestation and forest degradation is not known but the pattern of forest loss visible today is largely a result of shifting agriculture and other community use of forests. Community forest uses can be expected to increase dramatically as population and consumption increases. Approximately 70% of the total forested area is vulnerable to degradation and deforestation from subsistence/small-scale uses. Pit sawing and charcoal production probably consume more timber than commercial logging. Restricting the expansion of shifting agriculture, charcoal production and pit sawing, particularly into >80% cover forest, is therefore a strategic priority.

Proposed Strategic Priorities	Rationale
2. Sustainably manage commercial forestry, to reduce impact of logging in areas conceded (or proposed) as Forest Management Contracts, Community Forest Management Agreements or other designations where commercial forestry may occur.	FMCs cover contain approximately 24% of the total forest area and 29% of the >80% forest. They are located in areas of high carbon stock and biodiversity. They lie between protected areas and so are important for maintaining wildlife corridors and large forest blocks. There is a relatively well-developed policy and regulation for sustainable forestry but very little practical implementation. Standards and monitoring procedures are being strengthened, particularly through the VPA process. These potentially apply to pit sawing. It is possible that some FMCs may become CFMAs under the pending Land Rights Law. The application of same standards in CFMAs is therefore important.
3. Conserve forest carbon stocks by completing and managing a network of Protected Areas, including existing and Proposed Protected Areas and proposed conservation priority areas.	Completion of the Proposed Protected Area Network would protect 18% of the closed dense forest and 13% of the total forested land in Liberia (forest cover $\geq 30\%$). The policy/regulatory framework for implementing the PAN and enforcing conservation measures is already in place. Currently, only 3% of forest land is protected by established protected areas and even in these the capacity to enforce conservation laws is very limited. The PAN as currently proposed falls short of the commitment to conserve 30% of all forested land that is made in the 2006 Forestry Reform Law. The addition of conservation priority areas as a longer-term measure would achieve this 30% commitment.

Proposed Strategic Priorities	Rationale
4. Reduce emissions from deforestation by protecting high carbon stock and high conservation value forest in agricultural concessions.	<p>13% of the national land area is designated as agricultural concession; for rubber or palm oil plantation. These concessions are heavily forested, containing 10% of the total national >80% forest and 12% of 30-80% forest.</p> <p>Palm oil plantation are the most immediate and significant potential source of emissions from deforestation. The amount of forest land that is permitted for development (i.e. clearance) is equivalent to 5% of the total national forested area.</p> <p>Deforestation should be limited to less-dense forest because industry standards such as RSPO require companies to set aside HCS and HCV forest. Even if this is achieved, the management of set-aside forests is uncertain and it is vulnerable to degradation and eventual deforestation from community use. Community pressure on remaining forest will increase dramatically as jobs and incomes from the plantation result in increased population and consumption, and as communities are displaced from plantation land.</p> <p>The policy context for managing HCS/HCV forest in oil palm concessions is strong, backed by international agreements, and such standards could potentially be applied to other agriculture and non-agriculture sectors (e.g. to Timber Sales Contracts and to mining)</p>

Enhancement of forest carbon stock is judged to be less of a priority, at least in the short-term, because Liberia has more forested land that it can conserve compared to deforested land that it could reforest. However, the potential for reforestation and afforestation exists and pilot projects to test this option should form part of the REDD+ strategy. Reforestation was conducted by the FDA in the pre-conflict era, with commercial forest plantations and experimental wood fuel plots. These were destroyed during the conflict but small projects to explore the possibility of restoration have already been started. In parts of Liberia, such as Northern Lofa, where there are substantial deforested areas that have become unproductive savannah, there is the potential to experiment with forest enhancement on a larger scale.

4.1.1 The role of Protected Areas in conserving forest carbon stocks

The importance of Protected Areas was highlighted in chapter 2. The Proposed Protected Areas Network covers a large proportion of the national forest land and almost a fifth of the >80% forest that holds the highest carbon stock.

To be eligible for REDD+, the inclusion of Protected Areas must bring clear 'additionality'; in other words, it must enable conservation that would not have happened anyway. There are strong grounds for Protected Areas being eligible in the case of Liberia. A small minority of the proposed Protected Area Network is actually protected by legislation. Enforcement of conservation laws is very limited therefore existing and proposed Protected Areas are threatened by the drivers of deforestation described in this report. There is ample evidence from satellite imagery and from local projects that existing and proposed protected areas are being encroached and degraded. Protected Areas therefore represent the main strategy for conserving conservation stocks. The Protected Area Network as currently proposed provides the basis for extending the area under statutory conservation in the short term. The detailed survey and planning work that is required to prepare each Protected Area is likely to result in boundary changes in response to community preferences. In addition, there is also an opportunity to incorporate new areas because the current proposed network covers only 13% of the forested area whereas national forestry policy contains a commitment to conserve 30%. Several studies suggest where these new areas might be, and what this represents in terms of forest area and carbon stock that is placed under a conservation policy. A 2013 study of biodiversity hotspots recommended the use of conservation priority areas as the basis for the remaining Protected Area Network¹⁹. These conservation priority areas overlap with, but are different from, the current Proposed Protected Areas and bring the total area to the national commitment of 30% of all forest land. Alternatively, a study by FDA and UNEP from the same year uses Key Biodiversity Areas and

¹⁹ Junker, J., et al. Integrating wildlife conservation with conflicting economic land-use goals in a West African biodiversity hotspot. *Basic and Applied Ecology* (2015), <http://dx.doi.org/10.1016/j.baec.2015.07.002>.

International Bird Areas to identify conservation areas that cover 29% of Liberia's national area and contain 38% of Liberia's biomass carbon stocks²⁰.

Experience to-date has shown that the establishment of Protected Areas is a long process with many important steps along the way. As a REDD+ strategy option, the establishment of Protected Areas is therefore likely to be divided into a short-term objective – establishing a core of protected areas for which the planning is relatively advanced – and a longer term effort to expand and consolidate the national network.

4.1.2 Equity and sustainability

Because of the way in which Liberia's natural resources were used to fuel conflict rather than development, and because of the steps that Liberia has taken to break with this past and establish a natural resource economy that supports equity and sustainability, the REDD strategy should also prioritize strategy options for distributing REDD+ benefits fairly, and for investing REDD+ income so that the benefits are sustainable.

4.2 REDD+ strategy options

Under each of the strategic priorities, REDD+ strategy options are proposed. This includes a fifth priority, which is about the way in which REDD+ will be implemented so that the benefits from REDD+ are distributed fairly and are sustainable.

²⁰ Kantor, J., Bertzky, M., Ravilious, C., Kapos, V., Osti, M., Trumper, K., Dickson, B. (2013) Mapping potential biodiversity benefits from REDD+. Liberia. Preliminary Results. Prepared by UNEP-WCMC, Cambridge, UK; Forestry Development Authority, Government of Liberia, Monrovia, Liberia

Priority 1. *Reduce forest loss from pit sawing, charcoal production and shifting agriculture.*

- 1.1 Manage pit sawing (chain saw logging) to reduce loss of forest.
- 1.2 Reduce impact of charcoal industry on forest through better regulation, improved efficiency and the development of alternatives energy sources.
- 1.3 Increase area and productivity of non-forest land under permanent food and cash crops, to reduce the expansion of shifting agriculture.
- 1.4 Locate services and new infrastructure development in non-forest and less-dense forest areas.
- 1.5 Integrate hunting, artisanal mining and forest restoration into community-led livelihood and sustainable forest management practices.

