THE GOLA REDD PROJECT

Project Title	*The Gola REDD Project*
Version	*4.0*
Date of Issue	*10 January 2021*
Prepared By	*The RSPB on behalf of the Gola Rainforest Conservation LG (the project proponent) with technical assistance from Winrock International, USA*
Contact	*Richard Dixon, RSPB, UK Headquarters, The Lodge, Sandy, Bedfordshire, SG19 2DL, UK tel +44 (0) 1767 680551richard.dixon@rspb.org.uk*

CONTENTS

List of Figures

List of Tables:

1 PROJECT DETAILS

1.1 Summary Description of the Project

The Gola REDD project helps to conserve the forested areas of the Gola Rainforest National Park (GRNP) in south east Sierra Leone. The GRNP and adjacent forests are Sierra Leone's largest remaining area of Upper Guinea Tropical Forest, a forest type recognised as a global biodiversity hotspot (Myers et al 2000). The area contains 60 threatened species, including 8 endangered and 1 critically endangered species (Klop et al. 2008).

Gola Rainforest Conservation LG, a not-for-profit company manages the Gola REDD project. The Gola REDD project is an avoided deforestation project designed to tackle the threat to the forest of unplanned deforestation due to encroachment of smallholder agriculture. In this Project Document (PD) the Gola REDD project is renewing its baseline. The projects will generate GHG emission reductions through the following measures:

i) improve the conservation strategy and enhance the management effectiveness of the GRNP

ii) enable sustainable resource management throughout the project zone by engaging in a suite of livelihood improvement activities with local communities

iii) develop a monitoring program that provides robust information to underpin management decisions and a research program that allows GRNP to become recognized as an international centre of excellence and

iv) build a conservation trust fund that will provide a means of ensuring conservation actions last beyond the lifetime of the project.

Incomes from credit sales will provide a stream of revenue that contributes to conservation and livelihoods to reduce emissions from unplanned deforestation activities.

Prior to the project: The GRNP was a production forest but under inadequate conservation management. The Forestry Division within the Government of Sierra Leone's Ministry of Agriculture, Forestry and Food Security (MAFFS) is responsible for the management of the nation's forests, including GNRP. Current funding levels results in a lack of capacity and finances to effectively manage forest areas protected by legislation resulting in encroachment and widespread deforestation within the country's protected areas.

Conservation actions as a direct result of the Gola REDD project will protect these species, preserve the 68,340 ha of tropical forest and has conserve over 3.9 million tonnes of CO_2-e since its inception in 2012[1], as well as provide livelihood support to the 122 impoverished communities that surround the GRNP.

The Gola REDD project is the first REDD project to be developed in Sierra Leone and West Africa and aims to demonstrate that protecting forest resources can be both socially and environmentally beneficial. It is envisioned that it will pave the way for future projects of a similar nature that will provide Sierra Leone with a viable sustainable alternative to forest conversion and biodiversity loss.

Because this is a baseline renewal, and therefore the second PD, this PD at times will reference the original PD (2015) where we deem it unnecessary to repeat existing information.

[1] No including leakage or other deductions.

1.2 Sectoral Scope and Project Type

For the second baseline the project remains within sectoral scope 14 "Agriculture Forestry and Other Land Use" of the VCS. It is a frontier Avoided Unplanned Deforestation (REDD AUDD) project and is not grouped.

1.3 Project Eligibility

This project is eligible under the VCS program as a REDD AUDD as per *Table 1. Decision Tree for Determining REDD Project Activity Type and ARR Suitability Is the forest land expected to be converted to non-forest land in the baseline case, or expected to be subject to authorized conversion to a managed tree plantation in the baseline case?* and is under its second verification. See the current MIR report and original PD (2015) for more details.

Table 1. Decision Tree for Determining REDD Project Activity Type and ARR Suitability Is the forest land expected to be converted to non-forest land in the baseline case, or expected to be subject to authorized conversion to a managed tree plantation in the baseline case?

<table>
<tr><td colspan="4">Is the Forest land expected to be converted to non-forest in the baseline case?</td></tr>
<tr><td colspan="2">Yes</td><td colspan="2">No</td></tr>
<tr><td colspan="2">Is the land legally authorized and documented to be converted to non-forest?</td><td colspan="2">Is the forest expected to degrade by fuelwood extraction or charcoal production, in the baseline case</td></tr>
<tr><td>Yes</td><td>No</td><td>Yes</td><td>No</td></tr>
<tr><td>Avoided planned deforestation</td><td>Avoided unplanned deforestation</td><td>Avoided forest degradation</td><td>Proposed project is not VCS REDD activity currently covered by the module framework</td></tr>
</table>

1.4 Project Design

The project is a single installation.

1.5 Eligibility Criteria

This is not a grouped project see original PD.

1.6 Project Proponent

Organization name	The Gola Rainforest Conservation LG
Contact person	Alusine Fofanah

Title	Protected Area Manager
Address	147 Dama Road, Kenema, Sierra Leone
Telephone	00 232 76418272
Email	asfofi@yahoo.co.uk

1.7 Other Entities Involved in the Project

Table 2. information and roles/responsibilities for any other entities involved in the development of the project.

Organization name	The Royal Society for the Protection of Birds (RSPB)
Role in the project	• Member of the Gola Rainforest Conservation LG and a representative sits on the board of directors • Act as authorized representative on behalf of the Gola Rainforest Conservation LG • Technical lead in the development of the documentation required to validate and verify the project under VCS and CCB standards • Market and negotiate the sale of any project credits • Provide technical and management assistance to the project implementers throughout the project lifetime
Contact person	Richard Dixon
Title	Greater Gola Landscape Programme Manager
Address	RSPB UK Headquarters, The Lodge, The Tropical Forest Unit, Sandy, Bedfordshire, SG19 2DL, UK.
Telephone	+44 (0)1767 680551
Email	richard.dixon@rspb.org.uk
Organization name	Winrock International
Role in the project	• Provide technical support during project development and validation, particularly in the development of the mapping and modelling components of the project
Contact person	Michael Netzer
Title	Program Associate
Address	2121 Crystal Drive, Suite 500, Arlington, Virginia 22202-3706,USA

Telephone	001 8056167903
Email	mnetzer@winrock.org

1.8 Ownership

The project proponent is the Gola Rainforest Conservation LG, a not-for-profit company formed by 3 partners; the Government of Sierra Leone, represented by the Ministry of Agriculture, Forests and Food Security, the Conservation Society for Sierra Leone (CSSL) and the Royal Society for the Protection of Birds (RSPB).

See the VCS Listing Representation (https://registry.verra.org/app/projectDetail/VCS/1201). The company's objectives are dedicated to the conservation of the Gola forests, the protection of biodiversity and working with local communities towards sustainable development objectives and equitable distribution of benefits from the revenues created by the project. The project will be implemented on the ground by the GRNP management department of the Gola Rainforest Conservation LG.

As per the original PD (2015), the GRNP has ownership of the project by virtue of a statutory agreement with the Government of Sierra Leone through contractual right of the land, vegetation and conservational management process that is leading to GHG emission reductions and/or removals.

As per the original PD, the project proponent has full right of use in respect of the project and all emission reductions or removals generated thereunder by virtue of having an enforceable and irrevocable agreement with the holder of the statutory and property rights in the land and vegetation that generates GHG emission reductions or removals, namely the Government of Sierra Leone, as per paragraph 3.11.1 (6) of the VCS Standard. The following describes (i) the nature of and evidence demonstrating the statutory and property rights of the Government of Sierra Leone in the land and vegetation in question; and (ii) the agreement that has been entered into between the project proponent and the Government of Sierra Leone with respect to the implementation of the project.

Statutory and property rights of the Government of Sierra Leone

The Gola Forest was originally designated as forest reserves through the following Forest Reserve Orders (See forest reserve orders file in the references):

The authority for these designations arose from the Forestry Ordinance, Cap 86 of 1924 and its successor, the Forestry Act, Cap 189 of 1960, respectively. Under these acts, the Government of Sierra Leone was vested with extensive management rights over the Gola Forest Reserves, including the right to use the area for production or protection objectives. When the Forestry Act, Cap 189 was later replaced by the Forestry Act 1988, the new Act expressly stated that all Forest Reserve Orders in force would remain in force unless revoked by the Minister (section 33(1)).

In 2010, the Government of Sierra Leone extended its rights in and over the Gola Forest through its designation as a national park, effected through the Proclamation for the Constitution of the Gola

Rainforest National Park (Statutory Instrument No.15 of 2010 – Gola NP proclamation). Under the Wildlife Conservation Act 1972 (provided as a reference to Fofanah 2012), national parks are subject to a high degree of Government management and control, including the right to make regulations and conduct activities to manage and conserve vegetation and to prohibit and enforce any actions that might endanger such vegetation (see, inter alia, sections 6, 7, 43, 66, 67, 74 and 75).

In addition, the process of the creation of a national park itself involves the extinguishment of any competing rights with respect to the area of the national park. This is done through a process whereby any persons with claims to land rights within the proposed national park are invited to submit such claims and, where no such claims are submitted they are deemed to be extinguished (see Wildlife Conservation Act 1972, sections 11 and 17 provided as a reference to Fofanah 2012). As evidenced by the Report of the Proceedings of the Reserve Settlement Court (provided as a reference to Fofanah 2012) and the Proclamation for the Constitution of the Gola Rainforest National Park, this process was duly completed in respect of the Gola Rainforest National Park, including an extensive sensitization campaign that included meetings and radio and television announcements, and no claims were submitted. Following the completion of this process and the designation of the Gola Forest as a national park, therefore, the Government of Sierra Leone possessed full Right of Use with respect to all land and vegetation in the project area.

While the designation of the Gola Forest as forest reserves and later as a national park vested the Government with full Right of Use, the Government of Sierra Leone has long recognized the customary rights of the historical landowners in the project area. In recognition of these rights the Government of Sierra Leone entered into agreements with each landowning family claiming customary tenure inside the project area under which such landowners agree to transfer full title to any credits generated through the project to the Government, as well as to refrain from engaging in any actions that may interfere with the execution of the project, in return for benefits which are agreed in a separate benefit sharing agreement (See REDD Benefit Sharing Agreement, Appendix E Tatum-Hume et al 2013a). A sample of these agreements is found in the Forestry Division report 2013, annex 2).

Agreement between the project proponent and the Government of Sierra Leone

The project proponent has a Joint Venture Agreement (these confidential documents can be provided to the auditor on request) with the Government of Sierra Leone under which the Government of Sierra Leone transfers the full rights to carry out the project and generate emission reductions and removals. This includes, inter alia, the following rights:

(i) The right to do all things necessary to develop the project under the VCS and generate emission reductions and removals (clauses 4.1(b) and 6.1(a));

(ii) The right to receive the cooperation of the Government of Sierra Leone in all matters relevant to the development of the project and the generation of emission reductions and removals (clause 4.1(e));

(iii) All right of use, as defined in the VCS Program Definitions (clause 4.1(e)(ii));

(iv) The right to act as the sole project proponent of the project (clause 5.2);

(v) Full title to all emission reductions or removals generated by the project, including all rights the Government received under the agreements with the traditional landowners of the Gola Forest (clauses 6.1(b) and 6.3(b)).

The Joint Venture Agreement is exclusive, enforceable and irrevocable (clause 6.1(a)) and has a term of 30 years (Clause 2.1).

In addition to the Joint Venture Agreement, a deed of assignment of rights to all emission reductions and removals generated by the project was signed between the project proponent and the Government of Sierra Leone (these confidential documents can be provided to the auditor on request). This is based on advice from Sierra Leone legal counsel that, since these rights arise out of rights to land, their transfer should be formalized by deed.

1.9 Project Start Date

As documented in the original PD (2015), the project start date is the 1st August 2012. Conservation activities to protect the Gola forest began on the ground in 2004 with the deployment of forest rangers but early conservation work was funded entirely through donor grants. Significant donor funding ended on 31st July 2012, at which point conservation activities would have halted had the RSPB (one of the partners in the Gola Rainforest Conservation LG) not stepped in with bridging finances until revenues from the sale of credits are available and adequate to mee operational needs. The 1st August 2012 is the project start date as from this is the date conservation activities were implemented that lead to the generation of GHG emission reductions and removals.

1.10 Project Crediting Period

As documented in the original PD (2015), the project crediting period begins on the 1st August 2012 and ends on the 1st August 2042. It is understood under new VCS guidance that AFOLU project crediting periods shall be a maximum of ten years and may be renewed twice (VCS Standard V4). For the GRNP REDD Project this is the first baseline renewal (2018) the next project crediting period will continue for 10 years till 2028 when another renewal of the baseline will be required.

1.11 Project Scale and Estimated GHG Emission Reductions or Removals

The Gola REDD Project generates on average greater than 300,000 tonnes of CO2e per year Therefore it is identified as a Large Project.

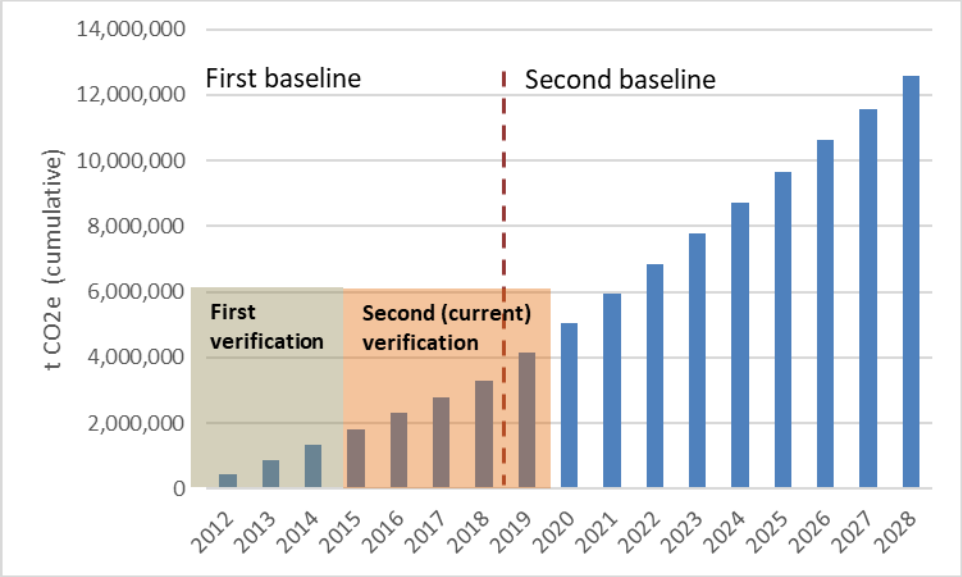
Table 3. Scale of the project (project or large project)

Project Scale	
Project	

Large project	X

The GRNP REDD project crediting period began in August of 2012. The Project was first verified and credited through 2014 (till January 1 2015). A second verification and crediting is underway through 2019. This PD, and therefore the second baseline assessment (i.e. baseline renewal), is renewing the baseline after 2018 (December 12 2018). Therefore, this PD established a new baseline rate of deforestation after 2018, and the current verification underway incudes emission reductions using the original (first) baseline for the period 2015 through 2018 and the renewed (second) baseline for 2019. Figure 1 shows the estimated GHG emission credits (not monitored results) for the initial baseline period (2012-2018), and the renewed baseline credits for the crediting period 2018 to 2028.

Figure 1. Estimated annual GHG emission reductions or removals for the project crediting period.



The results indicate an average of 926,739t CO_2e per year totaling just over 9.27 million t CO_2e between 2019 and 2028. This estimation includes avoided emissions minus 20% annual leakage (conservative estimate of leakage), and does not include the 10% buffer deduction.

Year	Estimated GHG emission reductions or removals for the second baseline (tCO_2e)
2019	854,449
2020	877,879
2021	900,384

2022	911,462
2023	924,807
2024	936,000
2025	947,459
2026	959,975
2027	972,050
2028	982,922
Total estimated Ers (2018-2028)	9,267,387
Total number of crediting years	10
Average annual ERs	926,739

1.12 Description of the Project Activity

Project activities under the second baseline renewal remained the same as original Project Document

Following the original PD (2015), the project aims to achieve GHG reductions by avoiding unplanned deforestation in the project area that is caused by the conversion of forest into the traditional crop-fallow cycle; a practice carried out by rural populations dependent on subsistence agriculture throughout Sierra Leone. The first goal of the project therefore revolves around strengthening the conservation strategy and effective management of the project area (GRNP) and a subset of project objectives and activities have been developed to achieve this goal (see Table 4 section 1). The second goal of the project revolves around working with local communities to encourage sustainable development and land use planning through a subset of objectives and activities that will develop farmers capacities and environmental awareness and enable them to become environmental stewards of the natural resources that underpin their livelihood activities (see Table 4 section 2). The third goal of the project revolves around ensuring that all components of the project are properly monitored in order to provide feedback for adapting the project activities where necessary to better achieve the projects vision and goals (see Table 4 section 3). By the end of the project, the aim is for the project activities to have reduced the deforestation threat to such an extent that the forest will continue to be protected. Two trust funds have been created to accumulate carbon revenues that in excess of what is required to manage the project activities. These funds will then be used after the carbon financing ends to continue any protection activities that are required.

None of the project activities are located within a jurisdiction covered by a jurisdictional REDD+ program.

Table 4. Objectives and activities of the Gola REDD project

1. Conservation strategy and effective management for the GRNP

Goal: To strengthen the conservation strategy and effective management of the GRNP and enable the project to be a stimulus for building National policies and regulations as well as informing relevant regional and international platforms of best conservation practice

Objectives	Activities	How activities will achieve GHG reductions and time scale
1. Protect the integrity of the GRNP	1.1 Forest ranger teams to carry out regular forest patrols to deter, prevent and control illegal activities 1.2 Strategic patrol planning to optimise coverage of the protected area while targeting areas of high conservation value and ensuring a timely response to known and potential threats 1.3 Maintain clear and permanent boundary demarcation 1.4 Maintain and where necessary establish infrastructure such as forest ranger stations, road access and park headquarters 1.5 Develop robust communication channels with neighbouring communities and local authorities that enable threats and grievances to be efficiently and effectively addressed	National Park status on its own does not guarantee the long-term survival of key species and habitats and the integrity of carbon stocks; habitats and species require active management or protection measures and these must be based on sound information and enforcement of legislation through the control of illegal and damaging activities. These activities will need to be implemented throughout the lifetime of the project and by preventing illegal activities that result in deforestation GHG emissions will be reduced.
2. Enable effective management through implementation of best practice administrative and financial systems and the provision of necessary staff training and equipment	2.1 Maintain robust procurement and accounting policies and procedures 2.2 Ensure financial planning and reporting is in compliance with company requirements 2.3 Ensure that recruitment follows Human Resource policy of equal opportunities and best practice 2.4 Provide staff with training and professional development opportunities to ensure the project's capacity needs are met and that staff are able to progress in their careers. 2.5 Develop, implement, evaluate and report on annual operational plans 2.6 Provide a secure work environment for staff and visitors	Effective project management must have all the mechanisms in place to assist and guide staff in carrying out their work and enable them to demonstrate that resources are being used in a cost-effective legal and transparent manner. Without such 'behind the scenes' management processes the project would be unable to efficiently function and reduce GHG emissions, such activities will be implemented throughout the lifetime of the project.
3.Strengthen communications and	3.1 Document and disseminate best management practices (through	Promoting the project's best practices and developing

actively promote the project with local, regional and national stakeholders (and wherever possible in international arenas)	meetings, publications, workshops and the project website) 3.2 Advocate for the replication of the project to support wider conservation initiatives nationally and in the sub region 3.3 Establish and maintain strong links, dialogue and collaboration between the project and key local, provincial and national stakeholders 3.4 Establish the necessary legal framework for the implementation of co-management and other activities required by the project	institutional coherence amongst Government and Non-Government agencies will create a positive environment for natural resource governance and the demonstration of effective REDD activities are essential for achieving widespread support of the project and will assist the development and implementation of national mechanisms and effective protected area management elsewhere in the country thus reducing GHG emissions for the project and wider landscape. These activities are to be implemented throughout the lifetime of the project.

2. Sustainable natural resource management

Goal: To enable local people to become environmental stewards of the natural resource base that underpins their livelihoods through education, capacity building, land use planning and activities that enhance the socio-economic benefits derived from the sustainable use of the project zone's forests and agricultural land.

Objective	Activities	How activities will achieve GHG reductions and time scale
1. To improve productivity on existing crop fallow land	1.1 Assess current land use systems and design intervention strategies that are inclusive of the most vulnerable 1.2 Develop and implement training workshops for farmer field schools and provide inputs to establish and maintain farmer capacity for best practices in sustainable agriculture 1.3 Pilot innovations to increase productivity in demonstration plots 1.4 Research human-wildlife conflict and pilot awareness mechanisms and measures to reduce impact (to link in with objective 2) 1.5 Provide comprehensive ongoing training and supervision of agriculture officers 1.6 Implement the monitoring plan and adapt activities according to results of evaluations	Improving the productivity on land that is already part of the traditional bush fallow cycle will reduce deforestation (and therefore GHG emissions) and benefit household food security and income; this is part of the project strategy to achieve a net positive impact for communities in the leakage belt. This activity will be implemented in all 122 villages of the leakage belt in the first 6 years of the project, after which time progress will be assessed and a new activity plan developed (see Tatum-Hume and Witkowski 2013 for further descriptions

		of the activity and the implementation plan).
2. To improve productivity and farmer income from cocoa production and other diversified sustainable income generating activities	2.1 Assess existing agricultural commodity value chains and identify gaps for agricultural products, Non-timber forest products and sustainable forest products and constraints for forest edge communities 2.2 Provide training and inputs for the production/collection, post-harvest processing and marketing needs of the identified crop 2.3 Increase organization and capacity of small holders to enable increased trade and income e.g. through certification, and or cooperatives 2.4 Develop and promote the Gola area as an eco-tourism destination that benefits and involves local communities 2.5 Implement the monitoring plan and adapt activities according to results of evaluations	Rehabilitating cocoa plantations will have the benefit of both increasing farmer income and maintaining forest cover thus ensuring that GHG are not emitted through the conversion of old plantations into other land uses. This activity will be implemented in all 122 villages of the leakage belt in the first 6 years of the project, after which time progress will be assessed and a new activity plan developed. (see Tatum-Hume and Witkowski 2013 for further descriptions of the activity and the implementation plan).
3. To enable forest edge communities to achieve financial independence	3.1 Establish savings and internal lending group(s) within participating villages 3.2 Provide training, guidance and monitoring of each groups committee and activities 3.3 Train Private Service Providers within each group to establish further groups within each village 3.4 Implement the monitoring plan to monitor impacts of activities as compared to the baseline scenario on livelihoods and wellbeing in accordance with the specific indicators detailed in the social monitoring plan and adapt activity if required (e.g. additional training)	Enabling villagers to have access to a pot of funds that can be used to finance alternative livelihoods or used in times of emergency will provide improved and diversified incomes thus reducing pressure on forest resources (and thereby reducing GHG emissions) whilst providing net positive benefits to forest edge communities. This activity will be implemented in all 122 villages of the leakage belt in the first 6 years of the project, after which time progress will be assessed and a new activity plan developed. (See Tatum-Hume and Witkowski 2013 for further descriptions of the activity and the implementation plan).
4. To provide an enabling environment and capacity for forest edge communities to sustainably manage forest areas	4.1 Capacity building and awareness raising of importance of Natural Resource Management in villages in the project zone (to link in with objective 5) 4.2 Identification, prioritization and engagement of cluster forest edge	Effective CBNRM will mitigate leakage in the project zone and preserve habitat connectivity between the forest blocks and forests in Liberia thus contributing to both climate and biodiversity objectives. From a

	communities for community based natural resource management work 4.3 Review and update in a participatory manner, existing by-laws on traditional land use practices 4.4 Establish co-management areas inside project area (GRNP) with resource use agreements and at community request, in the leakage belt 4.5 Identify and promote the strengthening of traditional governance systems to enable communities to participate more effectively in the protection and of the GRNP and enforcement of its laws and regulations.	community perspective land use planning will ensure that natural resources which underpin many livelihood activities are available in perpetuity. Tenure security in the form of use rights and access will be enhanced inside the park through the designation of community use zones and co-management agreements. This activity will be developed over the lifetime of the project with the forest edge communities in the leakage belt.
5. To enhance environmental awareness and promote community participation in the management of the GRNP	5.1 Develop and implement an education strategy with modules dedicated to targeted topics and audiences 5.2 Establish and maintain a network of school nature clubs 5.3 Develop a GRNP volunteer program in forest edge communities for unemployed youth 5.4 Identify and support environmental stewards in neighbouring communities 5.5 Conduct annual awareness raising and educational roadshows and other events to reach remote forest edge communities 5.6 Monitor the success of the educational programme following the monitoring plan and selected indicators, adapt as required	Promoting understanding and knowledge of the values of the GRNP and forests is a necessary pre-requisite for enabling the emergence of environmental stewardship in local communities. If communities value and preserve forests this will reduce emissions of GHG, educational activities will be implemented throughout the lifetime of the project.
6. Implement and monitor mechanisms that equitably compensate stakeholders and promote incentives for conservation practices in the project zone and offsite zone	6.1 Implement the distribution of funds and activities outlined in the Benefit Sharing Agreement 6.2 Develop structures and monitoring procedures to ensure effective and transparent distribution of funds and in-kind benefits 6.3 Support Gola Community Development Committees in develop procedures and criteria to select development projects for funding 6.4 Provide advice and capacity building to Gola community Development Committees 6.5 Oversee the fair election of Gola Community Development Committees 6.6 Support the Government in updating the GRNP landowner register	The development and maintenance of an agreement and mechanisms that reward and incentivize stakeholders to reduce deforestation and compensate others for foregone rights in an equitable, effective and transparent manner is essential to prevent elite capture and to foster support for the project. The Benefit sharing agreement will be periodically renewed through-out the project.