Priority 2. *Reduce impact of commercial logging*

- 2.1 Ensure that all industrial logging is practiced to high conservation standards, so that loss of forest and biodiversity is minimized.
- 2.2 Conserve and maintain areas of high conservation value within commercial forestry concessions, such as important wildlife corridors.
- 2.3 Review Timber Sales Contracts to ensure compliance with forestry laws and EIA standards and establish a strong presumption against further TSC contracts on dense forest and within 3km of Protected Area.
- 2.4 Prevent unregulated pit sawing and charcoal production in forestry concessions.
- 2.5 Manage commercial forestry in community forests larger than 1,000 ha.4 to achieve sustainable logging standards as apply to FMCs.

Priority 3. *Complete and manage a network of Protected Areas.*

- 3.1 Complete the Protected Areas Network and strengthen management to prevent forest degradation
- 3.2 Expand the Protected Areas Network to conserve 30% of forest land
- 3.3 Reduce pressure on Protected Areas from surrounding communities (using measures from Priority 1).
- 3.4 Develop and implement land use plans at landscape scale, to integrate production and conservation.

Priority 4. *Prevent or offset clearance of high carbon stock and high conservation value forest in agricultural and mining concession.*

- 4.1 Conserve HCS-HCV forest within agricultural concession areas, including developing and implementing a policy for the sustainable management of these conserved areas (using measures from Priority 1)
- 4.2 Apply policy of conserving HCS-HCV forest to all agricultural concessions, including private farms larger than 1,000 hectares.
- 4.3 Ensure that mining result in zero-net deforestation, through mechanisms such as biodiversity offsets.
- 4.4 Locate future large-scale agriculture and mining concessions in less dense and non-forest areas.

Priority 5. *Fair and sustainable benefits from REDD+*

- 5.1 Define carbon rights and develop policies and regulations for upholding these.
- 5.2 Establish benefit sharing mechanisms for REDD+, in harmony with those operating in the forestry, mining, agriculture and other relevant sectors.
- 5.3 Operate a robust monitoring, reporting and verification system for demonstrating reductions in emissions achieved through REDD+ policies.

5. Appraisal of REDD+ strategy options

The strategic priorities and strategy options described above come from analysis of land use and forest cover and stakeholder consultations that indicates the most effective way to achieve REDD+ objectives.

Consideration must also be given to the economic efficiency of the strategy options and to their feasibility to be implemented, given the strengths and weaknesses of Liberia's institutions and regulatory framework. REDD+ strategy options must also be inclusive of safeguards on environmental and social issues. This chapter therefore provides an appraisal of the REDD+ strategy options, applying three forms of assessment:

- Cost-benefit analysis (CBA)
- Feasibility analysis
- Strategic environmental and social assessment (SESA)

The CBA and feasibility analysis were conducted as detailed studies within the LTS-NIRAS REDD+ strategy assignment. The SESA was conducted as a separate contract, within the R-PP Implementation Grants commissioned by the FDA, and is described in a separate report. What follows is the application of the findings from all three studies to the REDD+ strategy options proposed in the previous chapter.

5.1 Cost-benefit analysis

The CBA reveals the economic effects of the REDD+ strategy options. Three cost elements are examined in a detailed study conducted as part of the REDD+ strategy preparation:

1. **Opportunity cost:** REDD+ opportunity costs are the difference in net benefits from maintaining or enhancing forest cover and the net benefits from converting these forests and using the land for alternative purposes.

2. **Implementation cost:** The costs and investments required to implement REDD+, and to avoid or minimize displacement of emissions to other regions or sectors.
3. **Institutional cost:** Costs incurred at the political-administrative level to develop, manage and enforce REDD+ related activities as part of a national REDD+ program.

The main results of the CBA are presented below, however the full CBA report is provided in Technical Annex E.

5.1.1 REDD+ opportunity cost

The REDD+ opportunity cost is the cost to the land user of changing from their current land use to a form of land use that will reduce emissions from deforestation or forest degradation. Opportunity costs are important for implementation of the REDD+ strategy because they indicate the level of incentive that will be required to motivate a change of land use practices. If current practices are very profitable, the opportunity costs of foregoing that profit will be high and the land user will require a relatively large incentive to be persuaded to change.

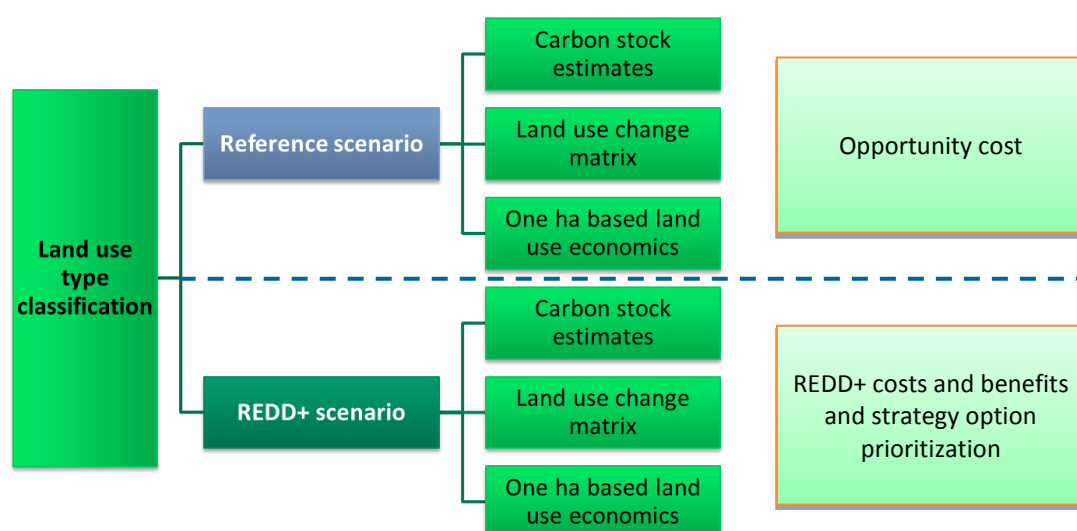


Figure 4 - Approach for assessing opportunity costs and REDD+ benefits

Economic models were developed for the various land uses to compare their financial performance under two scenarios: a reference scenario and a 'with

REDD+’ scenario. Under REDD+ management these land uses will change to more sustainable forms contributing to reduced pressure on forests, reducing the impact of forestry, and conserve carbon stocks.

An overview of the profitability of land uses under the business as usual scenario is presented in Figure 5. To show the relationship between land use profitability and the carbon stock associated with that land use, average carbon stock values for the latter are also indicated²¹.