	6.7 Assess pupil access and participation in secondary schools. Develop criteria for scholarship selection and provide scholarship package to community selected students 6.8 Assess and implement where possible other strategies for providing educational support to remote forest edge communities which fall outside the current school coverage	

3. Research and monitoring

Goal: To develop and maintain a comprehensive social and biodiversity database and monitoring system to ensure the availability of accurate, relevant and timely information to inform and enhance project management and the effective protection of the forest and delivery of anticipated social and biodiversity goals.

Objectives	Activities	How activities will achieve GHG reductions and time scale
1. To carry out specific studies to fill critical gaps in information on biodiversity, ecological processes and social-ecological systems	1.1 Carry out ecological research into key species and recommend management interventions if required 1.2 Develop conservation action plans for key species and habitats 1.3 Carry out socio-economic research to understand community dynamics 1.4 Promote national and international research involvement in the project zone	This objective will provide the necessary scientific information to guide the project's management and protection measures thereby ensuring that forests are preserved and GHG reductions achieved.
2. Establish and maintain a biophysical and socio-economic database	2.1 Design, implement and maintain a database to capture all data collected 2.2 Analyse and report on data	This objective ensures that the project maintains a robust dataset upon which management can rely to make informed decisions
3. To carry out monitoring of key species, habitats, ecological processes and socio-economics to determine and evaluate the project's progress and impacts	3.1 Carry out regular monitoring of pre-identified and agreed sets of indicators for climate change, forest cover, biodiversity and community development 3.2 Carry out regular analysis and report on available data 3.3 Disseminate reports and results to stakeholders and the scientific community	This objective will ensure that the implemented management actions are creating the predicted and desired changes and enables the project to adapt the management strategy accordingly
4. To promote GRNP as a centre for national and international research on tropical rainforest	4.1 Set up the required infrastructure for national and international research to be held in the project zone 4.2 Develop and implement an education program for schools and	This objective will secure and enhance the recognition of GRNP's high Conservation values, fill gaps in scientific knowledge and

ecosystems and integrated conservation and development approaches to protected area management	visitors to the centre to build environmental awareness 4.3 Establish collaborative partnerships on agreed research questions 4.4 Facilitate independent research projects within the project zone, the results of which must be shared with local communities through meetings or workshops and published on the project website 4.5 Promote and advocate research results	understanding, as well as build the capacity and reputation for national research thus creating the impetus to protect Gola during and beyond the project cycle at a national and international level.

1.13 Project Location

The Gola REDD project is located in the south east of Sierra Leone. The nearest entry point to the project area is 30km south-east of the district headquarter town of Kenema and 260 km east of Freetown, the nation's capital. The eastern area of the project lies adjacent to the Moro and Mano Rivers and the international border with Liberia. To the south, the area is bisected by the Kenema-Zimmi highway. The project lies within three districts: Kailahun and Kenema in Eastern Province and Pujehun in Southern Province.

The forests in Gola REDD and surrounding area are the largest area of lowland tropical forest remaining in Sierra Leone and form part of the Upper Guinea forest ecosystem which is classified as one of the 25 most important biodiversity hotspots in the world (Myers et al. 2000). The Gola forests are a key stronghold for a large number of endangered and threatened bird and mammal species and are also politically important as they form part of a larger 'trans-boundary peace park' envisioned by the Government of Sierra Leone and Liberia to assist in establishing permanent peace in a previously troubled cross-border region.

The Project location for the second baseline renewal remains the same as the original PD. An updated KMZ file will be submitted for the 2020 verification. However, small changes in the boundary of the Project Area were made between 2012 and 2018 as the project worked with surrounding villages to demarcate the exact project boundary. These small changes resulted in less than 0.1% of the project area. As of 2018 the forest area within the GRNP was 68,340ha.

Table 5. Forest area within the GRNP mapped using remote sensing between 2007 and 2018 shows the updated forest area in the GRNP

Table 5. Forest area within the GRNP mapped using remote sensing between 2007 and 2018

	Forest area 2007	Forest area 2011	Forest area 2015	Forest area 2018
	ha			
Project Area	**69,683**	**68,498**	**68,445**	**68,340**

The map projection for project boundaries and all spatial analysis is:

Mapping Projection

Projected Coordinate System: WGS_1984_UTM_Zone_29N

Projection: Transverse_Mercator

False_Easting: 500000.00000000

False_Northing: 0.00000000

Central_Meridian: -9.00000000

Scale_Factor: 0.99960000

Latitude_Of_Origin: 0.00000000

Linear Unit: Meter

Geographic Coordinate System: GCS_WGS_1984

Datum: D_WGS_1984

Prime Meridian: Greenwich

Angular Unit: Degree

Figure 2. Location of the Gola REDD project within Sierra Leone

Following requirements set out in VM0007 BL-UP Module, the spatial boundaries required from the Gola REDD project are: the Project Area (PA), Leakage Belt (LB) and the Reference Region (RRD). See Section "3.3 Project Boundary" and Netzer and Walker 2013 baseline report for a detailed description of these project boundaries.

1.14 Conditions Prior to Project Initiation

The project area was originally gazette as a Production Forest Reserve. As explained in section 1.11 a key component in project development was to secure the area's status as a National Park, achieved in 2011. This is a clear demonstration that the project intends to leave a lasting legacy of conservation management that extends beyond the lifetime of the project. The project has not been implemented to generate GHG emissions for the purpose of their subsequent reduction, removal or destruction.

At project initiation, the following conditions are present in the project area;

Hydrology

The Gola REDD project covers important catchment areas for the Moro, Mano, Mahoi and Moa Rivers which are the main water supplies for local villages and towns (see Figure 3).

The north eastern area of the Gola REDD project and leakage belt, defined as the project zone, is drained by the Moro River which runs along the eastern boundary. The region is fairly well drained with elevated hilly terrain; only 8-9% of its area is under streams, swamps or poorly drained terraces.

The central area of the project zone is also drained by the Moro River running along the eastern boundary. This part of the project zone is intersected by a series of water courses and seasonally dry valleys. The most important water course to originate in this part of the project zone is the Mogbai River which flows east into the River Moro and has a catchment of approximately 52 km2 and an area of swampy terrain.

As the Moro River flows south, it flows into the Mano River which runs along the eastern boundary of the southern area of the project zone. The eastern section of this area feeds the Mano River via a series of small rivers and streams that are no longer than 15 km, for example the Watuma, Wemango and Weadia, and as a result is fairly well drained. The central area in the south is drained by a network of small streams which feed into the Mahoi River. The western part of the southern area is poorly drained with up to 18% of the area classed as waterway, swamp or poorly drained land. Streams in this area feed into the adjoining Moa River.

The watershed services provided by the project zone are vital to local and regional economies which are based on subsistence and cash crops. The project area is a watershed for the surrounding area outside the project area, no rivers flow into the project area, only out, the project area therefore will not be negatively affected by any hydrological connectivity from outside the project area.

Figure 3. Watersheds of the project area

Geology and Soils

The Gola REDD project zone is characterized by ancient crystalline rocks of the Archaen subdivision of the Precambrian period (Wilson, 1965). The granite greenstone complex, common in this area, contains iron and magnesium rich metamorphic rocks overlying a quartz-rich granite basement. Metamorphism gave rise to local occurrences of granulitic materials which are characteristic in parts of the project area. Most of the ores of chromium, gold and iron are located in the strips of metamorphic rocks that permeate the dominating granite (see Figure 4. Geology of the project area)

The soils in the project zone are mostly derived from granite. They are usually freely draining sands and gravels, with varying proportions of lateritic gravel. Four types of soil are recognized in the project area (Iles et al 1993):

1. Kulufaga. Rocky hill complex of moderate to high relief on Precambrian granite complex and local amphibolites; shallow sandy clay loams with locally deeper reddish clay loams;

2. Kailahun. Strongly dissected high level plains of low to very low relief and scattered isolated hills, on Precambrian granite complex and local granulites; moderately shallow to deep, sandy clay loams to clays often containing much gravel;

3. Blama. Dissected plains of extremely low relief with scattered small hills and terraces, on Precambrian granite complex and local granulites; moderately deep, very gravelly reddish clay loams to clays;

4. Sandaru. Variable dissected complex of plains and rocky hills of low to moderate relief, on Precambrian granite complex; moderately shallow to deep, sandy clay loams, gravelly on hilly terrain.

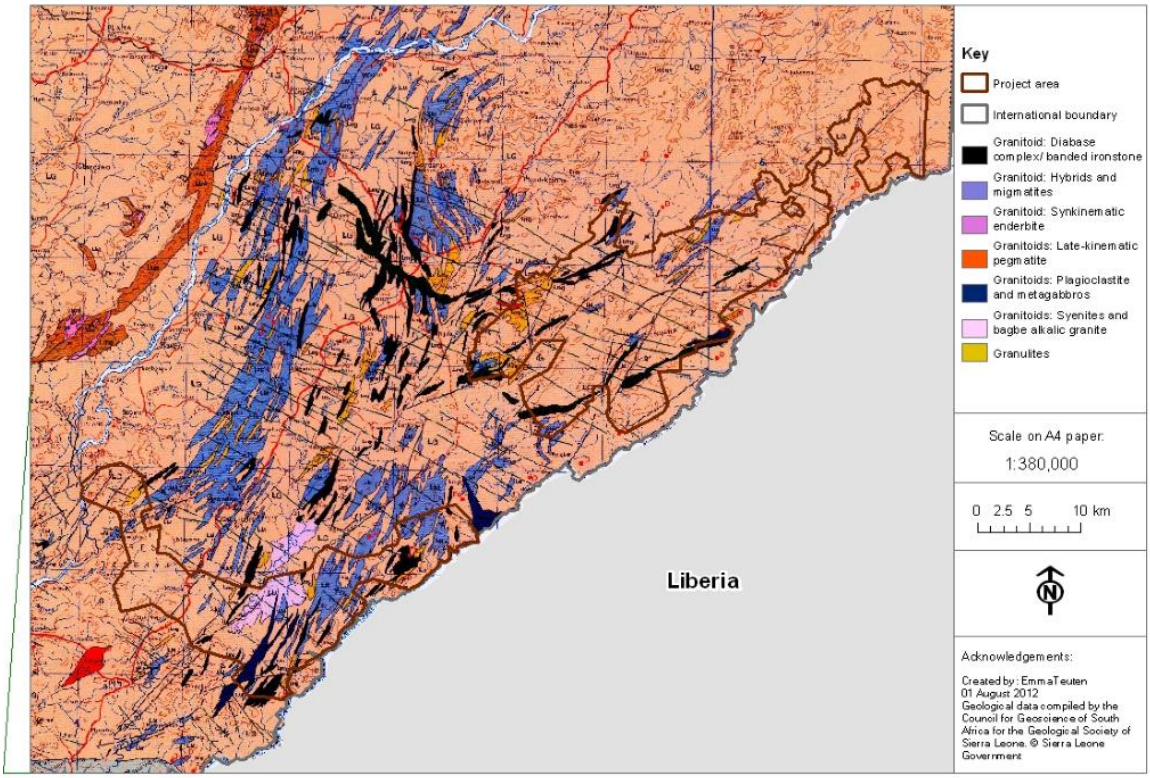


Figure 4. Geology of the project area

Geomorphology

The central area of the project zone contains the most varied geomorphologic features (see Figure 5. Geomorphology of the project area). Extensive rolling hills in this area give rise to form more rugged terrain and isolated rocky outcrops, some of which exceed 130m in length and 22% are over 330m in elevation. Over 9% of this area consists of steep slopes. The highest point, which reaches 427m, is known as Sangie Mountain. Slopes exceeding 27 degrees are common, and slopes of up to 45 degrees occur in the North and Eastern parts of this area.

The southern part of the project zone is lower than the central and northern area and becomes progressively lower and more uniform in slope from east to west. The highest point in this area is Bagla Hills at 330m in the east. The hilly terrain in this area is crossed by numerous watercourses which form steep sided water valleys.

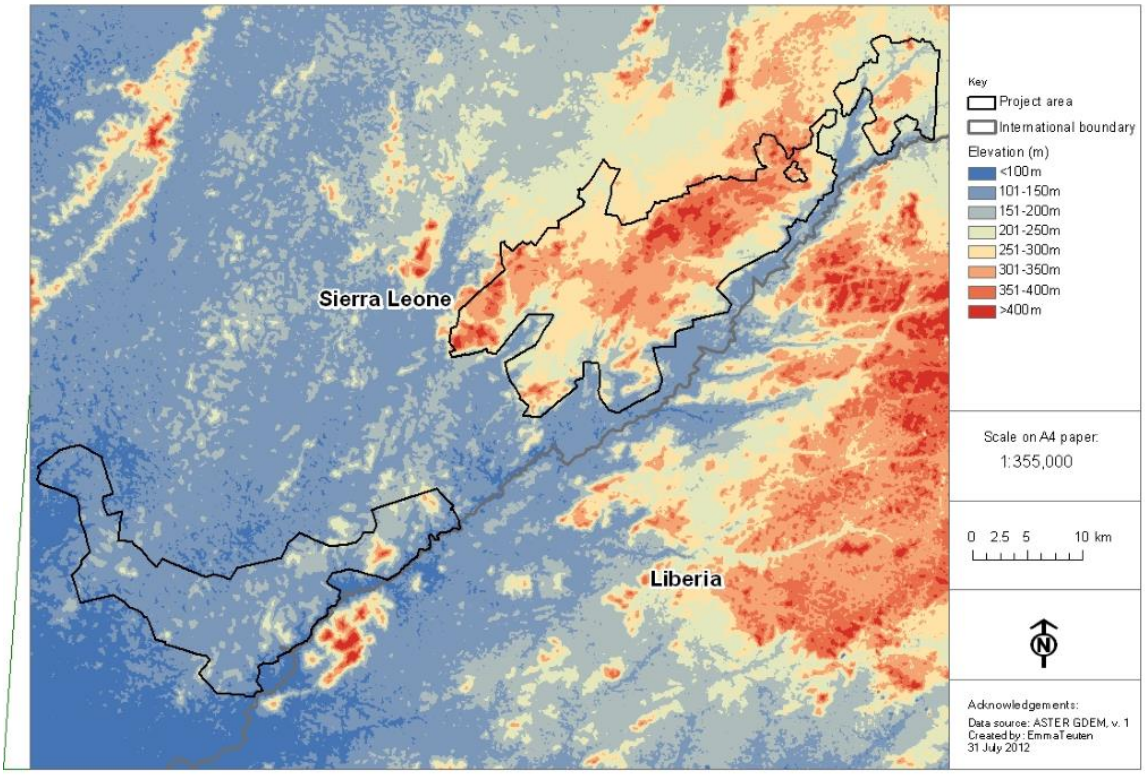


Figure 5. Geomorphology of the project area

Climate

The project zone lies within the wet tropical climatic zone. Historical and recent precipitation data is available from towns and villages in the project and offsite zone. White (1972) reports mean annual rainfall values of 2576 mm at Daru, 2605 mm at Pendembu and 2770 mm at Kenema. Cole (1993) reports 2630 mm for Zimmi, 2739 mm for Kenema and 2747 mm for Daru. Based on this data, mean annual rainfall is likely to be 2500-3000mm. In 2006 the total annual rainfall for Kenema was 2188 mm, which is lower than the historical average. During 2007 rainfall was measured within the forest of the project zone at 3 sites each month (Figure 6. Annual rainfall data for the project zone (based on 2007 data, from 3 stations in the project zone: Source Klop et al. 2008)) and the mean annual total for the 3 sites was 3117mm (Klop et al 2008), slightly higher than the historical average. Rainfall was recorded in every month; there is a pronounced dry season from December to March during which rainfall was less than 50 mm per month. The wettest months are July and August when rainfall was over 550mm per month.

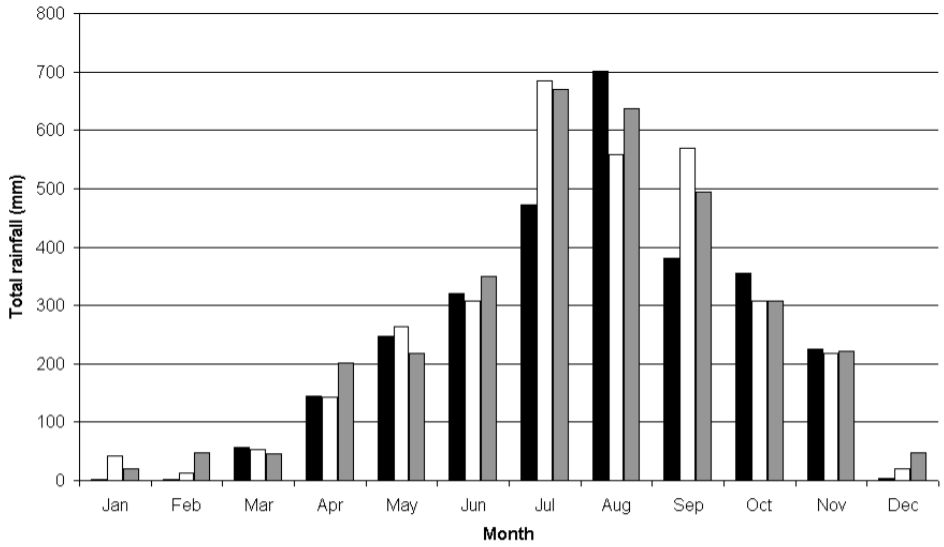


Figure 6. Annual rainfall data for the project zone (based on 2007 data, from 3 stations in the project zone: Source Klop et al. 2008)

Vegetation

All the forest of the project zone is part of a single forest type – the Western Guinean Forest. Extensive botanical surveys and ecological research characterises the project area into evergreen and moist semi-deciduous forest types but there is considerable overlap between these two classifications and they should be considered a continuum over a gradient (Klop et al 2008). This also corresponds with Hall & Swaine (1976) who argued that the West African rainforest showed too much continuity of structure to define associations at this level of detail. Like species composition, the biomass (i.e. carbon) between these two forest types are similar, with no statistical difference (Lindsell and Klop 2012).

Vegetation Diversity

The Upper Guinean Forests are species diverse, with some 2800 species of vascular plants known to occur in these forests (Jongkind 2004), of which about 650 (23%) are endemic to the region. So far a total of 899 plant species have been identified in the project zone, mainly in the project area and of these plant species 232 species are trees (Klop et al. 2008).

Vegetation Condition

Prior to the initiation of conservation work, the project area was classified as a Production Forest Reserve and until the late 1980's two large scale timber companies conducted commercial logging in the Gola REDD project area: the Forest Industries Corporation (FIC) and The Sierra Leone Timber Industry and Plantation Company (SILETI). FIC worked in the accessible areas of the western section of Gola Central in 1961, 1978 and during the period 1984-1986. FIC and SILETI worked in Gola South during the 1960's, 70's and 80's; operations finished in 1989.

As a result of past management practices the southern block of the project area in particular is still regenerating and has not reached yet an equilibrium state, (Lindsell and Klop 2012).

1.15 Compliance with Laws, Statutes and Other Regulatory Frameworks

The Gola Rainforest Conservation LG entered into a public-private partnership with the Ministry of Agriculture, Forestry and Food Security in 2015 which outlines the terms of the relationship between the Gola Rainforest Conservation LG (project proponent) and the central government. Under the terms of the agreement the company must comply with all relevant laws and to ensure this happens, the Government closely observes the management activities of the company.

National and local laws relevant to project implementation are:

National Forest Laws

The Forestry Division within the Ministry of Agriculture, Forestry and Food Security (MAFFS) is responsible for the management of forest areas in Sierra Leone. As the project area is the forested areas within the Gola Rainforest National Park, it falls under the management authority of MAFFS. The principal policies and laws relevant to the management of forest areas are the Wildlife Conservation Act of 1972, the Forestry Act of 1988 and the Forestry Act Regulations in 1990 and the recently passed National Protected Areas Authority Act 2013.

The Wildlife Conservation Act of 1972 established significant provisions for the conservation of wildlife ranging from the constitution of strict nature reserves, game reserves, and national parks, to prohibition of hunting of animals generally except with licence and permit. It also contains enforcement and penalty provisions. The Wildlife Conservation Act of 1972 stipulates in Part 2 Section 5 the constitution of national parks. The purpose of a National Park in Sierra Leone is 'propagating conserving and managing wild animal life and wild vegetation, and protecting sites, landscapes or geological formations of scientific or aesthetic value for the benefit and enjoyment of the public'. The first goal of the project (see section 1.11) is to implement effective protection measures of the National Park to ensure that the forest is conserved and that biodiversity is protected, thus demonstrating that the project is aligned with the Wildlife Conservation Act.

The Forestry Act of 1988 and its Regulations for 1990 established provisions for the administration and management of the Forest Reserves, Community forests and National Parks. It also established fees for licences and law enforcement provisions. The project has established a register of landowning families of the National Park and has entered into a benefit sharing agreement with the families and other local stakeholders to provide compensation for lost royalties and rights in the project area and is therefore aligned to the Forestry Act of 1988.

As a National Park, the objective is inter alia to conserve wildlife and vegetation, and activities such as farming, logging and mining are prohibited. Since the project intends to conserve the forest and

wildlife, and all Management Plans will be reviewed by the National Protected Areas Authority (NPAA), the project is aligned with National Forest Laws. The Forestry Division followed regulations in upgrading the forest reserves to National Park status (Fofanah 2012).

REDD regulations

The Government currently does not have any guidelines or regulations in place for REDD projects. A legal analysis carried out by Climate Focus (Climate Focus 2011) which reviewed the legal regulations surrounding the implementation of carbon projects in the Gola area concluded that specific legislation was not required to develop a REDD project in the GRNP.

Environmental Protection Agency Act

This act established the Environmental Protection Agency (EPA) to 'provide for the effective protection of the Environment and for other related matters'

Under the act, projects that make 'substantial changes in renewable resource use (e.g. conversion of land to agricultural production, forestry or to pasture land, rural development, timber production)' are required to carry out an Environmental Impact Assessment (EIA). As the project has not made any substantial changes to the renewable resources of the area and will not have any negative impacts on renewable resources or the environment as a whole an EIA was not required.

National Protected Area Authority Act

A recent act enacted in 2012, provided for the establishment of a National Protected Area Authority (NPAA) and Conservation trust fund to 'promote biodiversity conservation, wildlife management, research, to provide the sale of ecosystem services in National Protected Areas and to provide for other related matters. The project works closely with the NPAA to ensure that project activities are aligned with Government policy as the authority's main function will be to 'exercise oversight authority over National Parks and Protected Areas designated for conservation purposes' (part III, 12 (1)) and has responsibility to 'promote REDD projects in Sierra Leone' (part III, 12 (2)f), and evaluate and approve National Protected Areas annual operation plans and budgets (part III, 12 2 p(v)) amongst other objectives. It is written into the legal agreements between the project and the Government that the project will comply with all relevant legislation and will work with the MAF and the NPAA to ensure that the project is aligned with Government strategy.

1.16 Participation under Other GHG Programs

1.16.1 Projects Registered (or seeking registration) under Other GHG Program(s)

As per the original PD (2015) this section is not applicable as there are no other GHG programs registered or seeking registration in the Gola region of Sierra Leone. The project will not participate in any other GHG program, the project will only seek to have any credits generated via the VCS to be tagged by the Climate, Community and Biodiversity Standard. Sierra Leone does not have any binding commitments under the UNFCCC to meet limits on GHG emissions.

1.16.2 Projects Rejected by Other GHG Programs

As per the original PD (2015), the project has not applied to any other GHG program.

1.17 Other Forms of Credit

1.17.1 Emissions Trading Programs and Other Binding Limits

As per the original PD (2015), this is not applicable. GHG emission reductions generated by the project will be sold on the Voluntary Carbon Market or via private transactions. Sierra Leone does not have any binding commitments under the UNFCCC to meet limits on GHG emissions.

1.17.2 Other Forms of Environmental Credit

As per the original PD (2015), the project will be registered with the VCS and the CCBA (Climate, Community and Biodiversity Alliance). The CCB Standard does not generate credits, instead it will serve to demonstrate the exceptional community and biodiversity benefits that the project will generate. The project is therefore not seeking registration under any other GHG programs or for any other form of environmental credit

1.18 Additional Information Relevant to the Project

Leakage Management

As outlined in the original PD (2015), displacement leakage is assumed to occur due to the displacement of farming activities from the project area into the leakage belt.

Over the last 7 years, leakage prevention activities have been developed and implemented in coordination with the 122 forest edge communities that are located within the leakage belt to ensure that the external pressures driving deforestation are mitigated and benefits to communities are delivered. Following CCB assessment guidance and extensive consultations, the primary issue constraining communities in adopting more sustainable agricultural practices and reducing deforestation is identified as poverty. Whilst the project will not be able to address all the underlying factors that cause poverty, those that are believed to provide the most benefit to the project and to forest edge communities have been selected for implementation. These activities fall under goal 2 of the project which aims to encourage sustainable development whilst maintaining the forest resource base. Specifically, leakage mitigation activities cover the following. Progress on these are reported in each MIR (2015 and 2020);

1. Build the capacity of forest edge communities to increase productivity in key crop types on existing fallow land through the provision of inputs and training of farmers and master farmers, this will reduce the need to convert forest into the bush fallow cycle

2. Rehabilitate old shade grown cocoa farms to increase the productivity of this valuable alternative income thus increasing incomes whilst maintaining forest cover.

3. Develop internal savings and lending communities in villages to enable villagers to achieve financial independence and have a pot of funds to access for loans for improving potential for alternative resource generation and to use in times of hardship reducing reliance on the conversion of forests for income.

4. Provide forest edge communities with the capacity and an enabling environment so that they can actively engagement in co-management of the community-use zones in the project area and sustainably manage the forests in the leakage belt

5. Promote the awareness of the ecosystem services that are provided by forest and encourage greater value to be placed on the forest, thus linking in to the overall objective to protect the forest in the leakage belt and project area.

6. Implement and monitor mechanisms that equitably compensate stakeholders and promote incentives for conservation practices in the project zone and offsite zone.

The leakage belt will be closely monitored throughout the lifetime of the project to assess displacement leakage (see section 5).

Market leakage is not monitored.

Activities designed to reduce non-permanence risk

As described in the risk assessment tool, a number of minor risks were identified by the risk assessment and mitigation activities have been put in place as a result to reduce the risk (see VCS Risk Assessment), the following are highlighted as activities to reduce non-permanence risk;

1. Fire monitoring and prevention. Fire is identified as a minor risk to the permanence of carbon stocks but with the potential effects of climate change during the project's lifetime is none the less is being taken seriously with a fire monitoring alert system set up to monitor for incidences of fire and a prevention plan in place to react to any alert (see VCS Risk Assessment).

2. Legal Agreements. The project has developed a series of legal agreements to ensure the permanence of the project (available to auditor on request). Legally binding agreements are in place to ensure the project proponents have the correct legal framework to back up the project activities and ensure the long-term viability of the project.

3. Community Engagement. During project development communities were actively consulted in the design of project activities and agreements. Meetings, workshops, focal groups, surveys and numerous informal discussions have facilitated information sharing and gathering to ensure that a wide range of stakeholders from Chiefs through to forest edge community members have input into the project design process and validated each step of the development of activities, particularly those directly involving the communities (e.g. the livelihood project work with forest edge communities, the development of the Benefit Sharing Agreement, the establishment of Gola Community Development Committees and activities etc) (Tatum-Hume et al 2013a).

4. Trust Funds. A Trust Fund has been set up in Sierra Leone called the National Protected Area Trust Fund (not done by this project) to build financial resources and capacity during the lifetime of the project. A UK based Trust Fund (International Eco Fund) already supports GRNP, and as with the Sierra Leone fund, we hope to build the capital in the fund. There is a revenue sharing formula in the GRC agreements that instructs how funds are shared. Unfortunately, sales of credits are not yet enough to contribute to these funds, with all revenue being used to fund project implementation to date. Both funds will enable the objectives of the project to extend beyond the 30 years of the REDD project cycle and ensure permanence of carbon stocks beyond 2042 (the end of the REDD financing).

Commercially Sensitive Information

At the beginning of the project financial modelling was done to provide information to demonstrate the viability of the project and the implementing organization can be presented to the auditor upon request. Likewise, the legal arrangements for the project are also available to the audit team.

Sustainable Development

The project supports the delivery of a range of Sierra Leones national development and environmental priorities. Sierra Leone's Medium-term National Development Plan (2019–2023) sets the ambition for the next 5 years. Gola contributes to this in significant ways:

- Policy Cluster 7 – Addressing vulnerabilities and building resilience. Under this cluster, the government will focus on the following broad result areas: 7.1 Building national environmental resilience; 7.2 Strengthening forest management and wetland conservation;
- Key targets under policy cluster 7 By 2023, review and pursue land degradation neutrality targets
- Strategic Target: The strategic objective is to enhance the holistic conservation and management of Sierra Leone's biodiversity in all ecosystems for the benefit of present and future generations through an integrated approach.
- Other policy clusters such as agriculture and poverty

The establishment of the Gola Rainforest National Park was highlighted as a headline achievement in the first National Biodiversity Strategy and Action Plan (NBSAP) of 2004-10.

Sierra Leone's NBSAP is on its second iteration; 2017-2026.

Further Information

None

2 SAFEGUARDS

2.1 No Net Harm

The Gola project used the risk assessment tool created by the VCS to assess the risk and determine the appropriate risk rating for the project. Through applying the tool, the project scored a risk rating of 10. The minimum risk rating a project can have is 10. The Gola REDD project has therefore applied a risk rating of 10 in determining the number of VCS credits that are to be deposited into the AFOLU pooled buffer account (VCS non-permanence risk report).

Risks were assessed by type and included both internal risks; project management, financial viability, opportunity cost, project longevity and external risks; land ownership, community engagement and natural risks. Mitigation measures are in place for any identified risks as explained below.

Internal Risks

Project Management: The project has a well-established presence on the ground with over 150 staff. Illegal activities are monitored, addressed and reported with very few significant illegal incursions recorded. Staff are regularly trained and where needed external expert staff are appointed to bring specific skills.

Financial Viability: The project partners and staff successfully managed private and donor funds during early conservation work and in the development of the REDD project. Revenues from the sale of carbon credits have been slow to be realized but with the engagement of a professional Offset Retailer sales have progressed upwards with sales reaching $660,000 gross in FY2018 and $1,100,000 gross in 2019. This is still below the needed estimate of $1.4m annually but we are confident this will continue to increase eventually to be sufficient to cover the majority of the costs of implementing the project. Any excess revenues will be held in trust funds to be used to manage the GRNP beyond the lifetime of the project. One of the project partners, the RSPB, has been providing bridging finance through its own resources or grant writing and management until carbon revenues were available resulting in a minimal financial viability risk to the project (financial analysis available to auditor).

Opportunity Costs: The threat to the forest's integrity remains from commercial mining interests. The short-term financial benefits from such, vastly outweigh the carbon incomes. This has been mitigated through the forest becoming a national park in 2011 and the legal protections that this ensures that the project proponent is a not for profit company, registered in Sierra Leone

Project Longevity: A legal agreement is in place for the project proponent to manage the project area for the lifetime of the carbon project i.e. 30 years. As a National Park the regulations are in place to protect the area beyond the lifetime of the project, but regulations alone are not enough to prevent

deforestation. The Government created a trust fund to build capital over the lifetime of the project that will then be used to continue the conservation management once carbon financing ends. The risk of project activities not being maintained is therefore low (legal agreements available to auditor).

External Risks

Land and resource tenure: The Government of Sierra Leone represented by the Ministry of Agriculture and Forestry owns the carbon rights and management rights to the project area. These rights were legally transferred to the project proponent by way of a public-private partnership agreement to enable the sale of credits. Families within the 7 Chiefdoms are recognized as traditional landowners to the project area and were consulted to secure outstanding carbon rights and were paid compensation via the REDD benefit sharing agreement. There are therefore no risks associated with land ownership or management for the project.

Community Engagement: The VCS considers the project to be at risk if it has not adequately consulted with households reliant on the resources of the project area. Within the leakage belt of the project zone there are 122 communities. Consultations with communities in both the project zone and the offsite zone were intensive during project design and are ongoing during project implementation. Any negative impacts of conservation activities on local communities are mitigated via compensation mechanisms set up by the project that include a range of direct payments and livelihood activities with both project zone and offsite communities.

Political Risk: The VCS rates political risk by the governance scores determined by the World Bank indicators. Sierra Leone achieves a high political risk rating. The project considers that this risk is mitigated by the fact that the Government is an active partner in the project and demonstrates its long-term commitment towards reducing anthropogenic GHG emissions through participation in international climate change negotiations, developing a NAMA and putting in place appropriate governance structures.

Natural Risks

Analysis of natural risks including fire, extreme weather, pests and disease and geological activity revealed that the project zone is under very low risk from natural disasters. To mitigate any possible risk the project actively monitored fire outbreaks using the MODIS satellite early warning system, patrol teams were sent out to investigate any outbreak and react accordingly. In Sierra Leone wild fires are a more common occurrence in the North of the country where there are areas of extensive grassland.

Natural risks that may affect the leakage mitigation activities (livelihood projects) introduced to the Forest Edge Communities include the impacts of climate change and crop raiding by wild animals. Agricultural techniques that are being introduced to communities to increase productivity are designed to be ‘climate smart’ and to increase the resilience of communities and households to climate change for example short-duration rice varieties and agro-forestry systems both enhance the resilience of the farming system. Through land use planning the project encourages the

protection of water catchments and inland valley swamps which contributes to reforestation and improved water availability in the swamps.

Protection of the project area itself and the maintenance of connectivity between the forest blocks also helps community resilience by ensuring the long-term availability of ecosystem-services including provisional services (food stuff and materials) and regulating services (water quality and availability and micro-climatic conditions). Human wildlife conflict mitigation measures are about to be trialed with communities based on the results of wildlife conflict research before the most effective measures are scaled up and introduced to all Forest Edge Communities. Both natural risks to leakage mitigation activities were monitored and further mitigation measures will be introduced should any further risks be identified.

2.2 Local Stakeholder Consultation

This is the GRNP's second PD and first baseline renewal. The project has previously undergone validation and verification in 2015 (PD 2015 and MIR report 2015) and is currently under its second verification audit. As such, the project has detailed its stakeholder consultation in numerous other reports and been validated and verified for them in the past. Here we outline briefly how the project has met the requirements for this section by referencing the numerous other reports that describe the GRNP's stakeholder engagement and consultation.

The procedures and methods used to engage local stakeholders has been documented in the original PD from 2015 (PD 2015 Section 6), the first verification (MIR 2015) and now again in the second MIR for 2020 (Section 2.3.).

The procedures and methods used for documenting the outcomes are outlined in the first and second MIR report (MIR 2015 and 2020).

The mechanism for on-going communication with local stakeholders is detailed in MIR 2020 report (Section 2.3).

Over the course of the project the GRNP has collected data from local stakeholders through a number of mechanisms: primarily through community officers on a day to day basis and supported by periodic 'longitudinal surveys' the approach is outlined in more detail in the community monitoring plan (Henman 2013) and MIR 2020 Section 4.1.

The project has also communicated with local stakeholders which is outlined in numerous documents submitted for current and previous verifications. Including:

Communicating project design and implementation, and the results of monitoring, see MIR 2020 Section 2.3 and 4.3.

Communicating project risks, costs and benefits of the project to local stakeholder, see MIR 2020 Section 2.3., 2.5.

Communicating project relevant laws and regulations covering workers' rights in the host country, see MIR 2020 Section 2.3 and 2.5

Communicating project the process of VCS Program validation and verification and the validation/verification body's has been shared primarily with project implementers and proponents. Stakeholders typically have no access to internet therefore this has not been widely disseminated. However, the Project does annual "Road Shows" to talk to communities about the project, and has done a number of radio broadcasts.

2.3 Environmental Impact

As per the original PD (2015), the Gola REDD project will result in the long-term protection of the Gola Rainforest National Park. The National Park is part of the Upper Guinea forests, which is a globally, regionally and nationally significant area of forest. For many species of regional and national significance the project zone has become the last refuge in Sierra Leone and nearly all lowland forest species found in Sierra Leone have their major stronghold in the project zone. Given that the project activities are aimed at protecting the forest and associated biodiversity and that no negative impacts to the environment are anticipated to result from the project an environmental impact assessment was not carried out by the project.

2.4 Public Comments

No public comments were received in the comments period for the first verification from 27 August to 26 September 2015. The comments period for the second verification is planned for late 2020 early 2021.

2.5 AFOLU-Specific Safeguards

The GRNP has been implementing AFOLU safeguards throughout project implementation. Many of these safeguards are detailed in other reports. Below is an outline of the project safeguards and where to find this information:
Local stakeholder identification is an ongoing and continuous process. In the initial PD (2015) the approach is outlined and in the MIR from 2015 stakeholder mapping and consultation details are outlined in Section 1.7

Risks to local stakeholders were identified using the Risk assessment tool at PD level and each of the MIRs in 2015 and 2020.

The project has worked continuously with local stakeholders to mitigate impact to local stakeholder's property rights without the free, prior and informed consent. This includes acknowledging and paying families that had historical rights to the land, working with communities to better demarcate the boundary of village land and community land, and maintaining a grievance mechanism.

Ongoing communication and consultation is a core part of the project objectives. See 1.11 above and the latest MIR 2020 in section 2.3.

The GRNP project also established a grievance mechanism where local communities and stakeholders can address conflicts which may arise between the project proponent and local stakeholders. The mechanism was developed in 2012 (see overview in Tatum-Hume et al 2013a) and up to date incidents are detailed in MIR 2020 section 2.3.

3 APPLICATION OF METHODOLOGY

3.1 Title and Reference of Methodology

VM0007 REDD Methodology Modules (REDD-MF) (v1.5) (As per VCS, valid until the 8th of March 2021)

3.2 Applicability of Methodology

The GRNP meets the applicability conditions for VM0007 as outlined in *Table 6. Applicability of the methodology*.

Table 6. Applicability of the methodology

Applicability Conditions	Demonstration and justification for the project to meet the conditions
All land areas registered under the CDM or under any other carbon trading scheme (both voluntary and compliance-orientated) must be transparently reported and excluded from the project area. The exclusion of land in the project area from any other carbon trading scheme shall be monitored over time and reported in the monitoring reports.	The project is not registering any other land areas for a carbon trading scheme. Meetings have been held with land holders and other stakeholders involved in land use schemes in the area and no other organizations are developing CDM or other carbon trading schemes that need to be excluded from the project area or leakage belt.
Land in the project area has qualified as forest at least 10 years before the project start date	In Sierra Leone, forest is defined as land areas of at least 1ha, 30% crown cover and 5m tree height (FAO 2010). Analysis of satellite imagery from 2001 based on data collected in ground truthing surveys shows that the project area has been forest from at least 2001 (i.e over 10 years (see Netzer and Walker 2013). Historical information indicates that the area has been forested for

	a much longer period; a report by Unwin in 1909 describes the region as a mosaic of forest and farmland and recommends the establishment of a forest reserve in the remaining areas of forest (Unwin 1909).
If land within the project area is peatland and emissions from the soil carbon pool are deemed significant, the relevant WRC modules must be applied alongside other relevant modules.	The VCS defines peat as an area with a layer of naturally accumulated organic material that meets an internationally accepted threshold for the depth of the peat layer and the percentage of organic material composition. The project adopted the FAOs definition of depth as; 1.10 cm or more thick starting at the soil surface and immediately overlying ice, continuous rock, or fragmental materials, the interstices of which are filled with organic material; or 2. cumulatively within 100 cm of the soil surface either 60 cm or more thick if 75 percent (by volume) or more of the material consists of moss fibres or 40 cm or more thick in other materials and starting within 40 cm of the soil surface. The project adopted the FAOs definition of organic material composition as organic material that has one or both of the following; 1. 20 percent or more organic carbon in the fine earth (by mass); or 2. if saturated with water for 30 consecutive days or more in most years (unless drained), one or both of the following: a. (12 + [clay percentage of the mineral fraction × 0.1]) percent or more organic carbon in the fine earth (by mass); or b.18 percent or more organic carbon in the fine earth (by mass). Soils surveys sampled soils in Inland valley swamps – these are areas of poor drainage that were identified as the only areas that have the potential to contain organic or peat soils, defined by the FAO (2006/7). No peat was found in any soil samples (Cuni-Sanchez 2012c) and interviews with a leading soil scientist in Sierra Leone confirmed that peat has not been discovered in Sierra Leone (per comm.. Dr Alie Kamara).
Baseline deforestation and forest degradation in the project area fall within one or more of the following categories • Unplanned deforestation (VCS category AUDD); • Planned deforestation/degradation (VCS category APD); • Degradation through extraction of wood for fuel (fuelwood and charcoal production) (VCS category AUDD).	The project falls into 'unplanned deforestation' (VCS category AUDD).

Leakage avoidance activities must not include: • Agricultural lands that are flooded to increase production (eg, paddy rice); • Intensifying livestock production through use of feed-lots6 and/or manure lagoons.7	Leakage avoidance does not include these activities
Project proponents must be able to show control over the project area and ownership of carbon rights for the project area at the time of verification	The Ministry of Agriculture Forests and Food Security is mandated with the management of all forest areas in Sierra Leone, including the project area. This has been the case since the Gola forest reserves were created in 1926 (Fofanah 2012). As a National Park, the Ministry remains the institution responsible for the management of the project area (Fofanah 2012). Agreements between the project proponent (the Gola Rainforest Conservation LG) and the Government of Sierra Leone represented by the Ministry transfer both management and carbon rights from the Government to the project proponent for the lifetime of the project.
Baselines shall be renewed every 10 years from the project start date	The project will revise and update the baseline following VCS procedures and methodologies every 10 years from the project start date (August 2012). The baseline is currently being renewed in 2018 and therefore will need to be renewed again in 2028 to comply with VCS guidelines.
If land is not being converted to an alternative use but will be allowed to naturally regrow (i.e. temporarily unstocked), this framework shall not be used.	In the area surrounding the project, forested land is converted into the traditional crop-fallow cycle land use. The dominant crops are rice, maize, cassava, sorghum and millet. The landscape includes a mosaic of plots at different stages in this cycle. The average fallow period was found to be 7 years in areas close to the project boundary (Witkowski et al 2012a, Cuni-Sanchez 2012b). Since some locations deforested in the reference region used to estimate baseline deforestation rates may not be managed as the baseline scenario of a traditional crop-fallow cycle, the estimated deforestation rate excluded all areas that transitioned from forest to non-forest and back to forest within the historical reference period. This ensures a highly conservative rate of deforestation and eliminates that proportion of the landscape that is not under the baseline crop-fallow cycle.

Baseline agents of deforestation shall; 1. Clear the land for settlements, crop production (agriculturalist), or ranching, where such activity does not amount to large scale industrial activities; ii) have no documented and uncontested	The baseline agents of deforestation in the without project scenario clear the land for small scaled crop production (see section 2.5). They do not have the legal right to clear the project area, in the Wildlife Conservation Act of 1972 it states that amongst other prohibited activities people cannot carry out 'any act connected with forestry, **agriculture** or mining excavate or prospect, drill or level the ground or construct or perform any work involving the alteration of the

legal right to deforest the land for these purposes; and iii) are either resident in the reference region or immigrants	configuration of the soil or the character of the vegetation. (see Wildlife Conservation Act 1972, part 2, section 5).
Where, pre-project unsustainable fuelwood collection is occurring within the project boundaries modules BF-DFW and LK-DFW shall be used to determine potential leakage	From PRA surveys, the project area was not an unsustainable source of fuelwood collection in the pre-project period (Witkowski et al 2012a and community survey of fuel wood collection in 2018).

3.3 Project Boundary

The Project Boundaries have remained the same as those originally reported in the 2015 PD with the exception that forest area has changed within the project boundaries. The information in this section is the same as that provided in the original PD, however with updated numbers for forest area for the Project Area (PA), Leakage Belt (LB) and Reference Region (RRD) (*Table 7* and *Figure 7*).

Table 7. Forest area within each of the three major project areas for the GRNP.