The land use with the highest profitability (expressed as Net Present Value) and therefore the highest opportunity cost compared to natural forest is oil palm cultivation²², followed by agroforestry (cocoa, subsistence agriculture with long cycles) and commercial logging. Carbon stock is highest and NPV lowest in Protected Areas or forest not that is not allocated for concessions.

²¹ The land use labelled as "unused" forest is the same described as "un-designated" in chapter 2 and is subject to a variety of community/smallholder uses).

²² Oil palm cultivation by small holder farmers often includes processing fruit to oil. This value addition makes oil palm the most profitable crop. It cannot be compared to industrial size palm oil plantations and production and sale of fruit bunches to the industry by outgrowers – which was not included in this stage of the analysis.

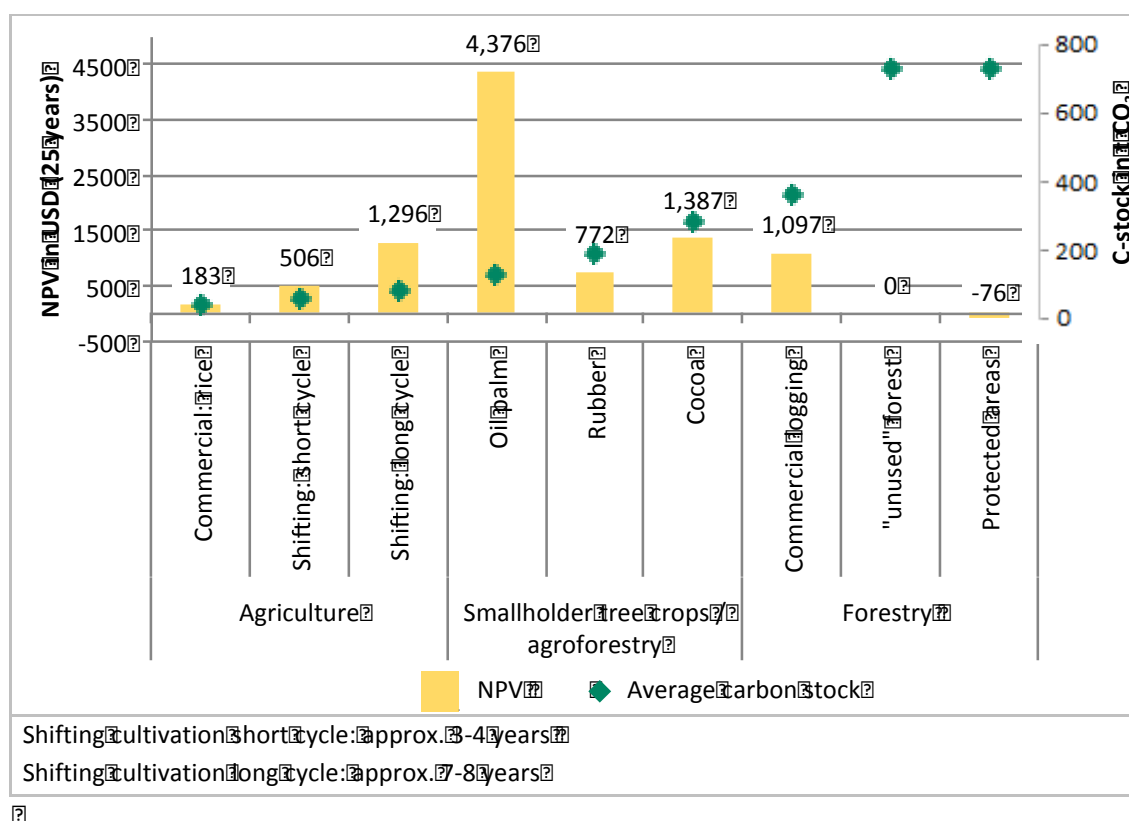


Figure 5 - Profitability of land use vs carbon stock (1ha) over 25 years

The opportunity cost is lowest for intensification of subsistence agriculture (shifting cultivation) and conversion of logging concessions to agriculture. The opportunity cost is highest for undisturbed forests converted to logging. Other main findings from the CBA include:

- The conversion of forest with no designated use to commercial logging produces a relatively large quantity of emissions and is profitable to the land owner/user. Preventing this land use change, or limiting it so that the level of logging is sustainable and maintains a high level of carbon stock, will therefore require a large financial incentive or strong regulation and enforcement.
- The conversion of non-designated forest and forest within Protected Areas to extensive shifting cultivation produces less, but still significant, emissions and benefits the land user financially. Expensive or robust interventions are therefore also required to prevent this conversion.
- Conversion of this same land type for intensive farming (permanent agriculture) produces a similar amount of CO₂ as conversion for

shifting agriculture, but produce less financial benefit to the land user (because of the higher input costs).

- Conversion of logged land for intensive farming produces relatively little emissions but the farming is less profitable than logging. Little incentive would be required to prevent this land use change and hence maintain the forest cover associated with commercial forestry.
- The conversion of land used for shifting agriculture to intensive farmed land is not a change that is likely to occur under the BAU because it comes at a high cost to the land user. A policy to encourage this conversion would therefore be expensive.

Further details on opportunity cost for the three strategies explored in this CBA are presented below:

- Complete and enforce a network of Protected Areas
- Maintain logging and other extractive forest uses at sustainable levels
- Reduce shifting agriculture by increasing the area of land under permanent agriculture.

Complete and enforce a network of Protected Areas

Protected Areas have the potential to protect forest and other high conservation areas from extractive and destructive uses. As previously mentioned, three PAs have been gazetted and another three are being processed by parliament for gazette. According to the last available budget the FDA has approximately \$3 USD/ha to manage the existing reserves²³. PAs in Liberia do not generate revenues, for example from tourism.²⁴ The low budget limits the conservation forestry department of the FDA to crisis management rather than proactive conservation work with land users or regular enforcement.

In comparison, the management of the recently gazetted East Nimba Nature Reserve is co-funded by ArcelorMittal²⁵ and is estimated to cost \$30 USD/ha,

²³ Source: FDA, personal communication

²⁴ Part of the income from forest concessions is channeled towards PA management. However, it is not considered as an income created by PAs.

²⁵ ArcelorMittal has mining operations in the area. The engagement in the ENNR is part of ArcelorMittal's environmental offset program.

which includes conservation agreements with communities and the development of alternative livelihood activities.²⁶

The cost of establishing and effectively managing the protected areas network will therefore be considerably higher than the budget that is currently spent by FDA and partners. The CBA indicates that management of PAs will always come at a net-cost. However, carbon savings can be substantial if compared to alternative land use forms and hence the potential to generate revenue from REDD+ payments is significant. Furthermore, 30% of the tax revenues to Government from commercial logging are meant to be directed towards conservation. Currently this income is mostly diverted into general government expenditure, to meet other spending priorities, but it represents another potential source of income for Protected Areas. There are therefore substantial and currently untapped revenue streams that could offset the heavy costs of conservation.