	Forest area 2007	Forest area 2011	Forest area 2015	Forest area 2018
	ha			
Project Area	69,683	68,498	68,445	68,340
Leakage Belt	73,365	62,882	55,658	48,452
RRL (PA+LB)	143,048	131,380	124,103	116,792
RRD	148,668	118,402	*	84,022

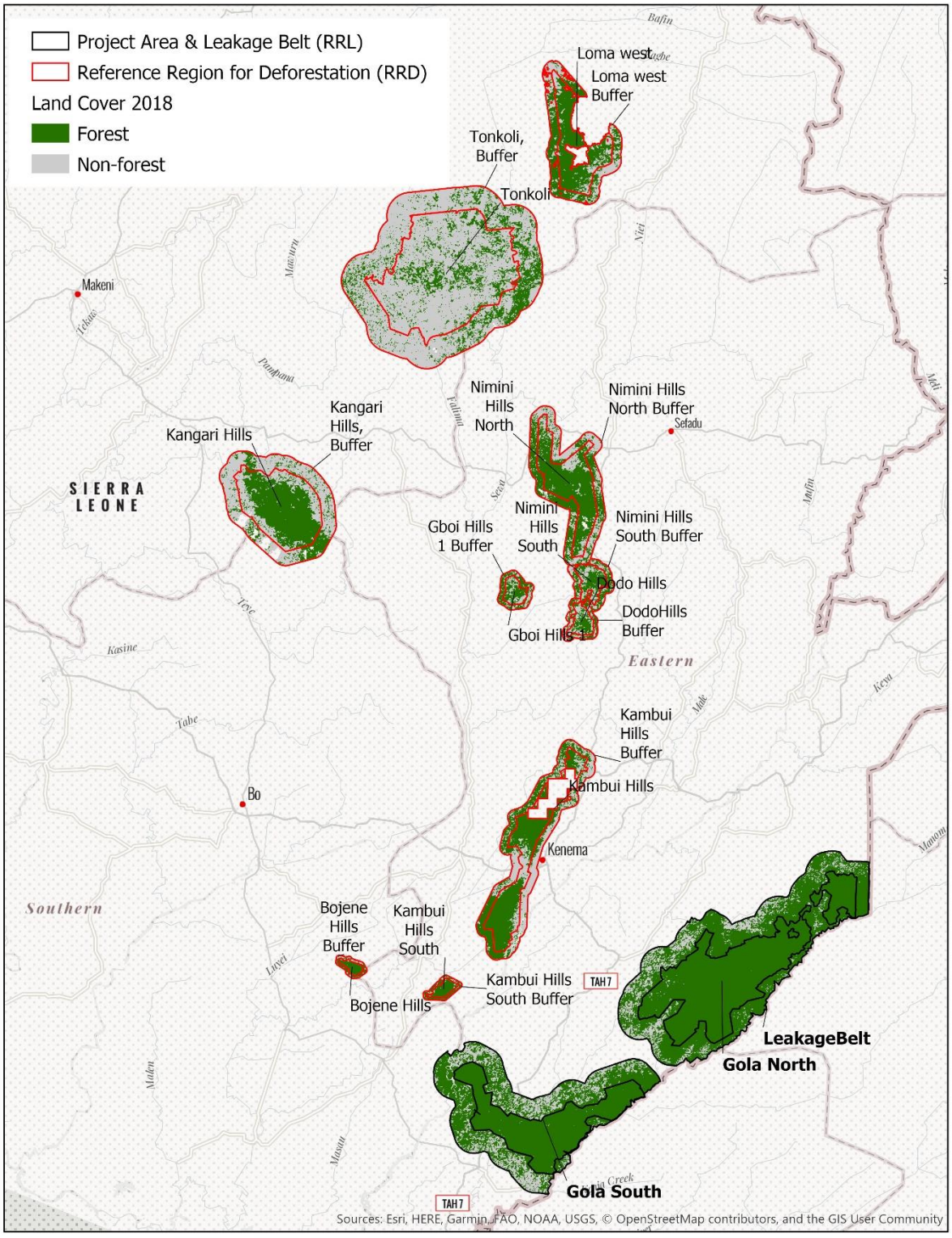


Figure 7. Project areas for the GRNP in 2018.

3.3.1 Project Area

The Project Area is divided into 2 forest blocks known as Gola North and Gola South (see *Figure 7*, the coordinates for these polygons can be found in the KML files in the appendices folder). Boundaries roughly follow the original boundaries of the Forest Reserves that were gazette between 1926 and 1963 (Fofanah 2012). Deviations to the original boundary are described in the boundary report (Marris et al. 2013). On the ground the boundaries have been cleared following protocols for demarcation (Marris et al. 2013), in coordination and agreement with the Forest Edge Communities living adjacent to the area. The improved demarcation of The Project boundaries and consultation with forest edge communities has continued throughout the project lifetime. This has resulted in small changes (less than 0.1%) in the total area of the GRNP. These changes in the project boundary result in small changes to the forest area reported by the GRNP over the lifetime of the project, therefore there are some small discrepancies in the area calculations from the original PD and this PD.

According to VMD0007 BL-UP the actual Project Area where carbon accounting will take place must be 100% forest at the start of the project (time zero). The current land cover show that this under this baseline renewal the GRNP Project Area boundaries as of 2018 is 68,340ha[2].

3.3.2 Leakage Belt

As per the original 2015 PD, to meet the VMD0007 leakage belt area requirements, the final Leakage Belt is defined as all forest areas within 4km buffer around the Project Area excluding area outside Sierra Leone, Tiwai Island Wildlife sanctuary, and areas that extended beyond the 7 Chiefdoms that surround the GRNP (Figure 7). Justification for selecting the leakage belt area can be found Netzer and Walker 2013.

3.3.3 Reference Region for Deforestation

As described in the original PD (2015), the methodology requires for the reference region for deforestation (RRD) to be representative of the general patterns of unplanned deforestation that influence the project area and leakage belt. In the absence of the project, the project area would have remained gazetted as a Forest Reserve with minimal funding for active management, as is the case for the other Forest Reserves in Sierra Leone. Based on this information the reference region was selected based on other similar Forest Reserves in Sierra Leone (that would be most similar to the GRNP in the baseline) and buffer areas around the Forest Reserves (that would be most similar to the Leakage Belt in the baseline) (Figure 7). The Forest Reserves which were finally used as

[2] The project proponent has full right of use in respect to the project area by virtue of entering into an enforceable and irrevocable agreement with the holder of the statutory and property rights in the land and vegetation of the project area, namely the Government of Sierra Leone (see section 1.7 for further details). The customary rights of the historical landowners of the project area are recognized by the project and by the Government and agreements have been made with each landowning family claiming customary tenure within the project area. Under these agreements the landowning family transfers full title to any credits generated through the project to the Government, and refrains from engaging in any actions that may interfere with the execution of the project, in return for benefits which are agreed in a separate benefit sharing agreement (See REDD Benefit Sharing Agreement, Appendix E Tatum-Hume et al 2013a, a sample of the agreements is found in the Forestry Division report 2013, annex 2). (See section 1.12.1 for greater detail).

reference areas were then decided based on other key factors identified in the VCS methodology (BL-UP), (Netzer and Walker 2013). The resulting reference region included 10 Forest Reserves and buffer areas around those reserves that were roughly 90-100% the area of their forest reserve, thereby mimicking the ratio of the Project Area to the Leakage Belt area. For this baseline renewal, following the requirments BL-UP, the historic baseline period has been revised from the original baseline 2001 to 2012 to the renewed baseline from 2007 to 2018.

3.3.4 Temporal Boundaries

Start and end date of the historical reference period

For the GRNP the first baseline period mapped across the RRD (temporal boundary) was developed from three land cover maps 2001, 2007 and 2011. The second, and current, baseline period mapped across the RRD used 2007, 2011 and a new land cover map for 2018 (Table 8. GRNP temporal boundaries for the first and second baseline events and verification events.). Land cover maps for just the Project Area and Leakage Belt were developed in 2015 for that year's verification event (does not require mapping of the entire RRD) and again for 2019 for the current verification (Table 8. GRNP temporal boundaries for the first and second baseline events and verification events.). Therefore, for the renewed baseline temporal boundaries are 2007 to 2018. The project is also conducting its second verification using land cover maps for the Project Area and Leakage Belt for the period 2015 to 2019, see MIR 2020 (Table 8. GRNP temporal boundaries for the first and second baseline events and verification events.).

Table 8. GRNP temporal boundaries for the first and second baseline events and verification events.

GRNP land cover maps (year)	Area of land cover mapping	First baseline	Second baseline	verification period 1	verification period 2
2001	PA,LB, RRD	1st historical baseline			
2007	PA,LB, RRD	1st historical baseline	2nd historical baseline		
2011	PA,LB, RRD	1st historical baseline	2nd historical baseline		
2015	PA,LB			1st monitoring event	
2018	PA,LB, RRD		2nd historical baseline		

2019	PA, LB				2nd monitoring event

Start date and end date of the project crediting period

In the original PD (2015) the project crediting period is identified as from the 1st August 2012 to the 1st August 2042, i.e. 30 years. Projections of baseline emissions are presented only for 10 years past the latest baseline renewal as per VCS requirements. With this PD the baseline is being renewed in 2018 and therefore the new crediting period is till December 2028 (10 years after 2018 land cover map).

Date at which the project baseline shall be revised

This baseline renewal is based on land cover maps from December 2018 (the project start date is August 2012). As per the methodology next baseline renewal will occur 10 years from that date – 2028.

Duration of monitoring periods

The first verification event occurred in 2015. The second verification is occurring in 2020 based on 2018 land cover maps. Subsequent events are expected to occur every 3 to 5 years.

3.3.5 Carbon Pools

The project is required to account for any significant decrease in carbon stock in the project scenario and any significant increases in the baseline scenario, therefore based on these requirements the following pools have been included in pre-deforestation and post-deforestation strata.

Table 9. Carbon pools included in carbon stock calculations. M indicates mandatory and O optional based on VM0007 Methodology.

Carbon Pool	Mandatory or Optional under VM0007	Included/ Excluded	Justification/Explanation of choice
Aboveground	M	Yes	This pool must be included following the methodology.
Belowground	M	Yes	This pool should be included according to the methodology as it's always significant. It is therefore included.

Dead-wood	(m)[3]	No	This pool should only be included if its greater in the baseline than the project scenario otherwise it is conservative to exclude. Following biomass surveys in the project area and in post-deforestation areas there is greater dead wood in the project scenario than the baseline scenario, it is therefore excluded (Tatum-Hume et al 2013b).
Harvested wood products	(m)[1]	(Yes)[2]	This pool must be included if the process of deforestation involves timber harvesting for commercial markets
Litter	0	No	Very little litter was found to be present in the baseline or project scenario, it was therefore decided to conservatively exclude this pool.
Soil organic carbon	0	Yes	Soil carbon analysis has shown this pool to be a significant source of carbon, which would be significantly reduced in the baseline scenario (Tatum-Hume et al 2013b). This pool is therefore included.

(m)[1] Mandatory where the process of deforestation involves timber harvesting for commercial markets

(Yes)[2] Harvested wood products are included in the project. Commercial harvesting in the project area is unknown (although it occurred historically in the 1980s in Gola South) and unanticipated in the baseline scenario. However, given that local people use some long term wood products when forest is converted to farmbush the project does include this pool. (See Section 3.1.2.4)

(m)[3] Mandatory if this carbon pool is greater in baseline (post-deforestation/degradation) than project scenario and significant; otherwise can be conservatively omitted

3.3.6 Sources of greenhouse gases

The project is required to account for any significant increase in emissions of GHG relative to the baseline that are reasonably attributed to the project activity. The following sources have therefore been assessed for inclusion into carbon accounting.

Table 10. Sources of GHG included in carbon accounting for the project

	Source	Gas	Included	Justification/Explanation

Baseline	Biomass burning	CO_2	No	However, carbon stock decreases due to burning are accounted as a carbon stock change
		CH_4	Yes	Included
		N_2O	Yes	Included
	Combustion of fossil fuels	CO_2	No	Conservative to exclude
		CH_4	No	Potential emissions are negligibly small
		N_2O	No	Potential emissions are negligibly small
	Use of Fertilizers	CO_2	No	Potential emissions are negligibly small
		CH_4	No	Potential emissions are negligibly small
		N_2O	No	Conservative to exclude
Project	Biomass burning	CO_2	No	But carbon stock decrease due to burning are accounted as a carbon stock change
		CH_4	Yes	Emissions will be accounted when fires occur
		N_2O	Yes	Emissions will be accounted when fires occur
	Combustion of fossil fuels	CO_2	No	According to VM0007, can be neglected if excluded from baseline accounting

N_2O and CH_4 is included in the baseline for biomass burning. They are excluded from the baseline for combustion of fossil fuels and the use of fertilizers, because it is conservative to omit them. The estimation of emission from nitrous oxide is required in the project case if leakage prevention activities include the increases in the use of fertilizers, however the Gola REDD Project will not use fertilizers as a leakage prevention activity, and therefore emissions from nitrous oxide are excluded. All N_2O and CH4 emission from burning will be accounted in the project case.

3.4 Baseline Scenario

Following the original PD that was validated in 2015, the GRNP's baseline scenario remains the same. The justification for this continued baseline is evident in the deforestation that has occurred over the project period in the RRD as smallholder farmers expand into these poorly protected forest reserves.

The baseline scenario is identified following "VT0001 Tool for the Demonstration and Assessment of Additionality in Agriculture, Forestry and Other Land Use (AFOLU) project activities", which is described in Section 3.5 below, through extensive stakeholder surveys, and through a spatial analysis of land cover change in Sierra Leone following the methods described in VM0007. Based on these analyses, it was determined that the most likely baseline scenario is the conversion of forest by smallholder agriculturalists. Detailed surveys of the common land use practices of such agriculturalists found that the average fallow period was found to be 7 years in areas close to the project boundary and 7.5 years in the surrounding areas (Witkowski et al 2012a, Cuni-Sanchez 2012b).

To estimate the rate at which baseline forest would have been deforested, all Forest Reserves in Sierra Leone with comparable environments were analyzed for their relevance as a reference region (i.e. comparable) to the project area and leakage belt. Forest Reserves were assessed to identify if

there were significant differences in deforestation rates between different types of Forest Reserves (production and protection). There was found to be no significant difference between reserves. Forest Reserves that had known industrial logging or mining activities in the last 10 years were excluded. Forest Reserves with no legal distinction were also excluded. Each Forest Reserve was assessed using PRAs, and published reports to establish similarities to the project area and leakage belt. After selecting Forest Reserves that were most similar, buffer areas around the Forest Reserves were established. Mimicking the requirements for the definition of the leakage belt the buffer areas were made to be 90-100% the area of the corresponding forest reserve. These areas (Forest Reserves and buffer areas) were identified as the reference region for establishing the expected rate of deforestation in the project area and leakage belt.

Following the methodology the quantification of the threat and location of unplanned deforestation was assessed using the modelling programs Land Change Modeller (LCM) and GEOMOD. These modelling programs have been well established for use in REDD projects. The model was calibrated and confirmed (i.e. validated) following the guidelines of the BL-UP.

Finally, the baseline carbon stock changes were calculated for the project area and leakage belt following BL-UP. At the time of this baseline renewal (2018) the GRNP is also undergoing verification for the 2015 to 2019 monitoring period following M-MON.

3.5 Additionality

Additionality is demonstrated following the Verified Carbon Standards (VCS) tool 'VT0001 Tool for the Demonstration and Assessment of Additionality in Agriculture, Forestry and Other Land Use (AFOLU) project activities' which applies a stepwise approach. This Additionality Assessment was validated and verified in 2015. It is believed that this original assessment will still stand (depite any updates to the Additionality tool) as the original case for the Projects Additionality should not change after the project official start date. Also, all the drivers and risk remain the same as they did at the project start in 2012.

STEP 1 – IDENTIFICATION OF ALTERNATIVE SCENARIOS

Step 1a. Identify credible alternative land use scenarios to the proposed VCS AFOLU project activity Scenarios

The following 8 alternative scenarios were identified for the project;

1. Continuation of Forest Reserve designation and issuance and implementation of selective logging concessions

Historically the project area (GRNP) was designated by the government as a timber production area. Gola East and West reserves were gazetted as Forest Reserves in 1926 (now known as Gola South), Gola North in 1930 (now known as Gola Central) and extensions added in 1956 and 1963 (now known as Gola North) (See Figure 11). Two large scale timber companies worked in the Gola project area, the Forest Industries Corporation (FIC) and The Sierra Leone Timber Industry and Plantation

Company (SILETI) (Illes et al 1993). FIC worked in the accessible areas in the western section of Gola Central in 1961, 1978 and during the period 1984-1986. Some 19% of Gola Central was exploited during this period (Illes et al 1993). Gola South was more extensively logged by both FIC and SILETI during the 1960's, 70's and 80's, operations finishing in 1989 (Iles et al 1993).

Although the most accessible timber has been removed, Iles et al. (1993), estimated that 28,000 m^3/year could be sustainably extracted. Currently there is ban on timber exports; only timber products with added value can currently be exported from Sierra Leone but a high tax levy on each container acts as a disincentive to commercial operators (Sheku Mansaray, Forestry Division pers. comm.). Currently any small-scale logging or larger scale commercial logging operations are therefore selling wood to the National market. Although there are limitations, the project area still has the potential to be commercially logged as an alternative land use scenario.

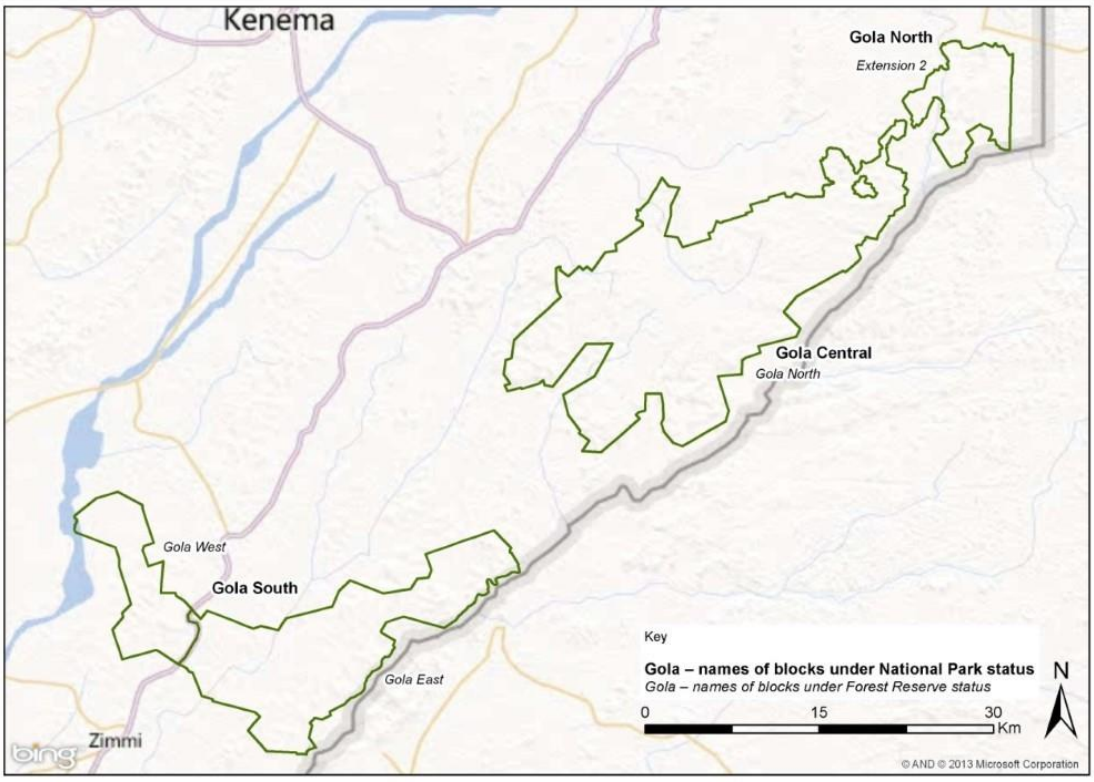


Figure 8. The GRNP with current and historical block names as a Forest Reserve and as a National Park

2. Continuation of the Forest Reserve designation lacking operation budget resulting in an influx of small-scale logging operations

Small scale logging operations remove selected trees from within the project area, causing localised degradation. Timber prices on the local market offer an attractive incentive for small-scale logging activities in a country where unemployment, especially among male youths is high (Peters et al 2010:6,7). Without the project small scale illegal timber extraction would take place, it is thought

that such activities would be highest in areas where no community forests remain and areas which are most accessible and have good timber stocks (Witkowski 2012). Small scale logging operations therefore represent an alternative land use scenario and such activities would result in degradation, paving the way for further degradation and deforestation processes.

3. Continuation of Forest Reserve designation with issuance and implementation of industrial mining concession operations in parts of the reserve

Before the civil war during the 1960's and 70's the mineral sector provided Sierra Leone with 70% of its foreign exchange earnings and of 20% of the GDP (National Recovery Strategy 2002:7). Minerals continue to be of key importance to the economy of Sierra Leone, as highlighted by the priority given to the sustainable development of the country's mineral wealth in the National Recovery Strategy (2002:55) and the Poverty Reduction Strategy Paper (2005:93). Mineral exports contributed to 54.3% of Sierra Leone's total exports in 2010 (ICMM 2012).

Mining concessions overlie the boundaries of other Forest Reserves; the Kangari Hills Forest Reserve for example is partly overlain by the Baomahun licence for Gold Mining where operations are owned and run by Cluff Gold (Cluff Gold report 2010: 8). Licenses for prospecting minerals have also been issued by the Ministry of Mines within the project zone in the past (see figure Figure 12). Subsequent investigations into the companies purporting to own the licences reveal that many are no longer operating, and the Ministry of Mines reports that there are no active mining licences in the Gola Forests (pers. comm. Director of Mines Jonathan Sharkah on 22 January 2013). The only possible threat is therefore over known deposits of iron ore contained in the Bagla Hills in the Southern block of the project area. The Bagla Hills contain a viable large-scale deposit of iron ore (SRK Consulting 2007) which would be extracted by open cast mining methods (SRK consulting 2007), if a licence was issued and would cause multiple direct and indirect impacts on the environment (MINEO 2000; 5).

During 2018 and 2019 there have been a number of arrests of local artisanal miners in Gola South and Central looking for Gold and other precious minerals. The people arrested were handed over to the precious mineral department of the Kenema police for prosecution. During the reporting period there have been no major mining interests threatening the GRNP.

Only the southern block of the project area therefore has the potential to be industrially mined as an alternative land use scenario.