Another potential revenue stream is biodiversity offsets. This is the approach adopted by ArcelorMittal that delivers substantially more funding for conservation of East Nimba Nature Reserve. It has been proposed as an approach for the mining industry as a whole in Liberia (Johnson, 2014) and is potentially applicable to other industries (including agricultural concession) that result in the clearance of forest. The advantage of the proposed 'consolidated' approach to biodiversity offsets is that it allows resources to be directed into the areas of highest biomass and biodiversity value, and to fit into the national conservation policy. Individual site arrangements, in contract, would likely produce a more fragmented pattern of conserved and developed land that is less effective in both commercial and conservation terms and is more expensive to manage.

Sustainable forest management

Commercial forest management has been scrutinized in recent years in several studies and in preparation for the Voluntary Partnership Agreement (VPA) with the EU²⁷. Accordingly, the potential impacts of logging concessions on forests

²⁶ ENNR, with < 12,000 ha, is a very small PA and located in a densely populated area. Accordingly the boundary-area ratio (and resultant pressure by surrounding communities) is likely higher than in other PAs or proposed PAs.

²⁷ Part of Forest Law Enforcement, Governance and Trade (FLEGT)

and economics are fairly well documented. A sustainable forest management standard exists but it is not always well implemented by companies due to lack of enforcement. It has been estimated that the volume of timber harvested per hectare over the length of the FMC (25 years) exceeds the increment over the same period (Shearman, 2009). A reduction of volume harvested to sustainable levels would likely have a significant impact on the short-term profit of logging companies, reducing NPV (25 years) from > \$1,000 USD/ha to < \$300 USD/ha but could result an increase in carbon stock of > 200 tCO₂/ha over time (the time horizon depending on state of forest degradation)²⁸. The achievement of sustainable extraction rates is, in any case, necessary if the Government of Liberia is to achieve its policy objective of having a timber industry that generates employment and revenues in perpetuity.

The "business as usual" case for Community Forest Management Agreements (CFMAs) assumes harvesting of timber by small entrepreneurs paying fees to the community as well as reliance of the community on forests for subsistence (non-timber forest products and shifting cultivation) in a largely unregulated environment.

An NPV of approximately \$33 USD/ha²⁹ can be achieved in the absence of forest management cost to the community and likely overexploitation (and eventually conversion). Considerably fewer revenues accrue if communities formalize their claim in a CFMA and manage forests sustainably. The initial cost for forest management planning is especially high, while day-to-day management costs (monitoring, contract management, adjustment of plans) of the community are unknown and, hence, not included in the CBA. The estimated NPV (15 years) is only \$12 USD/ha but is offset by reduced emission reductions of > 300 tCO₂/ha.

Increase area under permanent agriculture

Agriculture in Liberia is dominated by subsistence farmers producing food crops and palm oil for home consumption and to a limited extent for sale in the local market (e.g. rice and palm oil) or the export market (cocoa). Farming of food crops (rice, maize, cassava, vegetables) relies usually on shifting cultivation and

²⁸ This analysis is based on the assumption that average forest growth and carbon sequestration rates are not changed by logging.

²⁹ Based on 15 years, duration of CFMA

little or no inputs such as fertilizer and pesticides. Likewise farmers cultivating permanent tree crops tend to use local unimproved varieties and few inputs, if any. As a result yields are low and product quality often not compliant with international standards (e.g. USAID 2015; GoL MoA 2007, personal communication CARI (Suakoko) and WIENCO).

Table 10 shows the difference in profitability of agroforestry and food crops with traditional and improved management for two example crops: cocoa and rice. Economic benefit over 25 years is estimated to be 10 to 20 times bigger than results achieved currently if applying modern agricultural practices, including inputs and improved varieties.

Table 10 - Cost and benefit of permanent agriculture

Table 10 – Cost and benefit of permanent agriculture				
Land use	Parameter	Management		Change
		BAU	REDD+	
Agroforestry: Example cocoa	Cost ¹ in USD/ha	7,346	17,290	13,764
	Revenues ¹ in USD/ha	8,800	33,000	
	NPV ^{1,2} in USD/ha	1,387	15,151	
	Carbon stock ³ in t CO ₂ /ha	261	261	± 0
	Change in NPV in USD/ t CO ₂ BAU to REDD+			N/A
Commercial food crops: Example rice (upland)	Cost ¹ in USD/ha	2,317	11,850	4,077
	Revenues ¹ in USD/ha	2,667	20,000	
	NPV ^{1,2} in USD/ha	183	4,260	
	Carbon stock ^{3,4} in t CO ₂ /ha	27	10	- 17
	Change in NPV in USD/ t CO ₂ BAU to REDD+			+ 239
¹ Cost, revenue and NPV presented were calculated over a timeframe of 25 years.				
² The discount rate of (10%) is applied				
³ Carbon stock/ha includes above ground and below ground biomass.				
⁴ Carbon stock traditional = shifting cultivation 3-4 year cycle.				

Higher yield per unit of land can relieve pressure for forest conversion, but more profitable agriculture may also create a reverse incentive, leading to accelerated forest conversion if not supported by a conservation policy.

5.1.2 Implementation cost

The implementation cost is the direct cost of the interventions required to achieve the objectives of a national REDD+ strategy. It also includes the cost of creating an enabling environment for implementation of REDD+ by government, civil society and private sector. Implementation costs depend on the scale of implementation; for example, how many households will be targeted or how big an area will be covered by the REDD+ activities. The potential scale in terms of area was derived from the most recent land cover assessment by Metria-GeoVille in 2015, and land use as recorded in available national data. The land cover classes, however, are broad and don't distinguish specific land uses such as shifting agriculture. Other data on land cover area is limited, as described in chapter 2, and so estimates of the potential scale of

implementation rely on various assumptions and are to be refined in the future as more information becomes available.

The estimated REDD+ implementation cost over 25 years is \$1.7 billion USD (Table 11). The establishment and maintenance of PAs alone is estimated to cost \$750 million USD, constituting over 40% of the total cost. On a per hectare basis, sustainable forest management (SFM) is the most attractive option with an estimated annual cost of < \$10 USD/ha. Interventions targeting the agriculture sector are comparatively expensive with annual costs in the range of \$50 USD/ha but are highly complementary to forest conservation (PAs and SFM) and have the potential to contribute to the economic development of Liberia (see section 5.1.1).

The extent to which these costs can be offset through REDD+ payments (see section 5.1.3) depends on the commitments of international partners to support REDD+ and potential market-based mechanisms.

Table 11 - REDD+ program cost and potential emission reductions

Strategy	Area		Program cost ¹		Average annual emission reductions ¹
	thousand ha		million USD	USD/ha*yr	t CO ₂ /yr
a) Complete and enforce a network of Protected Areas	Current area	200	750	24	14,000,000
	Additional area	1,000			
b) Maintain logging and other extractive forest uses at sustainable levels	Current	1,000	485	8	5,000,000
	New	1,300			
c) Reduce shifting agriculture by increasing the area of land under permanent agriculture	Cocoa	90	95	42	Supporting emission reductions in a) and b); Carbon sequestration may be possible
	Oil palm	50	340	54	
	Food crops	200			
Total	Forests	3,300	1,670	N/A	19,000,000
	Agriculture	340			

Strategy	Area	Program cost ¹		Average annual emission reductions ¹
	thousand ha	million USD	USD/ha*yr	t CO ₂ /yr
¹ Program cost and emission reductions are calculated for a timeframe of 25 years. Annual cost per ha will be higher to begin with, and then gradually reduce with improving management standards and capacities, and additional areas included in the activities.				