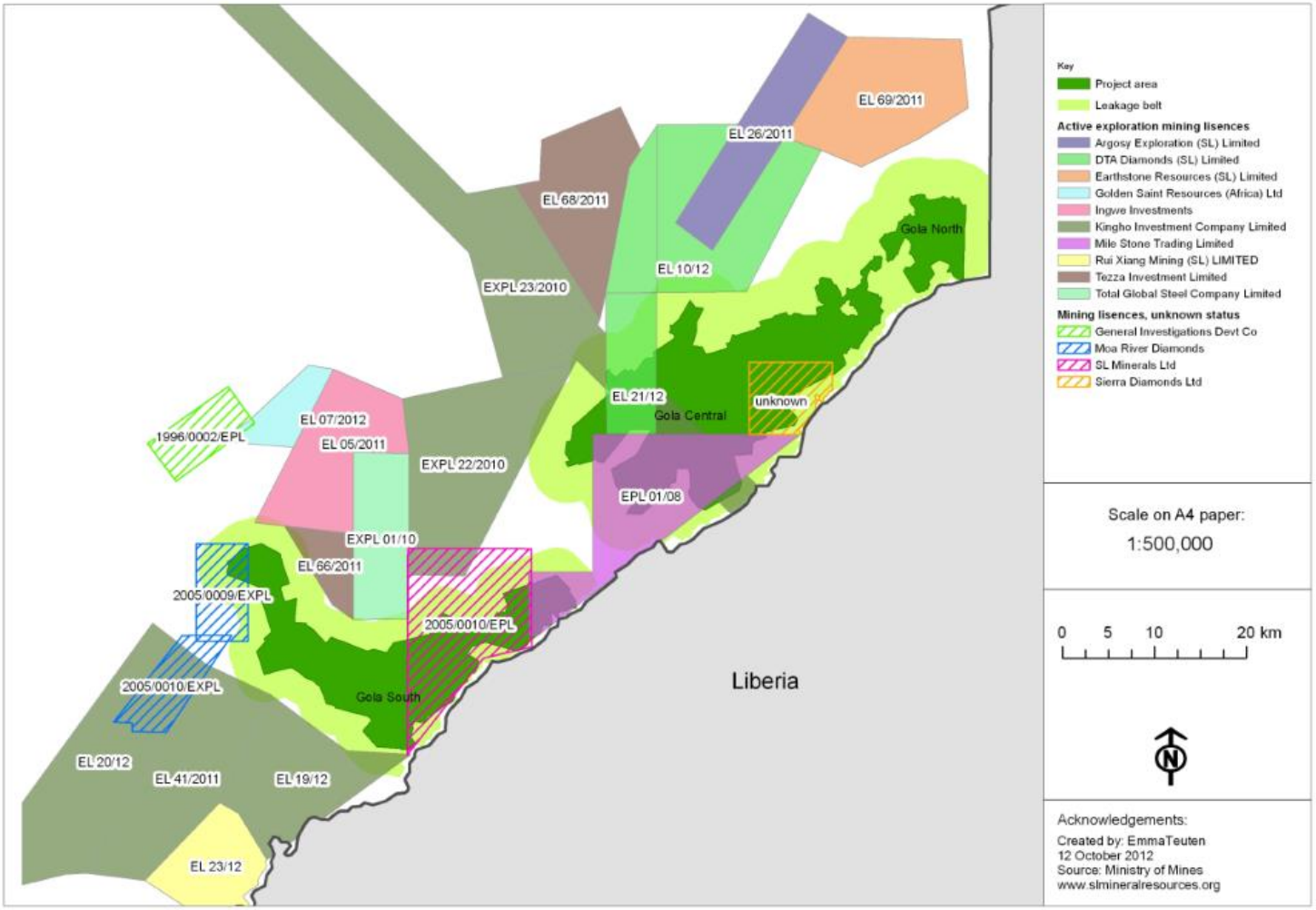


Figure 9. Mining licenses previously issued in the project zone (source: Ministry of Mines website; www.slmineralresources.org)

4. Continuation of the Forest Reserve designation lacking operation budget resulting in an influx of artisanal miners

Mining activities carried out locally by artisanal miners looking for gold and diamonds have been reported from within and around the borders of the project area, (Witkowski 2012). In particular, the Chiefdom of Nomo experienced high levels of artisanal mining during 2011 when 70 miners were arrested from within the project area by the patrol teams (Witkowski 2012). There has been military involvement in these illegal activities and the Forest rangers have received threats from organised groups of artisanal miners. Artisanal mining is carried out in small, shallow pits (approximately 1m deep), using rudimentary tools and results in forest degradation rather than large scale deforestation (Witkowski 2012). Such activities represent a potential alternative land use scenario for small parts of the project area, where there are believed to be small accessible deposits of minerals. Incidents of mined went down but during 2018 there were 18 arrests, in Gola central

and South, including two Park Rangers all were handed over to the Kenema police and sentenced to two years in prison. The made objective of the mining activities was to find gold.

5. Continuation of the Forest reserve lacking operational budget resulting in unplanned deforestation: small scale degradation and deforestation resulting in shifting cultivation by small holder agriculturalists

Smallholder agriculture is widely cited in the literature as a primary driver of deforestation in Sub-Saharan Africa (EC 2010, Union of Concerned Scientists 2011, Gibbs et al 2010). Although in some countries this may be an over-generalization (Ickowitz 2006), in Sierra Leone there is a strong case that the conversion of forest into the farm fallow cycle is one of the primary drivers of forest loss. Climatic conditions would allow Sierra Leone to support forest cover in approximately 60% of its land area but current forest cover is estimated at only 5% (NBSAP 2003). Extensive loss of national forest has been driven primarily by the conversion of forest land into the bush fallow cycle*;* subsistence agriculture being the principal livelihood of 80% of the labour force in Sierra Leone (USAID 2007). The Ministry of Agriculture, Forestry and Food Security (MAFFS) also highlights the conversion of forest to agriculture as one of the key drivers of deforestation (MAFFS 2004, PRSPII 2008:144). Estimates that 600,000 hectares of forests have been cleared for shifting cultivation (National long term perspective studies 2004; 29); Sierra Leone received the world's lowest Environmental Performance Index rank in 2010 (163/163).[4]

A high proportion of the labour force in Sierra Leone is dependent on land for agricultural subsistence activities; 75% according to the National Poverty Reduction Paper (2005:33) and 90% of the farming population are small holder farmers according to the National Rice Development Strategy (National Rice Development Strategy 2009:5). However, subsistence activities are highly inefficient (Goodman 2008), and fewer than 5% of farmers have access to fertilizers, insecticides and herbicides which could help boost productivity (National Rice Development Strategy 2009:7). Both biotic and abiotic factors such as disease, pests, low soil fertility and poor extension services limit farmers yields and factors such as poor crop management, inappropriate storage facilities and poor market access limit farmers' ability to sell produce (National Rice Development Strategy 2009:7). In the region of the project area agricultural yields were calculated to have a value of $70 per hectare (Goodman 2008), which is very low compared to other West African countries such as Ghana at $180 per hectare (Grieg-Gran 2008). Low productivity combined with an increasing population's demand for food - an average 2.8% pa growth rate was recorded for Sierra Leone by the World Bank between 2004 and 2010 (World Bank 2010), and 2% average growth rate in Forest Edge Communities around the project area (Bulte et al. 2013) - results in a need for more land to farm as cash poor rural households struggle to afford imported rice prices (National Rice Development Strategy 2009).

Deforestation as a result of farming activities has occurred in the past in the project area before conservation management activities began in 2004 (Witkowski 2012) and is considered to be the continuation of the pre-project land use. Farming encroachment into the project area (then a forest reserve) occurred in many areas for various reasons. In some cases it occurred as farmers wanted

to expand their farming activities and project boundaries were not clear. As there was no management presence on the ground there were little consequences felt by farmers for encroaching (Witkowski 2012). In other cases families wished to re-exert their historical right to farm inside the reserves (Davies and Richards 1991:29) and so created small plantations or farms inside the Forest Reserves, and in other cases new villages and farms were created within reserve boundaries either during the war when people were seeking a safe place to go, or pre-war by families looking for a new place to live and farm (Musa Swaray, town Chief and Forest ranger, pers. comm., Witkowski 2012). The soils found in newly cleared areas of forest are widely perceived to have much higher fertility and therefore produce better yields which has driven the conversion of forest areas (Witkowski 2012, Davies and Richards 1991:27,29), and whilst areas of primary forest are harder to clear without labour and equipment, without the project the degradation caused by small scale logging and mining activities would open up the area and more readily allow access for small holder agriculturalists. A similar pattern of agricultural encroachment is seen in the other Forest Reserves selected as the Reference Region for the project (Showers 2012, Cuni-Sanchez 2012b, Netzer and Walker 2013).

Without the project activities gradual encroachment into the project area is likely as well as the appearance of new communities inside the project area; smallholder agriculture is therefore an alternative land use scenario.

6. Continuation of the Forest Reserve designation lacking operation budget resulting in an influx of plantation agriculture

The GoSL is actively promoting agricultural investment opportunities for national and international investors. Cash crops such as rice and cocoa as well as the production of agrofuels such as sugar cane and palm oil are targeted as investment opportunities in rural areas. A newly created government agency, the Sierra Leone Investment and Promotion Agency (SLIEPA), assists investors and offers generous incentives (SLIEPA presentation). Large scale plantations (above 16,000 hectares) are in the process of being established in the Kailahun and Pujehan districts (two of the three districts in the project area). Socofin S.L. for example is making an investment of $100 million for 12,000 hectare rubber and oil palm plantation in the Pujehun District (Green Scenery report 2011) and smaller scale investments are being made within the project zone (e.g. tropical farms who purportedly have a 1200ha concession for cocoa production per comm.. tropical farms). Without the project, plantations would be a credible alternative land use scenario for the project area.

7. Continuation of the Forest Reserve designation lacking operation budget resulting in degradation due to charcoal and fuel wood collection

The majority of the population uses firewood and charcoal for cooking; over 80% of energy is derived from biomass and it is estimated that 4 million cubic meters of wood biomass is extracted annually to meet domestic energy requirements in Sierra Leone (UNDP 2007). According to the Assistant Director of Forestry, firewood collection and charcoal production are two of the drivers of forest degradation in Forest Reserves in Sierra Leone (Garnett 2012), though such activities are illegal

unless the trees are already downed or dead. Species such as *Parinari excelsa* (Chrysobalanaceae) are used to make charcoal and this species is one of 10 most common trees found in the project area (Klop et al 2008). Neither fuel wood collection nor charcoal production were revealed as primary drivers of deforestation or degradation in the project area as there is ample farmbush closer to the communities for collection and wood collected in the forest is considered too wet (Witkowski et al 2012b). Small areas of forest may become degraded without the project in the project area but charcoal and fuel wood collection are not likely alternative land use of the project area.

8. Designation of area as National Park and committed long term financial resources allowing for protection of forest resources

In recognition of the importance of biodiversity, Sierra Leone has signed and ratified the Convention on Biodiversity and on numerous occasions the current President, Dr Ernest Bai Koroma, has publically committed to conserving the country's natural forest resources for the ecosystem services they provide (Koroma 2009, 2011). The GoSL could therefore have upgraded the project area into a National Park in the absence of the project. As discussed later in G2.2, steps two and three, the GoSL does not have the financial resources to protect the project area or the other gazetted areas of forest in Sierra Leone. The strategic priorities for investment of the Government of Sierra Leone revolve around consolidating peace and rebuilding the economy after the debilitating civil conflict (Poverty Reduction Strategy Paper II, 2008.); conservation is a low priority. The protection of Forest Reserves in Sierra Leone is not part of the Forestry Division's strategic plan (FD strategic Plan 2012-2014, Showers 2012:12), and therefore no budget is available from Central Government for activities relating to the management or protection of Forest Reserves or National Parks in Sierra Leone. In 2011, $115,814 *was* allocated to the Forestry Division in the Government of Sierra Leone's budget to manage 48 Forest Reserves and National Parks covering over 300,000 hectares of forest. It is therefore highly unlikely that *the* Government would have proclaimed the area as a National Park, had the finances from a REDD project not been highlighted as the future source of funding (Eco-securities 2008) for the Park management (per comm.. Sheku Mansaray, McClanahan 2011).

The designation of the area as a National Park with committed financial resources cannot therefore be considered as a viable alternative scenario but would be the scenario which serves as a with-project activity performed without being registered as a VCS AFOLU project.

As a result of the above analysis, the credible land use scenarios are therefore;

1. Continuation of the Forest Reserve designation and issuance and implementation of selective logging concessions

2. Continuation of the Forest Reserve designation lacking operation budget resulting in an influx of small scale logging activities

3. Continuation of Forest Reserve and issuance and implementation of industrial mining concession and operations

4. Continuation of the Forest Reserve designation lacking operation budget resulting in an influx of artisanal miners

5. Continuation of Forest Reserve designation lacking operation budget resulting in influx of small holder agriculture

6. Continuation of Forest Reserve designation lacking operation budget resulting in influx of Plantation agriculture

Step 1b. – Consistency of land use with mandatory laws and regulations

The principal laws that legislate the Forest Reserves and protected areas of Sierra Leone are the Forestry Act 1988, the Forest Regulations 1990 and the Wildlife Act 1992.

1. Continuation of Forest Reserve designation and issuance and implementation of selective logging concessions

Without the project, the forests would be controlled by Forestry Act No.7 of 1988 and administered under the Forestry Regulations published as part of the Act in December 1990. The forests would be managed by the Forestry Division of the Ministry of Agriculture, Forestry and Food Security (MAFFS). Commercial logging would be consistent with the mandatory laws and regulations from the 1988 Forestry Act which grant the Forestry Division the power to issue commercial timber licences and concessions in Forest Reserves (Fofanah 2012). Even as a National Park, concessions can be authorized by the Chief Conservator of Forests (Fofanah 2012). Provided the company has a licence or concession, this land use would be consistent with laws and regulations for either a Forest Reserve or a National Park.

2. Continuation of the Forest Reserve designation lacking operation budget resulting in an influx of small scale logging activities

Although small scale logging is illegal unless licences are granted (Fofanah 2012), there is currently little or no enforcement of the existing laws and legislation in other Forest Reserves, nor would there be in the project area without the project (Showers 2012). A reserve without active management due to low capacity and lack of finances within the Forestry Division (Showers 2012) is therefore readily subject to degradation by small scale logging activities. Degradation resulting from small scale logging activities is widely reported as a land use occurring in other Forest Reserves in Sierra Leone (Cuni-Sanchez 2012b, Showers 2012). Although it's not consistent with legislation unless loggers have a licence, it is common practice and therefore an alternative land use scenario.

3. Continuation of Forest Reserve and issuance and implementation of industrial mining concession and operations

Without the project the forests would be controlled by Forestry Act No.7 of 1988 and administered under the Forestry Regulations published as part of the Act in December 1990. According to section 3(a) and (b) of the Forestry Act, the Chief Conservator, under the direction of the Minister of MAFFS, is responsible for the efficient management and rational utilisation of the country's forest resources and their preservation. According to Section 28 (1) of the Forestry Act, no prospecting, exploration

or mining may be carried out in national or community forest. Section 9 of the Forestry Act also states that in a national or community forest no one can "cut, burn, uproot, destroy…clear any land, remove any timber… take any earth, clay, sand, gravel or stone except pursuant to a concession agreement or licence confirmed usage right or other authority under this act" (Forestry Act 1988:5, 20, 8). Furthermore, Section 21 of the 1994 Mines and Mineral Decree, which was in force when the licences outlined in step 1a were allocated, states that where an act is prohibited in another law, nothing in the Mines Decree will be interpreted as authorising that action (Global Witness 2010).

However, the fact that mining licences have been allocated over several Forest Reserves (Witkowski 2012) and are currently operational, as is the case in Kangari Hills Forest Reserve (Cluff Gold report 2010: 8) and in Farangbaia where a railway to extract mineral ore has divided the Forest Reserve in two (Showers 2012), demonstrates that legislation is not the only factor that should be considered in assessing alternative scenarios. Political will, development opportunities and finance must also be considered. Even as a National Park, a provision currently exists in the legislation allowing the President or the Chief Conservator of Forests to permit prohibited activities within National Parks if they are within National interests (Fofanah 2012). Commercial mining could be granted within a Forest Reserve or within a National Park in Sierra Leone if approved by the Chief Conservator or by the President. This land use would therefore be consistent with laws and regulations.

4. Continuation of the Forest Reserve designation lacking operation budget resulting in an influx of artisanal miners

Although as described above, artisanal mining is illegal unless licences are granted, there is currently little enforcement of the existing laws and legislation due to the Ministry of Mine's lack of human and financial resources (Fofanah 2012). The price obtained for gold and diamonds offers an attractive incentive for artisanal activities. In a country where unemployment, especially amongst male youths, is high (Peters et al 2010:6,7), other Forest Reserves in Sierra Leone are experiencing degradation as a result of artisanal mining activities (Showers 2012 and Cuni-Sanchez 2012b). Although not necessarily consistent with legislation, artisanal mining has become common practice in reserves with no active management.

5. Continuation of Forest Reserve designation lacking operation budget resulting in influx of small holder agriculture

Whilst farming activities inside Forest Reserves would be considered illegal without any formal permission, farming inside other Forest Reserves where management is minimal or non-existent has become common practice, (Cuni-Sanchez 2012b, Showers 2012, Netzer and Walker 2013). Without additional external funding the Government of Sierra Leone does not have the resources to protect its forest estates, and protection is not seen as a strategic priority when there are many other more pressing development issues on the agenda (Showers 2012). Farming inside the project area occurred before conservation management and law enforcement began in 2004 (Witkowski 2012). Encroachment by local communities for farming is therefore a commonplace activity inside Forest

Reserves in Sierra Leone and consequently an alternative land use scenario that is consistent with common practice.

6. Continuation of Forest Reserve designation lacking operation budget resulting in influx of plantation agriculture

As with the issuance of logging and mining concessions described above, the Chief Conservator has the authority to issue a licence or a concession for a plantation within a Forest Reserve or a National Park, making this land use consistent with legislation.

Plausible alternative land use scenarios:

1. Continuation of Production Forest designation and issuance and implementation of selective logging concessions

2. Continuation of the forest reserve designation lacking operation budget resulting in an influx of small scale logging activities

3. Continuation of Forest Reserve and issuance and implementation of industrial mining concession and operations

4. Continuation of the forest reserve designation lacking operation budget resulting in an influx of artisanal miners

5. Continuation of Forest Reserve designation lacking operation budget resulting in influx of small holder agriculture

6. Continuation of Forest Reserve designation lacking operation budget resulting in influx of Plantation agriculture

Step 1c. Selection of the baseline scenario

The REDD project activity is identified using the following decision tree, as delineated in VM0007. The result of this decision tree demonstrates that the REDD project activity is Avoided Unplanned Deforestation. Thus it is concluded that the baseline scenario is avoided unplanned deforestation.

Is the Forest land expected to be converted to non-forest in the baseline case?			
Yes		No	
Is the land legally authorized and documented to be converted to non-forest?		Is the forest expected to degrade by fuelwood extraction or charcoal production, in the baseline case?	
Yes	No	Yes	No
Avoided planned deforestation	Avoided unplanned deforestation	Avoided forest degradation	Proposed project is not VCS REDD activity currently covered by the module framework

The below potential land uses are deemed not the most likely land use due to the following characteristics:

1. Planned deforestation due to selective logging concessions

Selective logging concessions are **not** considered a land use in the baseline scenario for the project area as despite being consistent with legislation for a forest reserve, no concession licences have been granted within the project area in the last 30 years and are therefore an unlikely alternative land use.

2. Unplanned degradation due to small scale logging activities

Small scale logging activities result in localised degradation as typically only a few trees are removed from an area (Witkowski 2012). Commercial activities in the 1960s to the 1980's removed the most valuable and accessible timber (Illes et al 1993: 10, 29), but small scale activities involving local gangs and people to transport the wood are likely to feature in a baseline scenario as occurred pre conservation activities (Illes et al 1993: 34, Witkowski 2012). Degradation from small scale logging activities is **not** included in the baseline scenario as it would not result in deforestation, it will be however be monitored through the projects lifetime.

3. Planned deforestation due to Industrial mining concessions

Although industrial mining concessions for exploration have been issued within the project area in the last 10 years, no mining activities have ever been initiated and most of the companies that purportedly own the licences no longer operate. The only possible threat for industrial mining to occur is in the Southern block of the project area where there is a commercially viable deposit of iron ore in the Bagla Hills. It is a potential threat as several claims have recently been made by individuals and companies interested in mining there (Daily Mail 2012). However, the Government

has repeatedly stated that mining will not be allowed to occur in the GRNP (e.g. State House Communications Unit 2011) and therefore planned deforestation from mining concessions is not an alternative baseline scenario.

4. Unplanned degradation due to artisanal mining

Artisanal mining results in forest degradation and small areas of deforestation as mining pits are made with rudimentary tools and are small and shallow (Witkowski 2012). Artisanal mining was seen as an activity to supplement agricultural incomes by Forest Edge Communities and not the primary livelihood activity (90% of communities in the project zone reported that agriculture was the main livelihood activity (Bulte et al. 2013). Although artisanal mining is expected to take place in some small areas within the project area without the presence of forest rangers, it is not the dominant driver of deforestation and is therefore **not** considered in the baseline scenario. It will be monitored throughout the lifetime of the project.

5. Unplanned deforestation: degradation and deforestation resulting in land use change from smallholder agriculture

Historical trends regarding land use in Sierra Leone in and around Forest Reserves indicate that the primary driver of deforestation in Forest Reserves which are not actively managed is from encroachment by small holder agriculturalists converting forests into the bush fallow cycle. This is the most widespread driver of deforestation in Sierra Leone and would result in a mosaic landscape containing fields at various stages along the crop-fallow cycle, from active cropland to fallow areas (Netzer and Walker 2013).

6. Planned deforestation due to commercial plantations

Planned deforestation due to commercial plantations is not considered a likely alternative land use as currently there is no evidence of agriculture concessions being granted within the boundaries of the project area or other Forest Reserves in Sierra Leone.

As a result of step 1c, the most plausible land use scenario is:

Unplanned deforestation due to smallholder agriculture practices.

STEP 2 INVESTMENT ANALYSIS

Sub-step 2b

Detailed accounts of the costs incurred by the GRNP forest program to develop and operate the conservation management during the initial phase of conservation activities have been kept since 2008. The average yearly costs from the 4 years of activities plus the costs of implementing new leakage activities in the forest edge communities of the leakage belt which aim to mitigate leakage whilst providing net positive benefits have been summarized in table Table 11.

Table 11. Annual costs for the REDD project; averaged into a yearly amount calculated over a 5 year period (2013-2018)

Budget Item	TOTAL
Management	80,902
Research & Monitoring	58,298
Administration & Finance & HR services	134,957
Park Operations	232,622
Travel & Transport	9,548
Equipment, Consumables & Running costs	169,965
Other services & fees (incl communication, finances & verification event)	43,845
Visibility & Outreach	28,693
Community Benefit Sharing Development & Implementation	268,965
Infrastructure (maintenance & development)	28,432
Total GRNP Core Operations Annual Budget (£)	1,056,226
Core Ops Annual Budget €	1,248,354
Core Ops Annual Budget USD (@1,59)	1,686,117

The only income over this period has been from visitors to the park, the revenue from which is summarized in Table 12 below:

Table 12. Income from ecotourism activities

Year	Total Revenue	Revenue for Forestry Division	Revenue for Communities	Costs: Community Staff, Guides, food, transport, training & maintenance
2009	$357	$233	$124	0

2010	$1999	$1258	$741	0
2011	$1427	$757	$670	0
2012	$2791	$1640	$1151	0
2013	$366	$36	$36	$294
2014 (Ebola)	$231	$29	$29	$173
2015	$45	0	0	0
2016	$700	$13	0	0
2017	$10,577	$1,335	$1,335	$7,906
2018	$6,348	$1,085	$1,085	$4,178

The income generated by project tourism activities is given to the Forestry Division and to local communities involved in the tourism activities and is not kept by the project. The project activities therefore do not generate any income to offset the costs of the project.

Budget available from the Government of Sierra Leone

The strategic priorities of the Government of Sierra Leone revolve around consolidating peace and rebuilding the economy after the debilitating civil conflict (Poverty Reduction Strategy Paper II, 2008), conservation is a low priority for the allocation of funds.

The protection of Forest Reserves in Sierra Leone are not part of the Forestry Division's strategic plan (Forestry Division strategic Plan 2012-2014 and Showers 2012), and therefore no budget is available from the Central Government for activities relating to the management or protection of Forest Reserves in Sierra Leone. Instead, the Forestry Division's strategy focuses on reforestation, the promotion of commercial activities and the legislative framework for forestry. The staff required in the districts to fulfil the requirements of the Forestry Divisions strategic plan are paid directly by the Central Human Resources Department. In the 2012-2014 budget, a total of Le272,638 ($63) was available per month for 3 Forestry Division staff in Pujehun District, Le1,311924 ($305) was available per month for 16 staff in the Kenema District and Le79241 ($18) per month for 1 staff in the Kailahun District. This amounts to an average of $22 per person per month (below the widely accepted $1 per day international poverty line). These 3 districts are responsible for 13 Forest Reserves, not just the project area (GRNP). Without the project, it is assumed that these amounts would still be available to pay Forestry Division staff in the 3 districts where the project is located[5]. However, there would be no budget available for them to implement any forest management or protection activities.