5.1.3 Potential REDD+ benefits

The CBA results are dictated by estimates of private profit and carbon stocks or CO₂ emissions. However, the implementation of REDD+ can create other benefits which tend to be 'non-market' and therefore hard to measure. Nonetheless these can be important to the overall calculation of net benefits and the public good.

Other environmental benefits from REDD+ include conservation of biodiversity and protection of soil and water resources. Examples of socio-economic benefits are economic development, improved food security and climate change adaptation.

Environmental benefits can be quantified in terms of, for example, number of species or area of ecosystems preserved and area of watersheds protected (erosion, pollution); but are difficult to quantify in economic terms as – with very few exceptions – no markets for these services exist. Socio-economic change is measurable as, for example, as part of the population gainfully employed, per capita income, agricultural yield, and number of food secure households; however these figures can be influenced by a variety of factors going well beyond REDD+ measures, such as population growth and development of markets. Accordingly the following quantification of REDD+ benefits should be seen as indicative rather than complete.

The **financial net benefits** of REDD+ are difficult to quantify, given that costs are highly dependent on the scale of implementation, capacity amongst implementing partners and local conditions. The revenue is equally uncertain as currently no international market for carbon credits from forest projects exists. In Table 12, two scenarios are presented assuming full scale implementation and

implementation cost as presented in the previous section, but using different carbon prices (\$2 USD or \$4 USD per tCO₂).

The establishment and management of PAs will likely always come at a substantial net cost, even when lowering the average management costs considerably. In contrast, SFM has the potential to create a net benefit of REDD+ finance, while ensuring continued benefits from these forests by future generations. Surplus finance should be used to reduce the burden on private sector and for programs outside forests which reduce pressure on forest land. Assuming a higher carbon price the combination of PA and SFM becomes financially feasible. The combination of PA with forestry – e.g. as buffer around PAs – has also the potential to reduce the cost of PA management.

Table 12 - Potential REDD+ benefits

		Reduced deforestation		Reduced degradation: change to SFM
		Primary forest	Logged over forest	
		PA	Planned forest utilization	
Area deforested / degraded in BAU (ha)		230,000	400,000	2,200,000
Area deforested / degraded in REDD+ (ha)		160,000	70,000	1,120,000
Net-area avoided deforestation / degradation over 25 years (ha) ³		70,000	330,000	1,080,000
Reduced emissions ¹	t CO ₂ /ha	695	312	210
	t CO ₂ 25 years	49	103	227
Potential REDD+ finance over 25 years (million USD)	at USD 2/t CO ₂	97	206	454
	at USD 4/t CO ₂	194	412	907
Implementation cost over 25 years ² (million USD)		750		486
Net-benefit over 25 years (million USD)	at USD 2/t CO ₂	-653		173
	at USD 4/t CO ₂	-556		833
	at USD 2/t CO ₂			-479
	at USD 4/t CO ₂			277
¹ Does not include potential gains/losses from intensifying agriculture/agroforestry. ² The implementation cost for REDD+ projects targeting agriculture and agroforestry are not reflected here. and potential losses/gains from agriculture ³ Deforestation and degradation will be reduced by implementing REDD+ measures; not altogether avoided.				

Positive socio-economic change can be linked to rising level of employment as well as increasing economic gain per unit of land. A comparison for the potential gain in employment is presented in Figure 6 as number of people employed in a given land use. Both forest conservation and large scale commercial forestry employ few people in comparison to agroforestry cash

crops such as cocoa – that require approximately 17 people per 100 ha – and food crops approximately 34 people per 100 ha³⁰.

Some interventions in the forestry sector, such as strengthening forest management standards, are likely to increase the costs of enforcing regulations. Changing from conventional logging to SFM is estimated to reduce NPV (after 25 years) by approximately \$800 USD/ha, a cost similar to the establishment and management of PAs. While the former is carried out by the private sector, government should take into consideration the long term sustainability of the forestry; in other words, consider easing the financial burden on forest enterprises posed by REDD+ measures.

Significant gains in yield and subsequently economic success can be generated by improving agriculture standards and creating an enabling environment. Thus, in the long term, public investments into agriculture is likely to be paid back, for example in increased tax revenue and reduced need for aid in rural areas.

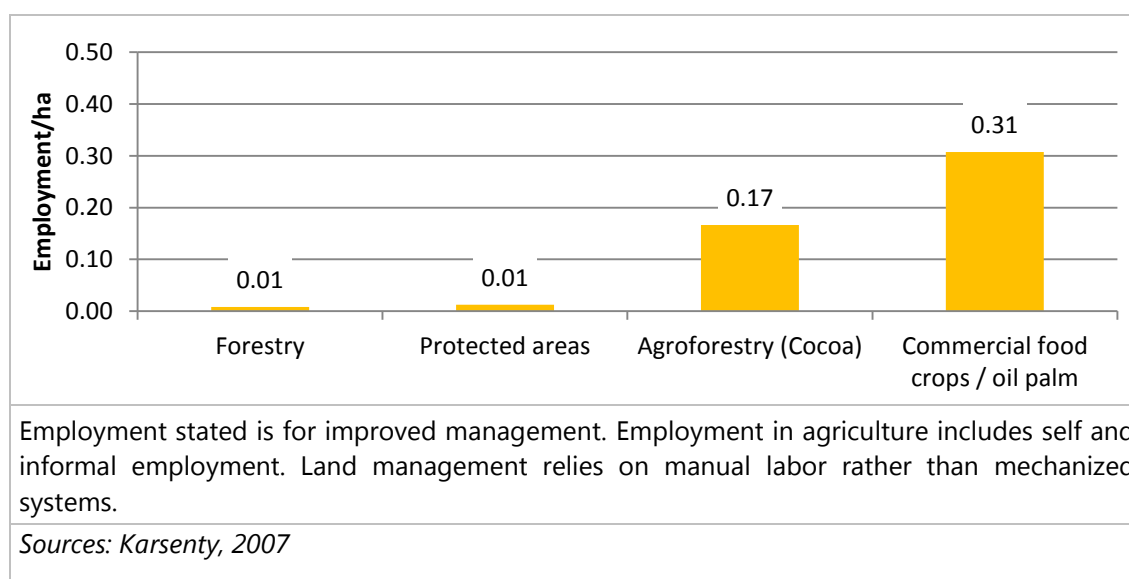


Figure 6 - Employment generated in different land uses

³⁰ Based on modern agriculture but not mechanized

5.1.4 Conclusions from Cost-benefit analysis

Conclusions on strategy options

Strategic priority 1: Reduce shifting agriculture by increasing the area of land under permanent agriculture.

Improved management of agricultural land will result in a clear net gain to farmers and investors. Agroforestry implemented on degraded land has the potential to sequester carbon, although the definition of forest recently adopted excludes industrial agricultural plantations; however it may allow for the inclusion of mixed agriculture, forestry and conservation systems. Improved management of annual crops will increase yields and contribute to reducing pressure on forests. However, considerable public sector investment will be required to change agricultural practices in Liberia.