The project activities and budget available from Central Government clearly do not generate any significant income to offset the necessary conservation management costs. The project would therefore be entirely reliant on VCS income to create financial benefit.

Having demonstrated that the project does not generate any financial benefits other than VCS related income, the project is then required to show that the project activities are not common practice. In the interest of transparency and best practice, the project, in addition to common practice analysis, also presents a barrier analysis to highlight the difficulties in implementing conservation projects in Sierra Leone

Step 4 – COMMON PRACTICE ANALYSIS

The Sierra Leonean Government is highly dependent on external financing. Since 2005 between 19 and 46% of Sierra Leones yearly revenue has come from foreign aid (EU report 2007;9, DFID 2012). As demonstrated in Step 2, the Government does not have internal funding to manage the country's Forest Reserves. In 2003 the National Biodiversity Strategy and Action Plan (NBSAP) reported a 95% dependency of the forestry sector on donor funding (NBSAP 2003). Financial dependency on short term and insecure donor funding sources creates a cycle of short term projects and does not allow for long term strategic planning and management or secure sharing of benefits with local stakeholders (IUCN 2006 Chapter 2 and 3). This is demonstrated in the only other National Park gazetted in 1995; Outamba-Kilimi, in the far north of the country. A 5-year World Bank project, the Biodiversity Conservation Project began in 2010 to improve the management of 3 protected areas in Sierra Leone, one of which is the Outamba-Kilimi National Park. In a METT analysis (Management Effectiveness Tracking Tool) carried out by the Biodiversity Conservation Project team in 2011 on Outamba-Kilimi National Park, one of the principal issues identified was that no current budget was available for the protected area and that management was wholly reliant on outside or year by year funding (Koker 2011). This has resulted in a lack of effective management of the National Park and associated problems of encroachment, deforestation and hunting (Koker 2011). There is no strategy to secure funds for Outamba-Kilimi National Park beyond the lifetime of the Biodiversity Conservation Project which ends in 2015. The possibility of future funding from REDD or PES schemes is mentioned as a possible future finance mechanism in project documents but there is no project funding to develop the necessary documents to secure this finance (BCP project proposal 2009). As demonstrated, it is common practice for outside donors to periodically finance short-term conservation work in Sierra Leone but this does not secure the long term finances necessary to reduce deforestation.

The Forest Reserve closest to the capital city – the Western Area Peninsular Forest Reserve which in 2013 was upgraded to a National Park, is another Park experiencing high levels of deforestation. As the Government does not have the finances or capacity to manage this Park, an international NGO (WHH – WeltHungerHilfe) began working with the Forestry Division to investigate alternative financing mechanisms including PES and REDD (e.g. OBf WAPFOR REDD scoping study 2011). Again, since the Government does not have the finances to stop deforestation within Forest Reserves and Parks, other NGOs are therefore beginning to investigate new sources of financing to

reduce deforestation, but this is far from common practice. The Western Area Peninsular National Park and the Gola project are separate projects in different geographical areas with very different alternative land-use scenarios and lack of funding seems to have halted the development of a REDD project in that Park (Per.comm WHH).

Within the project area, the RSPB has taken the lead in sourcing funding from donors for the initiation of conservation management activities in the GRNP, but as can be seen from the 'Review of Gola Funding Potential' (Hipkiss 2012), securing financing from a limited pool of donors results in a boom and bust project cycle as reported above. The GRNP team has failed to secure funding from donor sources beyond July 2012, despite extensive research and investment into proposals (Hipkiss 2012). It has therefore been common practice since 2004 for the project area to be protected using short-term donor funding, but donor funding is no longer available as explained Step 3a (investment barriers) and without funding, the project area will become like any other Forest Reserve or National Park in Sierra Leone and suffer from significant deforestation and degradation.

Clearly it is not common practice in Sierra Leone for the State to be able to fund the management of its forest estates. Requests to donors have been the only alternative tried in Sierra Leone to fund the management of Forest Reserves, but these funding streams are subject to the priorities of external governments and donor objectives, and therefore do not enable effective long term management. Developing REDD projects in Sierra Leone is not currently common practice. The Government has clearly stated that it intends to seek financing via REDD to provide the income to manage the State's forests (NSADP 2009, NPAA Act 2012) and it is intended that the long term nature of such revenues will overcome the boom and bust project cycle commonly found in other Forest Reserves in Sierra Leone financed by donors and thus result in a significant reduction to deforestation in the project area.

Step 5 – Impact of VCS registration

A resource-strapped Government would not have upgraded a Production Forest Reserve with the potential for revenues from timber or other sources such as minerals into a National Park without the expectation of receiving financing from other sources (pers comm. Sheku Mansaray, Acting Director of the Forestry Division). In Sierra Leone, upgrading reserves to National Parks has proved an ineffective option to protecting reserves e.g. the upgrading of Outamba-Kilimi National Park – See step 4. Since the sustainable financing report (Davies 2006) and the first carbon feasibility report carried out in 2008 for the Gola Forest Reserves, the expectation has been for emerging markets such as the carbon market to fund the management and benefit sharing mechanisms that were set up in the initial stages of conservation work. With this in mind the RSPB together with Birdlife International applied for funding from the EU to develop carbon projects, amongst other objectives, for work in the Gola Forest Reserves in Sierra Leone and Liberia (ARTP 2010). Some of the funding to develop a REDD project for the GRNP has therefore come from this project, other funding has come from the Critical Ecosystem Partnership Fund and from the RSPB.

3.6 Methodology Deviations

The project seeks one methodological deviation that was previously verified and validated for the Gola REDD project. The deviation does not negatively impact the conservativeness of the quantification of GHG emission reductions or removals.

Deviation in the definition of the RRD

This is a request for a deviation in the VCS Methodology VMD0007 Module BL-UP to amend the boundary definition of the Reference Region for Deforestation (RRD) For the Gola Rainforest National Park REDD project. This deviation is in response to limitations in the Methodology language that do not provide for an RRD to be developed for a Reference Region for Location (RRL) that has different policy and regulations between the Project Area (PA) and Leakage Belt (LB).

Currently the Methodology states "Policies and regulations having an impact on land-use change patterns within the RRD and the project area must be of the same type or have an equivalent effect at the start of the historical reference period, taking into account the current level of enforcement." Because the Methodology specifies only the PA, the RRD is limited in its ability to define an area that is representative of both the PA and LB (i.e. the spatial domains that make up the RRL) if policies and regulations are not similar. The deviation requests;

1) clarification in the language to allow the RRD to be similar to both the PA and LB, and

2) where policy and regulations affect the rate of deforestation in the PA and LB, and it is conservative to apply different rates, then 2 different rates shall be applied.

This Methodology deviation is meant to ensure an accurate RRD, and a conservative deforestation rate. The context of this deviation arises from the fact that the GRNP (formally the Gola forest reserve) is a discrete unit of land that has different policy and regulations than the surrounding area of land that make up the LB, which is held under the Chiefdoms and local communities surrounding the GRNP. Without REDD funds the GRNP would be subject to the insufficient funding that is typical for other forest reserves in Sierra Leone and would effectively be a "paper park" and subject to a similar baseline deforestation as other forest reserves in Sierra Leone (See Section 2.5). Analysis of forest reserves has shown that they are largely unprotected and not actively managed due to insufficient funding available from the Government of Sierra Leone (GoSL). This has led to illegal deforestation within the forest reserves which is acknowledged by national and local officials and has been detected using remote sensing. However, it is clear from remote sensing analysis that deforestation inside the forest reserves remains slightly lower than just outside the forest reserves (See Section 1.1.1.1 in Netzer and Walker 2013). Furthermore, Participatory Rural Analysis (PRA) with local communities around forest reserves shows that while there is very limited to no enforcement of forest reserve regulations, local people are aware of the boundary and the illegality of farming in the reserve. This knowledge likely results in the slightly lower deforestation within forest reserves. Therefore because of these different policies and regulations there are slightly

different deforestation rates in the forest reserves (most similar to the PA) than in the LB (most similar to areas around the FRs).

Given these differences the project requests a deviation in the VMD0007 BL-UP to develop an RRD with 2 boundaries:

1) the boundary of the forest reserves which are most similar to the PA, and

2) a buffer area surround the forest reserves that are most similar to the LB.

Deforestation rates for forest reserves will be applied to the PA, and deforestation rates from areas surrounding the forest reserve will be applied to the LB. This ensures that the deforestation rates in the PA are conservative and representative of other forest reserves.

For this deviation it is requested that the RRD be defined as the total area of forest reserves and buffer areas and that the separation of the total RRD into forest reserve RRD (FR-RRD) and buffer area RRD (BUFF-RRD) only be applied to the policy and regulation requirements and the rate of deforestation (Step 2 BL-UP).

The requested changes in the methodology for this deviation are presented as underlined orange text:

Section 1.1.1.1 Reference region for projecting rate of deforestation (RRD).

For the criteria e the methodology deviation shall have the below changes:

a. Policies and regulations having an impact on land-use change patterns within the RRD and the project area and leakage belt must be of the same type or have an equivalent effect at the start of the historical reference period, taking into account the current level of enforcement.

STEP 2.2 Estimation of the annual areas of unplanned baseline deforestation in the RRD

For the estimation of baseline deforestation the text shall have the below changes:

The modelled annual area of deforestation in RRD (ABSL,RRD,unplanned,t) shall be calculated across the historical reference period. Where the criteria “e policy and regulation” is different between the project area and leakage belt, the RRD boundary shall be made representative of the general patterns of unplanned deforestation that are influencing both the project area and its leakage belt. If it is demonstrated that deforestation rates in the area similar in policy and regulation to the project area are lower than those of the area of similar in policy and regulation to the leakage belt, then two deforestation rates shall be calculated and applied 1) for the area similar in policy and regulation to the project area (ABSL,PA-RRD,unplanned,t), and 2) for the area similar in policy and regulation to the leakage belt (ABSL,LB-RRD,unplanned,t). The methodology provides three approaches:

STEP 2.3 Estimation of annual areas of unplanned baseline deforestation in the project area

The projected unplanned baseline deforestation in the RRL is estimated as follows:

$$ABSL,RR,unplanned,t = ABSL,RRD,unplanned,t* PRRL$$

Where different deforestation rates are applied to the PA and LB due to differences in policy and regulation the baseline deforestation in the RRL shall be calculated as two rates:

$$ABSL,PA\text{-}RR,unplanned,t = ABSL,PA\text{-}RRD,unplanned,t* P_{PA\text{-}RRL}$$

$$ABSL,LB\text{-}RR,unplanned,t = ABSL,LB\text{-}RRD,unplanned,t* P_{LB\text{-}RRL}$$

4 QUANTIFICATION OF GHG EMISSION REDUCTIONS AND REMOVALS

4.1 Baseline Emissions

Following the original PD (2015) for the GRNP REDD Project, the quantification of baseline emissions followed the VM0007 methodology modules BL-UP (part 4 estimation of carbon stock changes and GHG emissions), X-STR, C-AB, E-BB. The population driver approach was not used. This section details the steps used following VM0007 BL-UP for the **GRNP's second baseline renewal** historical baseline 2007-2018. Much of the original baseline report follows the original BL-UP analysis detailed in Netzer and Walker (2013) (e.g. establishment of project boundaries) and is referenced throughout this section.

The original baseline with a historical reference period of 2001-2011 was applied to the Gola REDD+ Project follows VM0007 methodology modules BL-UP and is described in full in Netzer and Walker 2013. The project successfully underwent verification in 2015, (following M-MON), and in 2019, the project has decided to recalculate the historical baseline to account for the latest trends in drivers of deforestation in the region.

The updated baseline applies consistent methods and sources of data as the original, but reflects the more recent historical time period of 2007-2018. In accordance with module BL-UP, the baseline deforestation rate was calculated from a Reference Region for Deforestation (RRD) and the rate of deforestation was applied to the Project Area (PA) and Leakage Belt (LB) (together referred to at the Reference Region for Location – RRL) using spatial modelling.

Following the methodology deviation, presented in Section 3.6 of the PD and approved during validation, two deforestation rates were used: 1) within forest reserves (FR-RRD) applied to the PA, and 2) buffer area around forest reserves (BUFF-RRD) applied to the LB. All other methodology requirements were followed.

4.1.1 Definitions of project boundaries

Spatial boundaries

All project boundaries remained the same as those defined in the original PD (2015) and detailed in the baseline report Netzer and Walker 2013. The only change in area is reflected by the changes in forest cover within these project boundaries. These areas were assessed for the new baseline analysis for 2007, 2011 and 2018 (Table 13). Forest cover benchmark map was produced for 2018 (Table 13 and Figure 10).

Table 13. Project areas forest cover reassessed for the revised baseline.

	Forest area 2007	Forest area 2011	Forest area 2015	Forest area 2018
	ha			
Project Area	69,683	68,498	68,445	68,340
Leakage Belt	73,365	62,882	55,658	48,452
RRL (PA+LB)	143,048	131,380	124,103	116,792
RRD	148,668	118,402	*	84,022

* Land cover maps were only developed for the RRL (Project Area and Leakage Belt) in 2015 for the first monitoring event.

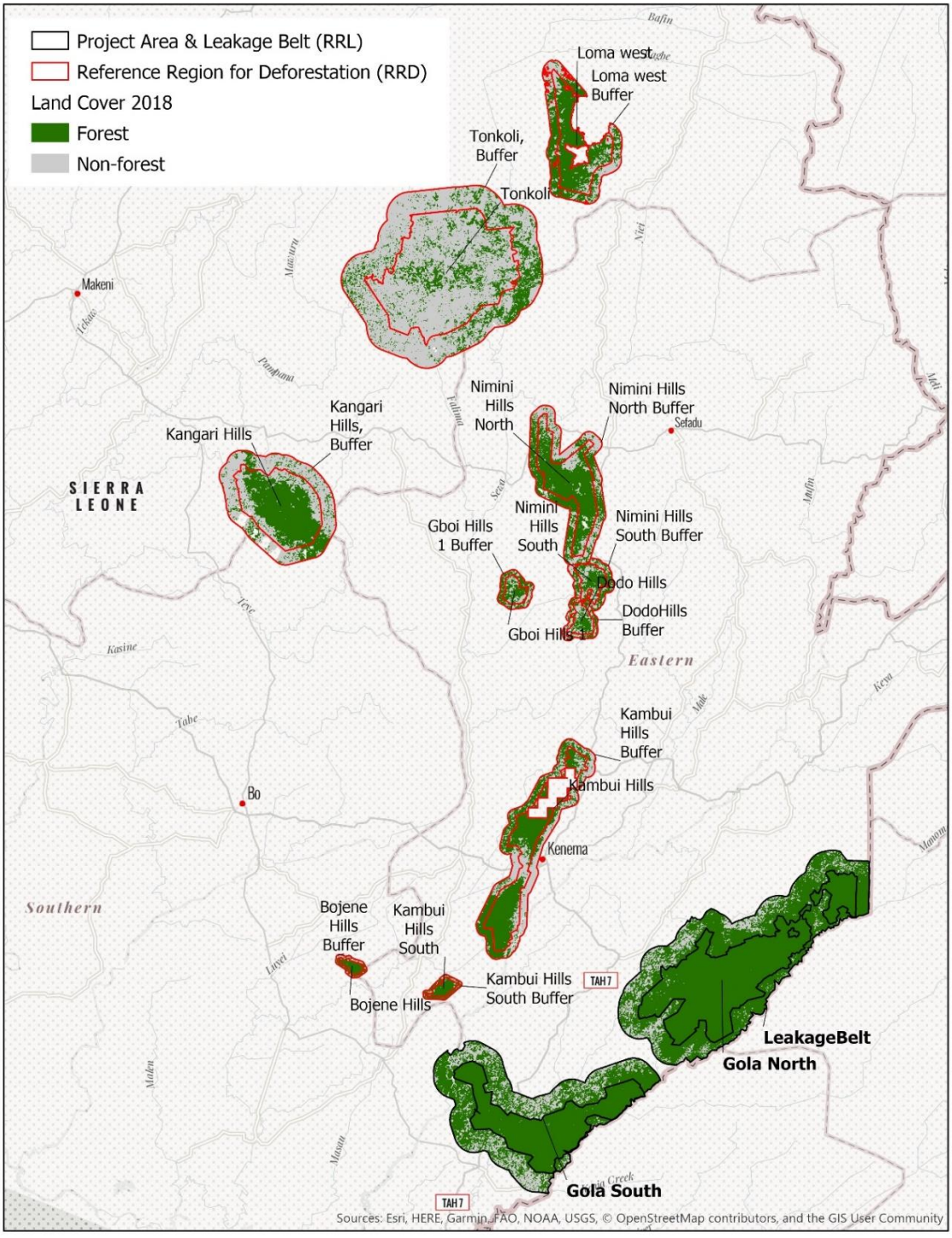


Figure 10. Project boundaries.

Temporal boundaries

The original start date of the Goal REDD Project remains the same at 1st of August 2012. The historic baseline was updated from 2001-2011 to 2007-2018. The first monitoring event occurred

in 2015 where the project was successfully verified. A second verification (MIR report) is occurring simultaneously for the years 2015 to 2019.

The Gola REDD Project has decided to renewed the project baseline, and therefore the start and end dates of the "historical reference period." As per REDD-MF "The historical reference period is the temporal domain from which information on historical deforestation is extracted, analyzed and projected into the future. A historical reference period must be defined for all eligible REDD categories. The starting date of this period must be between 9 and 12 years in the past and the end date must be within two years of project start date."

The new historic baseline period is established from the land cover maps from 1/1/2007, 1/1/2011 and the most recent 12/12/2018. This is a period of 11.9 years for the historic reference period. The 2015 land cover map could not be used for the baseline because it did not include the RRD area.

No other project dates were changed. As per REDD-MF the project has projected baseline emission for 10 years forward (2028) using spatial modeling that the project will use as the new fixed baseline for which monitoring will be measured against.

4.1.2 Estimation of annual areas of unplanned deforestation

Renewing the baseline requires compliance with both VM0007 modules BL-UP for LU/LC mapping and interpreting those results to establish the rate of deforestation in the RRD. Then the rate of deforestation in the RRD is adjusted by area to the RRL as the new baseline deforestation rate for the RRL. This RRL rate is then used for modeling the location of deforestation across the Project Area and Leakage Belt (RRL) (ex-ante). At the same time as this baseline renewal the Gola REDD Project is undergoing a verification and monitoring event for 2015 to 2019 (following M-MON and detailed int the MIR 2020 report).

4.1.3 Analysis of historic deforestation

Collection of appropriate data sources

As with the 2011 classification produced for the initial VCS and CCB Project Documents, a combination of optical data and Synthetic Aperture Radar data were used. In 2011 the precise satellites and sensors used were Landsat 5's Thematic Mapper (TM) and the Advanced Land Observing Satellite (ALOS)'s Phased Array L-band Synthetic Aperture Radar (PALSAR) (30x30 resolution). Both of these satellites have since failed, but successor mission data were available from Landsat 8's Operational Land Imager (OLI) and ALOS-2's PALSAR-2 sensor. Both OLI and PALSAR-2 produce similar data to TM and PALSAR-1, but with greater radiometric accuracy and, in the case of OLI, more bands, with slightly different wavelength. Following GOFC-GOLD guidance these different sensors should not cause differences in the sensor characteristics and therefore should not change the results. Therefore these different satellites continue to provide consistent times series analysis of land-use change

The Gola Rainforest National Park is located across the boundary of two different Landsat scenes, Path 200 Row 55, and Path 201 row 55 (WRS-2). Fortunately cloud free Landsat 8 scenes were found for both scenes for January 2015 (Figure 11 Table 14). A single scene of sentinel 1 C-band ground range detected 10m radar data was available for the whole project area and leakage belt, this is an improvement over the radar data used in the first bassline assessment because there were no gaps which had to be filled with 100m data (Figure 12 Table 14).

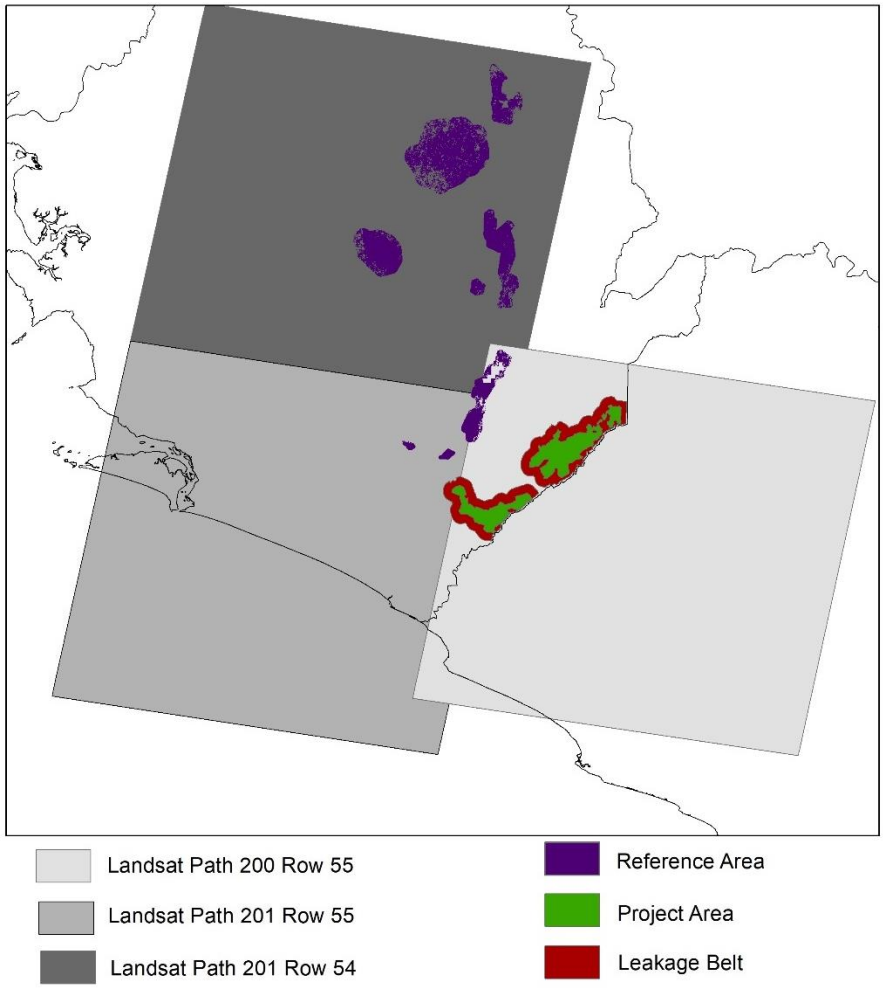


Figure 11. Landsat scene boundaries

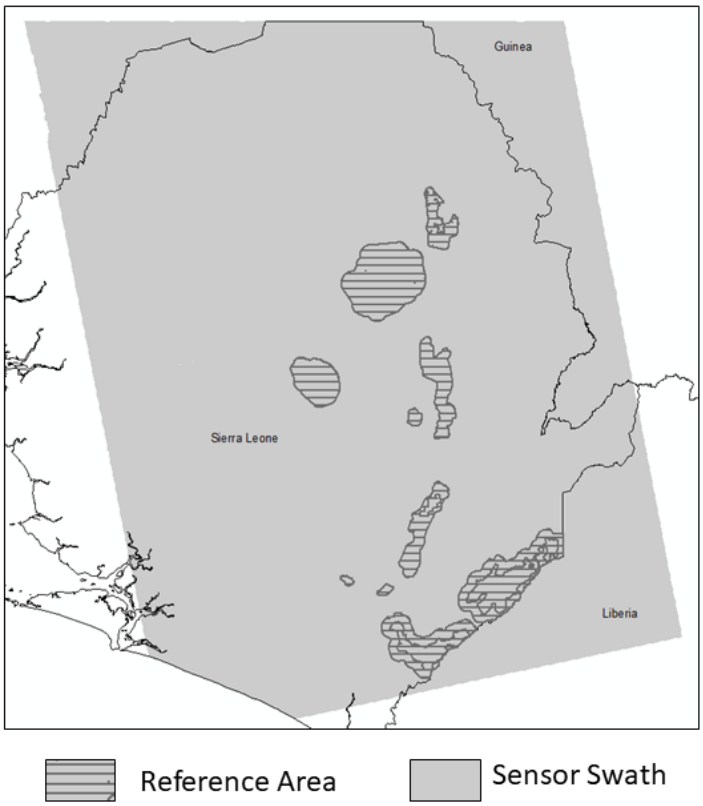


Figure 12. PALSAR-2 scene boundaries

Table 14. Metadata for all scenes used

Sensors	Scene ID	Mode & nominal resolution	Date
Landsat 8	LC08_L1TP_200055_20190116_20190131_01_T1	OLI, 30 m	16th January 2019
Landsat 8	LC08_L1TP_201055_20190123_20190205_01_T1	OLI, 30 m	23rd January 2019
Landsat 8	LC08_L1TP_201054_20190123_20190205_01_T1	OLI, 30m	23rd January 2019
Landsat 8	LC08_L1TP_201054_20181222_20181227_01_T1	OLI, 30m	22nd January 2019
ALOS-2 PALSAR-2	S1A_IW_GRDH_1SDV_20190123T185942_20190123T190007 _025609_02D7C1_F416	Sentinal 1 10 m	23rd January 2019
ALOS-2 PALSAR-2	S1A_IW_GRDH_1SDV_20190123T190007_20190123T190032 _025609_02D7C1_A092	Sentinal 1, 10 m	23rd January 2019

The level-2 Landsat 8 product is preprocessed, the raw data have been accurately georeferenced, the data converted to surface reflectance, and atmospheric corrections applied. Images from 2 dates were combined to give a total of 0.1% of pixels classified as cloud.