Strategic priority 2: Maintain logging and other extractive forest uses at sustainable levels.

Sustainably managed forests that are commercially logged can store a lot of carbon per hectare and retain many of the other values inherent to natural forest (e.g. biodiversity and watershed protection). Unlike Protected Areas, commercial forestry creates reasonably certain market revenues, making it suitable to private sector involvement both at small (CFMA) and large scale (FMC). Additionally, the financial burden of the government for implementation of sustainable forest management is considerably lower than for the management of Protected Areas.

Strategic priority 3: Complete and enforce a network of Protected Areas.

Both carbon stock conservation per hectare and scaling-up potential are high, suggesting PAs should be high on the list of REDD+ strategy options. However, effective PAs in Liberia will be costly to establish and manage and revenues are small or uncertain – e.g. potential REDD+ payments, conservation levy on commercial forestry; biodiversity offsets from mining and other deforesting industries, biodiversity conservation funds from international funders.

Broader implications for REDD+ strategy

Potential REDD payments are unlikely to cover all investments and costs for implementing the REDD+ strategy. Accordingly, the potential REDD+ payments

can only be seen as a trigger for a REDD+ friendly development pathway for the forestry and agricultural sectors, rather than the sole means to it.

REDD+ investments must be prioritized, weighing the potential GHG emission reductions, cost of interventions and likely impact on the socio-economic development potential of Liberia. For example sustainable forest management comes at low public cost (but high private sector cost) and can generate substantial GHG emission reductions in comparison to, for example, agriculture. Stimulating agroforestry crops as an alternative to shifting cultivation requires a significant public expenditure but also creates multiple benefits – contributing to reduced deforestation/carbon sequestration and economic development in rural areas.

Agricultural intensification increases profit per unit of land and can reduce the need for agricultural expansion if combined with effective land use planning and better legal framework and its enforcement. The burden on REDD+ finance can be reduced by increasing reliance on the private sector in the outreach to farmers.

Effectively managed Protected Areas can be expensive. Cost efficiency can be improved by concentrating PAs on large areas. Wherever possible, alternative revenue streams (e.g. biodiversity offsets) should be identified.

Sustainable forest use can be a mechanism for forest protection. SFM should be seen as an alternative and/or complementary approach to PAs, with the combination being considerably less costly. However, if SFM is to have a protective function it must be supported by better regulations, enforcement and alternative livelihoods for people relying on forests (similar to PAs).

Private sector will carry a large share of the financial burden of implementing SFM, in particular in terms of reducing annual allowable cut to a sustainable rate. To support the transition from current logging practices to more sustainable ones, more and better evidence regarding the impact of different logging practices on long term sustainability of forestry must be generated.

The costs and benefits presented here must be revised and adapted in the near-future as new/more information becomes available.

5.2 Feasibility analysis

In this section, barriers to REDD+ implementation are examined along with the policies and measures that would be required to overcome these barriers. The purpose is to assess the feasibility of implementing the REDD+ strategy options. The assessment is based on information gathered during fieldwork in Liberia and consultations with organizations in the natural resource management and land use sectors.

In this section, particular attention is paid to institutional and governance barriers because financial and investment barriers have already been considered in the cost benefit analysis, while environmental and social barriers are discussed in the following section.

Issues such as institutional capacity, governance and land tenure tend to be cross-cutting; potentially affecting the various strategy options in similar ways. The feasibility analysis therefore begins with the two basic types of intervention that are applicable to the REDD+ strategy options:

1. Providing alternative livelihoods and fostering economic development in communities to reduce their dependence on destructive uses of forests;
2. Effectively planning, regulating and enforcing the use of forest resources in the country.

Incentives and regulation, often referred to as "carrots and sticks" are the basic levers available to effect change.

5.2.1 The main barriers to changing livelihood practices

Agricultural alternatives to extensive shifting agriculture include developing more intensive and higher yielding cultivation on permanently farmed land. The main example of this in Liberia that is already promoted by national agricultural policy and supported heavily by international donors is the development of lowland "swamp" rice farming. As highlighted in the CBA, this is an expensive option and requires considerable technical and other support. Despite donors spending \$35-50 million USD per year on rice farming, a review of the effectiveness of agricultural expenditure led by the World Bank in 2013

concluded that there had been no detectable increase in yield per hectare or land productivity³¹.

Promoting tree cash crops (cocoa, oil palm, rubber) amongst smallholders is also a popular option that reflects current practices and which can provide a good mix of profitability and forest cover, according to the CBA analysis. It can reduce dependence upon subsistence agriculture and increase the profitability of land.

A third possibility, again well-recognized in the agricultural sector, is to increase the productivity of the existing farming practices. Through the use of artificial fertilizers or natural soil and nutrient enhancement methods, clearings in the forest can be cultivated for longer. This allows a longer time for the forest to re-establish (and sequester carbon) in the abandoned clearings. There is some experience of conservation agriculture in Liberia at project level, including a REDD+ pilot project in the Wonegizi³² Proposed Protected Area and in the biodiversity conservation program for the East Nimba Nature Reserve³³.

Non-agricultural alternatives include support for micro- and small businesses (trading, services and manufacturing) and the formalizing of industries such as pit sawing and charcoal production to improve productivity and sustainability. Improved technology can improve the efficiency of production – e.g. portable sawmills or more efficient charcoal kilns. The use of land for charcoal and firewood lots can relieve pressure on natural forest.

Such strategy options, which aim to change land use practices by encouraging alternative forms of livelihood, typically face the following barriers in Liberia:

³¹ Orłowski et al (2012) Liberia: Agricultural sector public expenditure review, January 2013.

³² Rothe (2015) Wonegizi Community-based REDD+ Project Plan Vivo Project Validation. Report to Fauna & Flora International, April 2015

³³ Arcelor Mittal (2015) Annual Report: Biodiversity programme for East Nimba Nature Reserve

Lack of access to capital	<ul style="list-style-type: none"> • Absence of a national agricultural development bank • No access to commercial agricultural microcredit • Very limited access to entrepreneurial microcredit • Limited or no ability to provide loan collateral
Lack of experience with new techniques and business in farmers and rural communities	<ul style="list-style-type: none"> • Lack of organized agricultural, forestry and charcoal business institutions providing capital (or inputs) and technical know-how to farmers, pit sawyers or charcoal burners

Possible actions to overcome these barriers to livelihood alternatives are to:

- Stimulate access to rural and agricultural credit, e.g. by making low-interest, patient capital available to lenders and re-introducing a state-owned agricultural development bank
- Support rural capacity building on technical and business know-how by businesses and NGOs
- Fiscally support agricultural companies working on out-grower models (while safeguarding farmers' development opportunities)

These are all familiar types of development interventions, which highlights the importance of 'mainstream' agricultural and rural development to the achievement of REDD+ objectives. The scale of funding and the level of outreach and technical support that is available in mainstream agricultural and development projects is much greater than that which the forestry and conservation sectors alone can apply.