Sentinel 1 radar data were provided as a level-1 processed product. Radiometric correction, speckle filtering and terrain correction were conducted in SNAP v5.0. The Digital Elevation Model (DEM) used in this correction was the 3 arc-second (approx. 90m) resolution Shuttle Radar Topography Mission (SRTM) DEM.

4.1.4 Mapping of historic deforestation

To map deforestation ESRI ArcGIS Software was used with the "Combine" tool. This combined the different land cover maps into a single map that shows no change (forest remaining forest), and change for each consecutive year mapped 2007, 2011 and 2018. The results from the GIS analysis are exported to excel and displayed in the "GRNP Baseline 2nd Verification" spreadsheet tab "Basline Land cover RRD 2018." Following the methods from the previous validation and verification, the analysis of deforestation excluded land cover changes that were indicative of a crop fallow cycle to ensure the project results are both conservative and accurate – attempting to eliminate secondary forest that is in crop rotation from the actual deforestation rate. Indicative changes that were conservatively excluded were things like forest in 2007 to non-forest in 2011, and back to forest in 2018.

This produce conservative and accurate results for forest loss across the RRD and forest cover maps for each of the three points in time.

4.1.5 Calculation of historic deforestation

As per BL-UP gross deforestation was calculated, and there was less then 1% cloud cover in the land cover maps.

4.1.6 Map accuracy assessment

A training dataset was created using a combination ESRI's World Imagery (dating from 2016), the Landsat mosaic and a limited set of ground truth data from 2011. Forest classes represented over 14,000 pixels, and non-forest classes represented over 17,000 pixels, over a total area of >24,000km2.

A separate dataset was created for the accuracy assessment, using points on a 2km grid across the project area, the leakage belt and the reference sites. These were visually identified as forest (599 pixels) or non-forest (411 pixels) using a combination of ESRI's 2016 World Imagery and the Landsat mosaic.

The classification output was assessed against an independent dataset, that was not used in the original classification. The overall accuracy for the classification exceeds 90%, which is the accuracy level required by VMD0007. The full confusion matrix is shown in (Table 15).

Table 15. Accuracy assessment for land cover maps

	Forest	Non-forest	Total	Error of commission (%)	User accuracy (%)
Forest	569	59	628	9.4%	90.6%
Non-forest	30	352	382	7.8%	92.2%
Total	599	411	1010		
Error of omission (%)	5.0%	14.3%		8.8%	
Producer accuracy (%)	95.0%	85.7%			91.2%

4.1.7 Estimation of the annual areas of unplanned baseline deforestation in the RRD

Using the new LU/LC data deforestation in the RRD (both the FR-RRD and BUFF-RRD) ($A_{BSL,RRD,unplanned,t}$) was analyzed to establish a revised baseline. For the revised baseline the project followed the same "simple historic average" approach used in the original baseline. The revised baseline was recalculated using 2007, 2011 and 2018 to establish new rates of deforestation for the forest reserves in the RRD (FR-RRD - this rate is associated with the Gola Project Area) and the buffer areas around the forest reserves (BUFF-RRD - this rate is associated with the Gola Leakage Belt). This stratification between FR-RRD and BUFF-RRD was approved as a methodological deviation in the Gola REDD Project Document (PD) 2015, and the first MIR 2015.

The following equations were applied to estimate the projected annual area of unplanned baseline deforestation:

$$A_{BSL,FR-RRD,unplanned,t} = {A_{FR-RRD,unplanned,hrp}}/{T_{hrp}}$$

$$A_{BSL,BUFF-RRD,unplanned,t} = {A_{FR-BUFF-RRD,unplanned,hrp}}/{T_{hrp}}$$

Where:

$A_{BSL,FR\text{-}RRD,unplanned,t}$ Projected area of unplanned baseline deforestation in the Forest Reserve *RRD* in year t; ha

$A_{FR\text{-}RRD,unplanned,t}$ Total area deforested during the historical reference period in the Forest Reserve RRD; ha

$A_{BSL,BUF\text{-}RRD,unplanned,t}$ Projected area of unplanned baseline deforestation in the buffer area *RRD* in year t; ha

$A_{BUFF\text{-}RRD,unplanned,t}$ Total area deforested during the historical reference period in the buffer area RRD; ha

T_{hrp}	Duration of the historical reference period in years; yr
t	1,23, …t* years elapsed since the projected start of the REDD project activity

Below are the updated numbers for the reevaluation of the historic baseline for the RRD (Table 16)

Table 16. Deforestation during the historic reference period in the RRD 2007 to 2018

	Total area deforested during the historical reference period in the RRD	Duration of the historical reference period	Annual deforestation during the historic period in the RRD
	$Area_{RRD,unplanned,t}$	T_{hrp}	$Area_{BSL,RRD,unplanned,t}$
	Hectares	Years	Hectares
Total RRD area	53,974	11.9	4,529
FR-RRD	27,845	11.9	2,337
BUFF-RRD	25,585	11.9	2,147

4.1.8 Estimation of annual areas of unplanned baseline deforestation in the project area

Following the methodological guidelines and the approved methodology deviation the projected unplanned deforestation in the FR-RRD and BUFF-RRD was associated with the Project Area and Leakage Belt. Where P_{rrl} is the proportion of forest area in the RRL's LB and PA at the start of the baseline period (now 2007) to the total area of the RRD's forest reserves and buffer areas, and **A**bsl,RR,unplanned,t is the area of unplanned baseline deforestation in the RRD in year t in the forest reserves and buffer areas. The projected area of unplanned deforestation is estimated using the following equation:

$$A_{BSL,RR,unplanned,t} = A_{BSL,RRD,unplanned,t} * P_{RRL}$$

Where:

$A_{BSL,RR,unplanned,t}$	Projected area of unplanned baseline deforestation in the reference region for location (*RRL*) in year *t;* ha

$A_{BSL,RRD,unplanned,t}$	Projected area of unplanned baseline deforestation in *RRD* in year *t*; ha
P_{RRL}	Ratio of forest area in the *RRL* at the start of the baseline period to the total area of the *RRD*; dimensionless
t	1, 2, 3, … t^* years elapsed since the projected start of the REDD project activity

Table 17. Estimation of annual areas of unplanned baseline deforestation in the RRL

	Annual deforestation during the historic period $Area_{BSL,RRD,unplanned,t}$ Hectares	Ratio of forest area in the RRL at the start of the baseline period to the total area of the RRD P_{RRL} %	Projected area of unplanned baseline deforestation in the reference region for location $A_{BSL,RR,unplanned,t}$ Hectares
Total RR* area	4,529	0.79	3,559
FR-RR*	2,337	0.78	1,819
BUFF-RR*	2,147	0.80	1,709

* represents both RRD and RRL as specified in the top row of the table.

Table 17 shows the revised baseline deforestation in the Gola Project Area (FR-RRL) and Leakage Belt (BUFF-RRL).

Therefore, the baseline annual deforestation in the Project Area is 1,819ha^{-1} y^{-1} and the baseline deforestation in the Leakage Belt is 1,709ha^{-1} y^{-1}

4.1.9 Location and quantification of the threat of unplanned deforestation

As part of the renewed baseline a new location analysis was conducted for the RRL (Project Area and Leakage Belt). As per VMD0007, the Gola REDD project is identified as having a "Frontier Configuration" and therefore location analysis is required (i.e. modelling). Frontier deforestation is forest destruction that occurs along a discernible frontier, such as a new road cut into a forest. The land surrounding the Gola REDD Project has been classified as having a frontier configuration because, patchy, deforestation is slowly progressing towards the frontier of the National Park.

The software used to model the location of deforestation in the RRL was TerrSet formally IDRISI Selva, which includes two models appropriate under VM0007 BL-UP for projecting deforestation: Land Change Modeler (LCM) and GEOMOD. Both have similar setup and dataset requirements and therefore can be used in tandem and both met all requirements set out in BL-UP, peer-review,

transparent and able to project location of future deforestation (Netzer and Walker 2013). LCM was used to derive the risk map which is derived from relevant factor maps and input to GEOMOD which projects future deforestation. The modelling was run from 2015 to 2028. The number of hectares per year deforestated in the Project Area (FR- ABSL,RR,unplanned,t) and the Leakage Belt (BUFF-ABSL,RR,unplanned,t) was projected into the future at a linear rate determined from the historic deforestation rates determined from the reference regions - Project Area is 1,819ha-1 y-1 and the Leakage Belt is 1,709ha-1 y-1.

4.1.10 Preparation of data sets for spatial analysis

The preparation of risk maps required an assessment to determine if the same drivers of deforestation identified in the original baseline exist within the Project Area and Leakage Belt (RRL), and then to process a set of "risk" maps that when combined most accurately project the location of deforestation across the RRL. This section described the processing of those risk maps.

The remotely sensed land cover maps are the same as those used for the analysis of the RRD, and as such meet the requirements described in section "Step 1 Selection and analyses of sources of land-use and land-cover (LU/LC) change data."

An assessment of the drivers of deforestation in the Gola REDD Project Area and Leakage Belt showed no indication that there were any substantive changes in those drivers or in the associated risk factors that were determined to be driving those agents of deforestation. Justification of the factor maps can be found in Netzer and Walker (2013). In compliance with VM0007 BL-UP Section 3.1.2 the spatial modeling includes at least one landscape factor, accessibility factor and anthropogenic factor.

Slope

Slope was included as a landscape factor and in alignment with the data preparation of the first baseline calculation, were classified into categories from most suitable to least suitable of 1-5, 5-10, 10-15, 15-20, 20-30, 30-40, and >40. Larger slopes were considered unsuitable for deforestation (Figure 13).

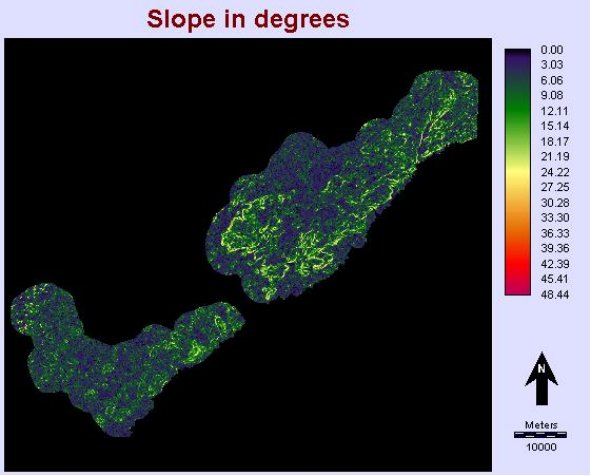


Figure 13. Slope risk factor map.

Distance to rivers & roads

Distance to rivers and distance to roads were variables found to have a significant link to the distribution of deforestation in the previous analysis conducted by Netzer and Walker (2013) and were both included as accessibility factors. There were no significant changes in the river or road networks since the first baseline assessment (Figure 14, Figure 15).

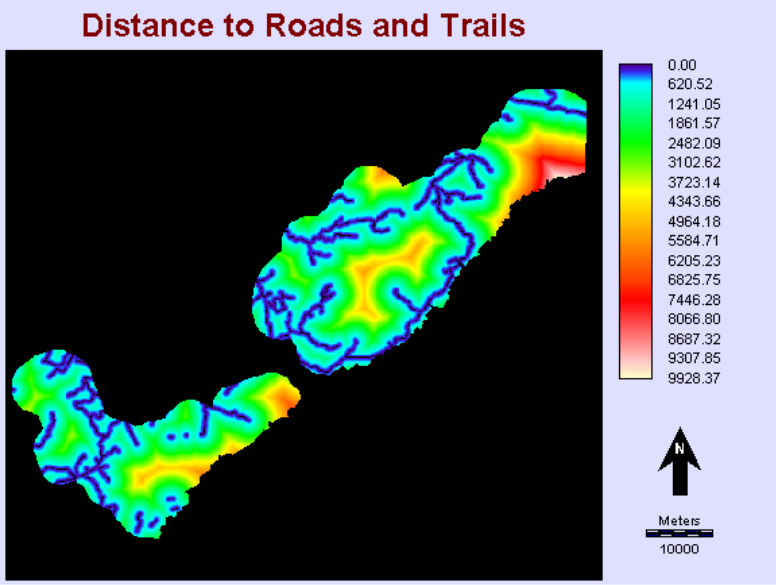


Figure 14 Factor map for distance to roads and trails

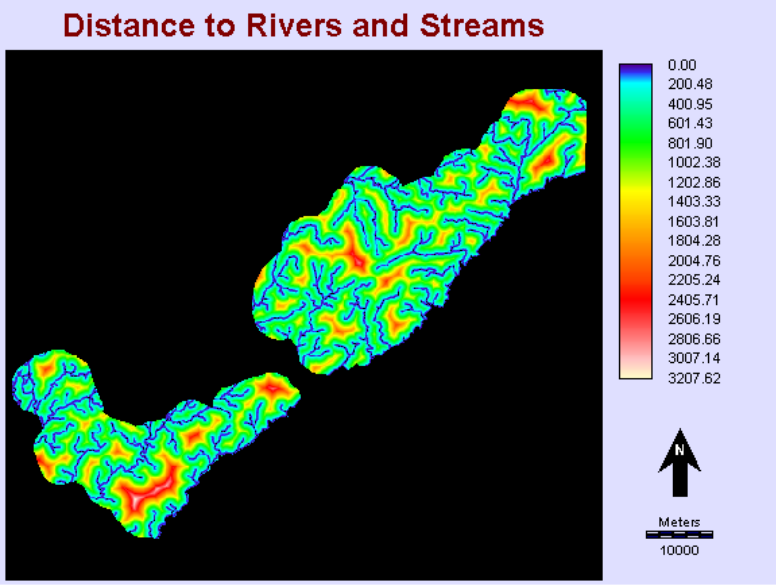


Figure 15: Factor map for distance to rivers

Location to villages was used as an anthropogenic factor in accordance with findings from the first baseline assessment. The village factor map was updated to incorporate 8 new villages. To capture the non-spatial variability of deforestation from distance to villages, the distance variable was run through LCM's evidence likelihood tool to develop a distance map that included non-linear spatial variability.

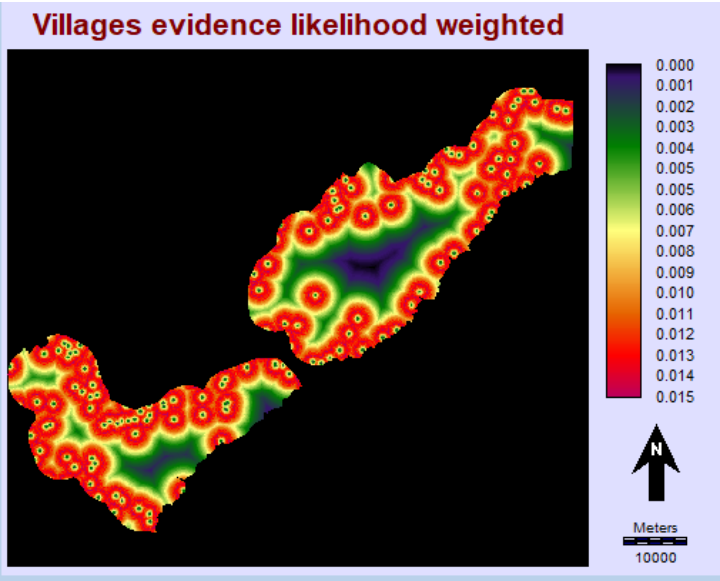


Figure 16 Factor map for distance to villages as calculated by the Evidence Likelihood tool in LCM

4.1.11 Selection of the most accurate deforestation risk map using an acceptable validation metric

The final risk map is developed using a combination of that factor maps (Figure 17). The risk map was developed using Land Change modeler's MLP Neural Network for model calibration and confirmation (BL-UP Step 3.3).

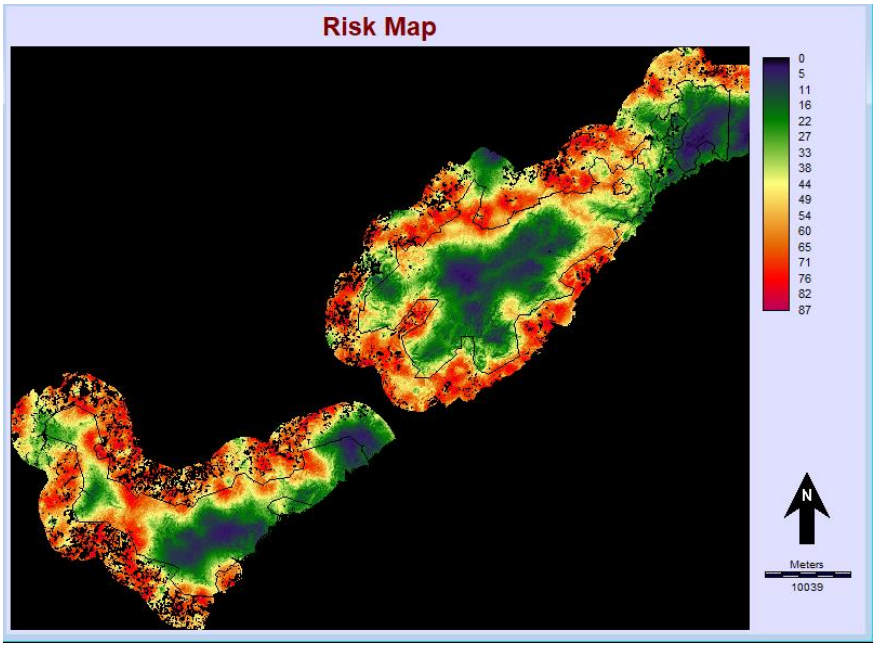


Figure 17.Risk Map for the GNP project RRL. Red indicated the highest risk areas and blue the lowest risk areas.

Model calibration and confirmation

Mirroring the analysis done in the first baseline assessment, the model's accuracy was assessed using the Figure of Merit Statistic (FOM), which is further described in Netzer and Walker 2013, and complies with confirmation requirements set out by the VMD007 methodologies. The FOM of the model met the methodology requirements of being above the threshold for best fit, at 29% which is 4 times the minimum threshold of 7.7%.

4.1.12 Location analysis

Results presented in this section show deforestation from the original baseline for the years 2015-2018, and then the results relevant for this PD's new baseline 2018-2028.

The model was run from 2018 to 2028. The area of deforestation in the Project Area (*FR-ABSL,RR,unplanned,t*) was stratified between Gola Central/North and Gola South. The area of deforestation across both strata was set to 1,819ha^{-1} y^{-1}. The Leakage Belt (*BUFF-ABSL,RR,unplanned,t*) was deforested at a rate of 1,709ha^{-1} y^{-1}. The GEOMOD land cover change model distributed the deforestation across the RRL based on the final risk map. The resulting deforestation in the Project Area is shown in Table 18 Projected area of deforestation in each strata

the Project Area. Results for the first baseline period are shown in gray. This PD sets the new baseline after 2018., and Leakage Belt in Table 19. Modeled land cover maps for 2016 and 2028 are shown in Figure 18, Figure 19.

Table 18 Projected area of deforestation in each strata the Project Area. Results for the first baseline period are shown in gray. This PD sets the new baseline after 2018.

Baseline			Gola Central & North ($A_{unplanned,2,PA,t}$)	Gola South ($A_{unplanned,1,PA,t}$)	Total annual	Cumulative
	t	year	Ha			
First baseline	1	2012	337	704	1,041	1,041
	2	2013	413	628	1,041	2,082
	3	2014	353	688	1,041	3,123
	4	2015	446	595	1,041	4,164
	5	2016	435	606	1,041	5,205
	6	2017	487	554	1,041	6,246
	7	2018	518	522	1,040	7,286
Second baseline	8	2019	996	823	1,819	9,105
	9	2020	1,071	748	1,819	10,924
	10	2021	1,121	698	1,819	12,743
	11	2022	1,115	704	1,819	14,562
	12	2023	1,159	660	1,819	16,381
	13	2024	1,153	666	1,819	18,200
	14	2025	1,155	664	1,819	20,019
	15	2026	1,179	640	1,819	21,838
	16	2027	1,193	626	1,819	23,657
	17	2028	1,181	638	1,819	25,476

Table 19. Projected area of deforestation in the Leakage belt. Results for the first baseline period are shown in gray. This PD sets the new baseline after 2018.