General economic development, the growth of jobs opportunities, services and infrastructure in less forested and more populated areas may similarly play an important role in relieving pressure on forests. In most cases, REDD+ financial support should be targeted at applying agricultural and development support for particularly forest-dependent communities, but in some cases, the most

effective strategy may be to target places and markets that are outside the forest area but which create the demand for its products. For example, most charcoal is consumed in urban areas, so efforts to reduce consumption or shift to alternative sources should be aimed at urban rather than forest areas.

5.2.2 Barriers to the better regulation of forests

Conservation of carbon stocks – by establishing sustainable logging practices in forestry concessions, by completing the Protected Areas network and by conserving high carbon stock forest in palm oil concessions – requires a strong regulatory framework and an effective relationship between communities, government and industry.

Regulatory framework

Much progress has been made in the regulatory framework for forestry and environmental management in Liberia in the past decade. This is supported strongly by international donors, initially US-led through the Liberian Forestry Initiative and now driven particularly by the bilateral agreement between Liberia and Norway and the EU-funded voluntary partnership agreement. From this experience there is a good understanding of the strengths of the regulatory framework and the remaining weaknesses. The policy and legal framework for REDD+ in particular is subject to a separate study and report within the project to develop a REDD+ strategy, and will inform the final strategy. Because REDD+ is a relatively new topic for many stakeholders in Liberia, necessary laws are yet to be developed. There is no national policy and law governing carbon rights. Nor is there a carbon accounting system, forest inventory or National Forest Monitoring system.

Implementation of policies and enforcement of laws

Despite the various gaps in the regulatory framework, experience has shown that the larger barriers are to do with the implementation of policies and the enforcement of laws. This is partly due to the limited capacity of the forestry sector (limited budgets, skills, training, equipment etc.) but after more than decade of 'capacity building' it is also clearly due to a difficulty with applying the capacity that has been acquired to achieve measurable results. Government bodies such as FDA are pre-occupied with securing sufficient budget from

central government, with necessary internal reforms to develop a skilled and motivated workforce and with immediate ‘fire-fighting’ (crisis management). These internal challenges need to be overcome before the focus of government institutions can switch from internal matters to delivering results.

Existing forest laws are not always followed at national level – e.g. granting of logging concessions – or enforced on the ground – e.g. protection of Protected Areas. The challenges to forest governance in Liberia are well documented³⁴. Yet good governance is essential for the integrity of the National Forest Monitoring System that is a vital component of a national REDD+ program. Liberia's progress with establishing the laws, systems and institutions for the verification of legal logging (the FLEGT-VPA) is important in terms of establishing a framework that is relevant to REDD+.

Although forestry reform laws and policies tended to be developed in isolation in the past, this is increasingly less the case now. For example, the preparation of the incoming national Land Rights Act prompted some adjustment to the regulations for the Community Rights with Respect to Forest Land law which preceded it. Similarly, the land inventory and dispute resolution procedures in the new Land Rights Act will set the framework for how this is to be done within the forestry sector and REDD+. The REDD+ strategy must therefore be outward looking and aware of the wider policy context.

In government, the institutional leadership and framework of supportive policies for land use planning are evolving. In 2013, the Ministry of Finance and Development Planning took over the planning brief previously held by the Ministry of Planning and Economic Affairs. The Land Commission took the lead in starting work to establish a national inventory of land use and detailed urban plans, and is due to be replaced by a new Liberia Land Authority³⁵. There is not yet an integrated approach to land use at a national level (hence the issue of overlapping concessions granted by different government ministries).

³⁴ Making the Forest Sector Transparent Liberia VPA Transparency Gap Assessment 2012. SDI Global Witness. Liberia: Assessment of key governance issues for REDD+ implementation through application of PROFOR forest governance tool, funded by FCPF-World Bank, 2013

³⁵ The Land Authority Bill (2015) aims to establish institutional arrangements for governing land rights, land management, land governance and land administration. Financial and technical support is provided by a five-year The Land Governance Support Activity (LGSA) project sponsored by USAID and implemented by TetraTech.

The technical and financial capacity in the bodies with a central role to play in land use planning, including FDA, EPA, Ministry of Land Mines and Energy and Ministry of Public Work is limited. There is a lack of budget for the recruitment and retraining of staff and technical knowledge/experience on forest inventories, forest management plans, Reduced Impact Logging (RIL) etc. is also limited.

There is also political opposition to the suspension or review of logging concessions, and to the expansion of Protected Areas. Consequently, the passage of legislation to establish each Protected Area is very slow.

The companies, communities and individuals who work in pit sawing and charcoal production are not collectively organized, and therefore difficult to engage. The 'barriers to entrance' to both industries are very low, especially for charcoal production, and they are therefore livelihoods on which poor and marginalized sections of society depend. Large and small companies generally benefit from the lack of regulation and so are likely to oppose regulation, and will seek the support of political representatives.

Measures to overcome barriers

The key actions for REDD+ required to overcome these barriers include:

- Building institutional and technical capacity in the FDA and EPA to contribute to the Land Authority, once it is established. The purpose of this is to strengthen the technical assistance for land use planning as it affects REDD+ priority policies and areas.
- Building financial, institutional and technical capacity in FDA for:
 - Understanding and enforcing sustainable forest management (including Reduced Impact Logging)
 - Community Forest Management application reviews and approval
 - Enforcement to ensure that management plans for FMCs and CFMAs are adhered to.
 - Conducting forest inventories, applying GIS methods and MRV best-practice.
 - Managing the pit sawing and charcoal production industries.

Performance-based payments

The bi-lateral agreement between Norway and Liberia is a 'game-changer' because it offers the possibility of performance-based payments for reducing emissions. For the first time in Liberia, REDD+ has become a serious potential income stream from forest management, to be considered alongside logging and other uses. Liberia's increased commitment to REDD+ may result in a review of the logging concessions that have been proposed but not yet finalized. And, as mentioned earlier in this report, the scale and location of proposed Protected Areas are likely to be reviewed to suit changed conditions on the ground and, possibly, to increase the area allocated for conservation to meet the national commitment to conserve 30% of forest land. Thus the general landscape for forest management is uncertain and highly challenging, although it is also rich with opportunities.

5.2.3 Liberia's experience of REDD+ pilots

Fauna & Flora International (FFI) implemented a community-based REDD+ pilot project from 2010 to 2014, funded by the Norwegian development agency, NORAD. The key objective was to establish two REDD+ demonstration sites through agreement with communities. After several years of failed attempts to do this in communities surrounding Sapo National Park in Sinoe County, the project succeeded with communities adjacent to the Protected Area of Lake Piso (South-West Liberia) and the Proposed Protected Area of Wonegizi (North-Western border with Guinea).

An evaluation of the project concluded that under the prevailing conditions in Liberia, REDD+ projects with forest-dependent communities could only be established in Protected Areas or areas designated as such³⁶. Outside of these areas, where commercial interests in logging, oil palm, rubber and other extractive industries are intense and under regulated, the uncertain benefits of REDD+ could not compete.

³⁶ Rothe (2013) Final evaluation of the Bridging the Divide Project of REDD Demonstration projects in Liberia. Report to FFI, December 2013.

Since this evaluation, the location and extent of various land uses has become slightly clearer (see section 2), raising the possibility that REDD+ can play an important role beyond Protected Areas. For example, within the palm oil concessions it has become clearer that there will be areas cleared for plantation, and substantial areas of high carbon stock and high conservation value forest that are not cleared.

The activities in Wonegizi have continued, recently focusing on carbon assessment, establishing conservation agreements with communities, provision of alternative livelihoods and the development of benefit sharing mechanisms. The experience of this project, as well as almost ten years of community forestry work sponsored by USAID, is that community-based conservation is difficult, expensive and very time consuming. Nonetheless, the vital progress achieved towards a visible demonstration of REDD+ in practice and the valuable lessons learned point to the importance of continuing - and greatly expanding - the level of practical implementation of REDD+ activities. It suggests that a 'learning by doing' approach should be a core feature of Liberia's REDD+ strategy.

5.3 Strategic environmental and social assessment

This section awaits the final "priorities Report" from the SESA contract which sets out social and environmental priorities, against which the potential impact of REDD+ policy options can be assessed. This SESA report will include recommendations of ways in which to address the priority issues in the strategy option development.

Based on early results of the SESA study, potentially negative impacts of REDD+ options on environmental and social issues are described in table X, along with the positive contribution that REDD+ strategy options could potentially make to these issues.

Table 13 - Impact of REDD+ strategy options on environmental and social priorities

Social and Environmental priority issues, by type	Potential negative impacts of REDD+ strategy options	Potential positive contribution of REDD+ strategy options
A. Biophysical –		
A.1 Climate Change		REDD+ strategy options all have a positive impact on climate-change related issues.
A.2 Biodiversity Conservation		Positive impact on biodiversity conservation issues.
A.3 Water and Soils	Agricultural intensification results in water and soil pollution (e.g. through use of inputs such as pesticides)	Other policy options aimed at conservation of carbon stocks with have positive impact on soil and water quality.
A.4 Governance	Pressure for establishment of protected areas and for control of land uses such as pit sawing and charcoal could aggravate lack of stakeholder involvement.	The policy options and strategy as a whole will contribute to the "mainstreaming" of forest conservation and to the strengthening of institutions.
B. Micro-economic		
B.1 Food security, Livelihoods and development potential	<p>Policy options that constrain or discourage shifting agriculture and other forest-using practices (e.g. expansion of Protected Areas) may increase food insecurity if development of alternative livelihoods for affected communities is not achieved.</p> <p>Restrictions on charcoal production and pit sawing may reduce employment and incomes of poorest and</p>	<p>REDD+ payments are a potentially significant source of funding to support alternatives to logging and other sources of income which degrade the forest resources that communities rely upon.</p> <p>Measures to increase productivity and develop alternative livelihoods may reduce dependence of shifting agriculture and</p>

Social and Environmental priority issues, by type	Potential negative impacts of REDD+ strategy options	Potential positive contribution of REDD+ strategy options
	most marginal people (landless, displaced people, women in subsistence economy)	improve food security and incomes.
B.2 Land	(as above): Restrictions on charcoal production and pit sawing may reduce employment and incomes of poorest and most marginal people (landless, displaced people, women in subsistence economy)	
B.3 Community cohesion	Changes to land use and distribution of REDD+ benefits could damage community cohesion if done without consent and unfairly.	
B.4 Governance	If not distributed fairly, REDD+ benefits could be a source of conflict.	Measures to achieve REDD+ strategy options support the strengthening of governance arrangements at all levels.
C. Macro-economic issues		
C.1 Revenues (foreign)	The imposition of higher standards and tighter controls on logging operations will reduce short-term profitability to private operators and potentially revenue to government.	<p>The scale of potential REDD+ payments is better known as a result of the bilateral REDD+ agreement with Norway.</p> <p>Improved forest management will improve the long-term viability and revenue-generating capability of the industry.</p>

Social and Environmental priority issues, by type	Potential negative impacts of REDD+ strategy options	Potential positive contribution of REDD+ strategy options
C.2 Supplies and Services for domestic market	Greater regulation of the pit sawing and charcoal sectors will result in increased prices for urban and rural consumers.	
C.3 Jobs	<p>Stronger regulation of forestry is likely to suppress activity and hence employment.</p> <p>If REDD+ measures to improve community livelihoods and services are focused on densely forested area, they may result in increased population and hence increased pressure on forest.</p>	<p>Spending of REDD+ income on education, health, enterprise creation etc. will increase employment.</p> <p>A sustainable forestry sector offers long-term employment opportunities.</p>
C.4 Governance (accountability and transparency)	Changes to land use and the introduction on REDD+ payments could increase land use conflicts unless done with consent and with a fair allocation of benefits and costs.	REDD+ policy options aim to improve governance of the forestry and related sectors and will include measures to improve regulation, transparency and enforcement.

Source: Based on preliminary results from the SESA study.

5.4 Appraisal results and implications for strategy options

In this interim report, the results of the appraisal exercise are presented but not applied to the preliminary strategy options. A high-level and tentative summary

of their possible implications for REDD+ strategy priorities is given in the table below, but a more rigorous appraisal will be done in the following work. In the light of this, the preliminary strategy options will be revised.

Table 14 - Initial appraisal of REDD+ strategic priorities against results of CBA, Feasibility Analysis and SESA.

CBA	Feasibility	SESA
Priority 1: Support the sustainable use of forests by communities; to prevent expansion of shifting agriculture and other small-scale activities degrading and clearing areas of highest value forest.		
Changing agricultural practices requires costly incentives, but cash crops especially are profitable potentially and employment benefits of agriculture are high.	Neither government or communities have much capacity for supporting or making changes to land use	Changes risks food security and livelihoods of most vulnerable. Incentives are likely to benefit elites.
Priority 2: Reduce impact of logging in Forest Management Contract and Community Forest Management Agreement areas.		
Sustainable forestry practices reduce profitability to operators, but offers good balance of economic performance and emissions reductions	Laws and policies for sustainable forestry are well established. Enforcement is weak but improving through VPA etc.	Tighter controls on community practices like pit sawing and charcoal may reduce livelihood options for vulnerable groups.
Priority 3: Complete and protect a network of Protected Areas, including existing and Proposed Protected Areas and proposed conservation priority areas.		
Protected areas are costly to establish and manage but are highly effective at producing environmental benefits.	Policy and legal framework is strong although capacity limitations and community rights issues make establishing PAs a lengthy process.	Protected Areas can exclude communities from livelihoods, food security and land rights unless carefully managed.
Priority 4: Prevent or offset clearance of high carbon stock and high conservation value forest in agricultural and mining concession.		
High thresholds for HCV and HCV forest will constrain economic benefits of palm oil etc.	International standards for 'zero-deforestation' are strong although easier to	Management of land in large concessions may exclude communities and infringe rights, but also

although benefits of access to certified markets (and environmental benefits) outweigh costs.	implement with larger reputable companies.	offers important employment/income opportunities.
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