Baseline			Leakage belt ($A_{unplanned,1,PA,t}$)	Cumulative
	t	Year	Ha	
First baseline	1	2012	1,544	1,544
	2	2013	1,544	3,088
	3	2014	1,544	4,632
	4	2015	1,544	6,176

Second baseline

5	*2016*	*1,544*	*7,720*
6	*2017*	*1,544*	*9,264*
7	*2018*	*1,544*	*10,808*
8	2019	1,709	12,517
9	2020	1,709	14,226
10	2021	1,709	15,935
11	2022	1,709	17,644
12	2023	1,709	19,353
13	2024	1,709	21,062
14	2025	1,709	22,771
15	2026	1,709	24,480
16	2027	1,709	26,189
17	2028	1,709	27,898

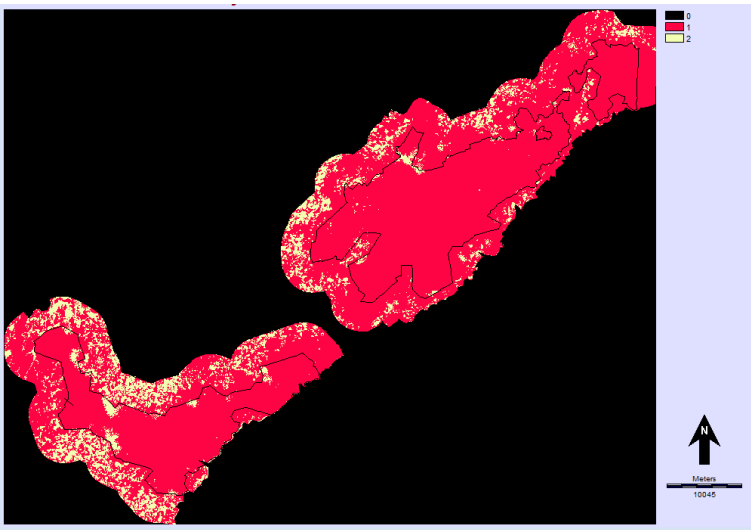


Figure 18. Modeled land cover in the RRL in 2018

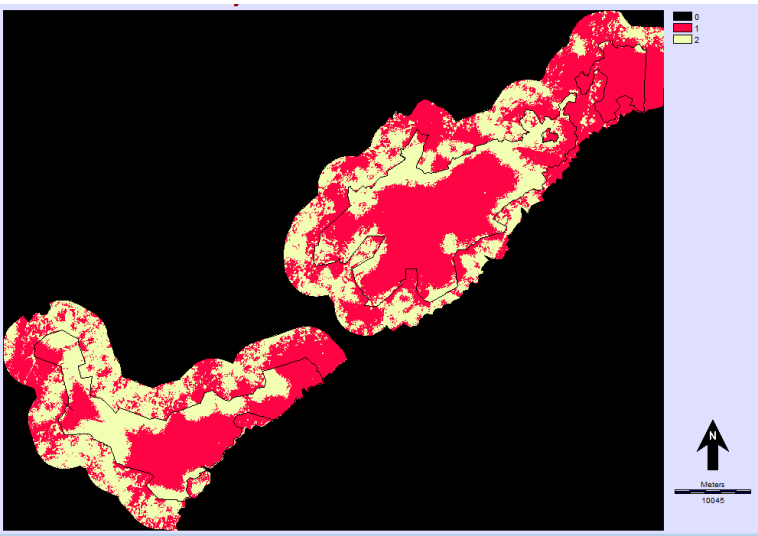


Figure 19 Modeled land cover in the RRL in 2028. Red is forest area and yellow non-forest.

4.1.13 ESTIMATION OF CARBON STOCK CHANGES AND GREENHOUSE GAS EMISSIONS

The Gola REDD Project Area stratification remained the same as the original baseline which used VM0007 Module X-STR.

4.1.14 Stratification

Forest carbon stocks and strata were derived based on extensive forest carbon ground measurements in the Project Area (Klop 2012). While this study found that forests across the project area were relatively homogenous in species composition (same forest type), there were significant differences in carbon stocks between and Gola Central/North and Gola South. It was hypothesized that the difference is attributed to the southern block having been more extensively logged, resulting in a forest with lower carbon stocks but with potential for re-growth (Lindsell and Klop 2012)[3]. Given these differences in carbon stocks the Gola REDD Project Area was stratified between Goal Central/North and Goal South (Table 20).

Table 20. Area of Gola REDD project strata in 2018

Stratum	area 2018 (ha)
Gola Central/North	42,989
Gola South	25,351

[3] Enhancement of carbon stocks was not undertaken by the first monitoring event (2015) because of the relatively short period of time since the first measurement two years prior. At the time of the second monitoring event (2019), remeasurement for enhancement had been initiated but was incomplete. Thus, carbon stocks in the Gola South strata have been conservatively assumed to remain the same.

Total	68,340

The Leakage Belt is the same forest type as the GRNP and is conservatively assumed to have the same carbon stocks as Gola Central/North. This is conservative because Gola Central/North has the highest carbon stocks and is undoubtedly the least disturbed forest in the Reference Region. The area of leakage belt was reevaluated as a part of the reevaluation of the baseline, to take into account forest loss, (see second 2015 MIR report for pervious area) (Table 21).

Table 21. Area of Leakage belt in 2018

Block	area 2018 (ha)
Leakage belt	48,452

4.1.15 Estimation of carbon stock changes per stratum

Forest carbon stocks

Carbon stocks were estimated in the forest areas following VM0007 Modules CP-AB and CP-S, excluding non-tree, litter and deadwood (Tatum-Hume et al 2013b). Above and below ground tree biomass and soil organic carbon for both strata (Table 22) and uncertainty was calculated as a percentage of the mean at 95% confidence intervals following X-UNC.

Table 22. Pre deforestation carbon stocks

Carbon Pool	Strata 1 (GRNP Central/North)				Strata 2 (GRNP South)			
	No of Plots	Mean Stock	95% CI	95% CI as % of mean	No of Plots	Mean Stock	95% CI	95% CI as % of mean
		t CO_2 ha^{-1}				t CO_2 ha^{-1}		
$C_{AB\_Tree,i}$	353	629	48.4	6.6%	49	578	76.6	13.0%
$C_{BB\_Tree,i}$		151.0	10.0	6.6%		138.7	18.0	13.0%
$C_{AB\_nontree,i}$								
$C_{BB\_nontree,i}$								
$C_{LI,i}$								
$C_{SOC,i}$	18	253.9	30.6	12.1%	29	192.3	24.4	12.7%
C_{BSL}		1,034.26	30.5	8.4%		909.05	49.1	12.9%

Post deforestation carbon stocks

Shifting cultivation farming is the primary livelihood activity for communities around the project area (Witkowski et al 2012a, Bulte et al 2013) and thus post-deforestation strata is crop-fallow.

Post-deforestation carbon stocks reflect the long-term average carbon stocks of agricultural land from 0-10 years. Following VMD0007, Section 4.2.2, Option 1- Simple approach , a time-weighted

average was used to estimate the above ground biomass of post-deforestation carbon stocks (Tatum-Hume et al 2013b) (Table 23), including 1-2 years of planted crops and the 10 year fallow.

Modules CP-AB and CP-S were used to estimate carbon stocks (Tatum-Hume et al 2013b), conservatively excluding non-tree, litter and deadwood as they were considered insignificant[4] following T-SIG (Tatum-Hume et al 2013b). Total post-deforestation carbon stocks in all pools follow Equation 17 of VMD0007 based on the above and below ground tree biomass and soil organic carbon (Tatum-Hume et al 2013b) (Table 23).

Table 23. Post-deforestation carbon stocks

Carbon Pool	Post Deforestation			
	Number of Plots	Mean Stock	95% CI	95% CI as % of mean
			t CO_2 ha^{-1}	
$C_{AB\_TreePost,i}$	99	127.0	19.8	12.8%
$C_{BB\_TreePost,i}$		34.3		
$C_{SOCPost,i}$		172.7		
$C_{BSL,post,i}$		334.0	19.8	12.8%

Estimation of carbon stocks in wood products per stratum

Wood products were calculated following CP-WP. Based on data from surveys undertaken during project development (Witkowski et al 2012a), the amount of wood products extracted during deforestation was estimated to be 20% (representing 20% of the farmers) and conservatively estimated that those farmers harvest 50% of the total above ground biomass. This resulted in a mean stock extraction shown in Table 24.

Table 24. Wood products extracted during deforestation

	Strata 1: GRNP North	Strata 2: GRNP South
AG Biomass	629.3	578.0
Mean stock of extracted biomass carbon (CXB,i)	48.41	44.46

Following CP-WP, the remaining long-lived wood products from the total biomass extracted is shown in Table 25.

Table 25. Carbon stocks entering the wood products pool

	Description	Strata 1: GRNP North	Strata 2: GRNP South
		t CO_2e ha^{-1}	t CO_2e ha^{-1}
CWP,i	Carbon stock entering the wood products pool from stratum i	5.25	4.83

[4] Less than 5% of the net carbon stocks http://cdm.unfccc.int/methodologies/ARmethodologies/tools/ar-am-tool-04-v1.pdf

CWP100,i	Carbon stock entering the wood products pool at the time of deforestation that is expected to be emitted over 100-years from stratum i	0.04	0.03

4.1.16 Estimation of the sum of baseline carbon stock changes

Per Section 4.2.3 of VMD0007 and equations 16-22, stock changes in each pool were calculated by subtracting post-deforestation carbon stocks from forest carbon stocks (Table 26). Non-tree, litter and deadwood were excluded as they were considered insignificant[5] following T-SIG (Tatum-Hume et al 2013b).

Table 26. Carbon stock changes per stratum

Carbon Pool	Strata 1	Strata 2	Post deforestation	Wood product CWP, strata1	Wood product CWP, strata2	ΔC,Strata 1	ΔC,Strata 2
	Mean Stock t CO_2e ha^{-1}						
$C_{AB\_Tree,i}$	629.3	578.0	127.0	5.3	4.8	497.1	446.2
$C_{BB\_Tree,i}$	151.0	138.7	34.3			116.7	104.4
$C_{AB\_nontree,i}$	x	x	x			x	x
$C_{BB\_nontree,i}$	x	x	x			x	x
$C_{LI,i}$	x	x	x			x	x
$C_{SOC,i}$	253.9	172.7	172.7			81.2	19.6
C_{BSL}	1034.3	334.0	334.0			695.0	570.2

4.1.17 Estimation of the sum of baseline greenhouse gas emissions

Emissions of CO_2 by combustion of fossil fuel

Fossil fuel combustion in all situations is an optional emission source. The Methodology Module E-FFC, states that project proponents may elect to include fossil fuel combustion if emissions are higher in the baseline than in the project case thus generating emission reductions through project activities. Where emissions from fossil fuel combustion are estimated in the baseline, monitoring and estimation must also occur in the with-project scenario.

As an optional emission the Gola REDD project has elected not to estimate emissions from fossil fuel combustion.

Emissions of N_2O due to nitrogen application

[5] Less than 5% of the net carbon stocks http://cdm.unfccc.int/methodologies/ARmethodologies/tools/ar-am-tool-04-v1.pdf

The estimation of emission from nitrous oxide is required if leakage prevention activities include the increases in the use of fertilizers (See Module REDD-MF).

The GRNP Project will not use fertilizers as a leakage prevention activity, and therefore emissions from nitrous oxide are excluded

4.1.18 Emissions of other GHG by biomass burning

Subsistence crop-fallow farming which involves clearing and burning the vegetation as the primary driver of deforestation in the project area (Witkowski et al 2012a). Thus, GHG emissions from biomass burning is expected to occur on all land deforested during site preparation and was estimated following Module E-BB (Table 27).

Table 27. Non-CO_2 emissions from biomass burning (for equations see Netzer and Walker 2013)

	Strata 1: GRNP North	Strata 2: GRNP South	Description
AG Biomass	629.3	578	Ave aboveground biomass stock before deforestation t d.m./ha
$B_{i,t}$	580.9	533.5	Ave aboveground biomass stock, after logs removed, before burning, t d.m./ha
Emissions per hectare, CH_4	37	34	CH_4 Emission from biomass burning per hectare, t CO_2e/ha
Emissions per hectare, N_2O	16	15	N_2O Emission from biomass burning per hectare, t CO_2e/ha

4.1.19 Calculation of net emissions

Stock changes in above ground biomass were emitted at the time of deforestation. Emissions from below ground biomass were emitted at a rate of 1/10 the stock for 10 years. Emissions from soil were emitted at 1/20 the stock for 20 years.

Following BL-UP net emissions were calculated for each strata in the project area and leakage belt over the monitoring period ex-ante 2015 to 2018 (Table 28). These are the total baseline emissions by strata for the Project Area and Leakage Belt (without project emissions).

Table 28. Ex-Ante calculation of net emissions for Project Area (Strat 1 North Gola, Strata 2 South Gola), and Leakage Belt. Results for the first baseline period are shown in gray. This PD sets the new baseline after 2018.

Baseline	t	y	BSLunplanned - Strata 1			BSLunplanned - Strata 2			Total CBSL,PA
			ha	t CO2e	t non-CO2e (EBiomassBurn,i,t)	ha	t CO2	t non-CO2 (EBiomassBurn,i,t)	t CO2
First Baseline	1	2012	337	172,811	18,042	704	322,147	34,617	547,616
	2	2013	413	217,085	22,111	628	295,411	30,880	565,487
	3	2014	353	192,815	18,898	688	330,041	33,830	575,584

4	2015	446	246,059	23,877	595	295,343	29,257	594,536
5	2016	435	247,435	23,288	606	307,173	29,798	607,695
6	2017	487	280,944	26,072	554	290,301	27,241	624,558
7	2018	518	304,503	27,732	522	281,986	25,667	639,888
8	2019	996	557,767	53,322	823	425,685	40,468	1,077,242
9	2020	1,071	611,897	57,338	748	400,766	36,780	1,106,781
10	2021	1,121	654,387	60,015	698	386,431	34,322	1,135,154
11	2022	1,115	665,013	59,693	704	389,797	34,617	1,149,121
12	2023	1,159	700,297	62,049	660	371,147	32,453	1,165,946
13	2024	1,153	711,335	61,728	666	374,247	32,748	1,180,057
14	2025	1,155	725,294	61,835	664	374,726	32,650	1,194,504
15	2026	1,179	750,695	63,120	640	365,000	31,470	1,210,284
16	2027	1,193	770,738	63,869	626	360,118	30,781	1,225,507
17	2028	1,181	777,307	63,227	638	367,309	31,371	1,239,214

Second Baseline

Baseline			BSLunplanned - Leakage belt			Total CBSL,LB
	t	y	ha	t CO2e	t non-CO2 (EBiomassBurn,i,t)	t CO2e
First Baseline	1	2012	1,544	791,750	82,660	874,410
	2	2013	1,544	816,042	82,660	898,703
	3	2014	1,544	840,335	82,660	922,995
	4	2015	1,544	864,627	82,660	947,287
	5	2016	1,544	888,919	82,660	971,580
	6	2017	1,544	913,212	82,660	995,872
	7	2018	1,544	937,504	82,660	1,020,165
Second Baseline	8	2019	1,709	1,046,407	91,494	1,137,901
	9	2020	1,709	1,073,296	91,494	1,164,790
	10	2021	1,709	1,100,184	91,494	1,191,678
	11	2022	1,709	1,109,047	91,494	1,200,541
	12	2023	1,709	1,117,910	91,494	1,209,404
	13	2024	1,709	1,126,773	91,494	1,218,267
	14	2025	1,709	1,135,637	91,494	1,227,131
	15	2026	1,709	1,144,500	91,494	1,235,994
	16	2027	1,709	1,153,363	91,494	1,244,857
	17	2028	1,709	1,162,226	91,494	1,253,720

4.2 Project Emissions

For the baseline renewal of the GRNP REDD Project VM0007 Methodology stipulated in Module REDD-MF that the same procedure must be followed ex ante and ex post using the relevant REDD Modules. Monitoring project emissions requires the use of M-MON. In Module M-MON the sum of GHG emissions in the project case is equal to the sum of changes from deforestation, degradation, GHG emissions from project activities, minus any forest carbon stock enhancements.

Net GHG emission in the project area for the GRNP REDD Project is calculated as:

$$\Delta C_P = \sum_{t=1}^{t^*} \sum_{i=1}^{M} \left(\Delta C_{P,DefPAi,t} + \Delta C_{P,Deg,i,t} + GHG_{P-E,i,t} - \Delta C_{P,Enh,i,t} \right) \quad (1)$$

Where:

ΔC_P	Net greenhouse gas emissions within the project area under the project scenario ; t CO_2-e
$\Delta C_{P,DefPA,i,t}$	Net carbon stock change as a result of deforestation in the project area in the project case in stratum *i* at time *t*; t CO_2-e
$\Delta C_{P,Deg,i,t}$	Net carbon stock change as a result of degradation in the project area in the project case in stratum *i* at time *t*; t CO_2-e
$GHG_{P-E,i,t}$	Greenhouse gas emissions as a result of deforestation and degradation activities within the project area in the project case in stratum *i* in year *t*; t CO_2-e
$\Delta C_{P,Enh,i,t}$	Net carbon stock change as a result of forest growth and sequestration during the project in areas projected to be deforested in the baseline[6] in stratum *i* at time *t*; t CO_2-e
i	1, 2, 3 ...*M* strata
t	1, 2, 3, ... *t** years elapsed since the start of the REDD project activity

Under the with project scenario there are anticipated to be no changes in carbon stocks as a result of deforestation or degradation in the project area due to the project activities that will protect the GRNP through enforcement and leakage prevention activities (see Section 4.3).

GHG emissions will be zero because the Project will not use fertilizers as a leakage prevention activity, and therefore emissions from nitrous oxide are excluded, and emission form fossil fuel combustion is ignored in the baseline and there for can be ignored in the project case[7].

[6] For areas with a degradation baseline (i.e. using BL-DFW) this parameter shall be set to zero, for areas with baseline set by BL-UP and BL-PL this parameter may be conservatively set to zero.

[7] VMD0014, E-FFC: "Fossil fuel combustion in all situations is an optional emission source."

Non-CO_2 emission from fire related to forest clearance is considered relevant for all areas deforested and will be included for any areas found to be deforested in the project case. These emissions will be calculated following Module E-BB.

$$E_{BiomassBum,i,t} = \sum_{g=1}^{G} \left(\left(\left(A_{burn,i,t} * B_{i,t} * COMF_i * G_{g,i} \right) * 10^{-3} \right) * GWP_g \right) \quad (1)$$

Where:

$E_{BiomassBurn,t}$	Greenhouse emissions due to biomass burning as part of deforestation activities in stratum *i* in year *t*; tCO_2-e of each GHG (CO_2, CH_4, N_2O)
$A_{burn,i,t}$	Area burnt for stratum *i* at time *t*; ha
$B_{i,t}$	Average aboveground biomass stock before burning stratum *i*, time *t*; tonnes d. m. ha^{-1}
$COMF_i$	Combustion factor for stratum *i*; dimensionless (see annex 1 for default values as derived from Table 2.6 of IPCC, 2006)
$G_{g,i}$	Emission factor for stratum *i* for gas *g*; kg t^{-1} dry matter burnt (see section III and annex 2 for default values as derived from Table 2.5 of IPCC, 2006)
GWP_g	Global warming potential for gas *g;* t CO_2/t gas *g* (default values from IPCC SAR: CO_2 = 1; CH_4 = 21; N_2O = 310)
g	1, 2, 3 … *G* greenhouse gases (to include carbon dioxide[8], methane and nitrous oxide)
i	1, 2, 3 …*M* strata
t	1, 2, 3, … *t** years elapsed since the start of the REDD project activity

4.2.1 Enhancements

Forest carbon stock enhancements was measured in the project scenario following M-MON. As outlined in Section 4.1 and Netzer and Walker 2013. Gola South was stratified using Module X-STR for areas assumed to be accumulating carbon. In Gola South ground measurements has been used to monitor the changes in carbon stocks through time as specified in the carbon pool modules. For Gola Central and North it will conservatively assumed that no carbon stock enhancement is occurring.

If Gola South is subject to degradation activities (as described in Section 4 and Module M-MON Step 2) the emissions from these activities will be estimated and deducted from the amount sequestered. Under the previous baseline and current MIR report there is no evidence of degradation that requires accounting (See MIR 2020).

Enhancements will be estimated following M-MON, and will be reported on during monitoring events.

[8] Carbon dioxide may be omitted where carbon dioxide emissions are calculated in an alternate module through stock change

In the first Gola Project Document (PD 2015) and in the first monitoring event (MIR 2015) the net carbon stock change from forest growth and sequestration had not been measured. In 2018 the Gola Project conducted a remeasurement of 48 plots in Gola South (Swinfield 2020). The remeasurement compared net carbon stocks from 2012 to 2018. The summary results are shown in Table 29, and presented in Swinfield 2020. The raw data is included in the Project's Excel database "Baseline Verification 2020" under Enhancments. The results show an annual sequestration of 20.3 t CO_2 ha^{-1}, with a confidence interval below the ±15% of 95%.

Table 29. Net carbon stock change from forest growth in Gola South.

	Number of Plots	Mean Stock	95% CI	95% CI as % of mean
		t CO_2 ha^{-1}		
Above & below ground 2012	48	720.2	94.1	13.1
Above & below ground 2018	48	842.1	111.5	13.8

$$\Delta C_{P,Enh,i,t} = \sum_{t=1}^{t}\sum_{i=1}^{M}\left(\left(C_{P,i,t} - C_{BSL,i}\right) * A_{Enh,PL,i,t}\right) \quad (8)$$

Where:

$\Delta C_{P,Enh,i,t}$	Net carbon stock changes as a result of forest carbon stock enhancement in stratum *i* in the project area at time *t*; t CO_2-e
$C_{P,i,t}$	Carbon stock in all pools in the project case in stratum *i* at time *t*; t CO_2-e
$C_{BSL,i}$	Carbon stock in all pools in the baseline in stratum *i*; t CO_2-e ha^{-1}
$A_{Enh,PL,i,t}$	Project area in stratum *i* in which carbon stocks are accumulating but that would have undergone planned deforestation in the baseline scenario at time *t*; ha
i	1, 2, 3 …*M* strata
t	1, 2, 3, … *t** years elapsed since the start of the REDD project activity

The eligible area is determined from the area due to be deforested in each year of the baseline as described in the Baseline Emission Section 4.1.

$$A_{Enh,UP,i,t} = A_{BSL,PA,unplanned,t} \quad (11)$$

Where:

$A_{Enh,UP,i,t}$	Project area in stratum *i* in which carbon stocks are accumulating but that would have undergone unplanned deforestation in the baseline scenario at time *t*; ha
$A_{BSL,PA,unplanned,t}$	Annual area of unplanned baseline deforestation in the project area at time *t*; ha yr^{-1}

i	1, 2, 3 …*M* strata
t	1, 2, 3, … *t** years elapsed since the start of the REDD project activity

4.3 Leakage

Leakage for the baseline renewal was determined following VM0007 Module LK-ASU. Project activities have continued since the project start and there have been no perceivable changes in the projects baseline scenario, and therefore to the assessment of leakage. However, through the course of project implementation over the last 7 years The Project has adjusted its leakage prevention activities in minor ways to ensure it continues to meet the desired needs of the project. All of these changes have been documented in the first and second MIR reports (MIR 2015 and MIR 2020), and none of them are significant or warrant any methodological deviations or change in leakage accounting.

As outlined in the original PD, various independent studies have established the primary driver of deforestation in Sierra Leone is from small scale agriculturalists (BCP project proposal 2009, MAFFS 2004:8). The National Poverty Reduction Paper (2005:33) cited small scale agriculture to make-up around 75% of Sierra Leone's labour force. This is particularly true for the rural population living in and around the Project Area and Leakage Belt, where nearly the entire population engages in subsistence agriculture (Witkowski 2012a, Showers 2012, Bulte et al 2013). There are other threats from logging, mining and industrial agriculture (e.g. palm oil or coffee plantations), but none of these threats are "planned[9]" and surveys indicated that in the Project Area and Leakage Belt villagers do not engage in such activities without the participation of immigrants who bring with them the skills, capital and equipment (Witkowski 2012a). Without protection of the Project Area, local deforestation agents would continue to convert forest into the bush fallow cycle, resulting in deforestation inside the project boundary.

Such deforestation would occur inside the Project Area (Netzer and Walker 2013) in the absence of the Gola REDD project but could be displaced to outside the Project Area as a consequence of the REDD project, resulting in leakage. Protection of the Project Aarea may also reduce immigration into the area as economic opportunities to exploit the project area for mining or logging area prevented (Witkowski 2012a, Cuni-Sanchez 2012b), however, such deforestation agents are conservatively ignored in the baseline scenario.

The Gola REDD project will reduce the threat of deforestation through continued protection of the Project Area and will reduce leakage in the Leakage Belt through community livelihood activities which consist of 6 different elements:

1) Capacity building for crop production; to improve productivity on existing crop fallow land in order to increase yields and reduce the need to convert forest into the farm bush cycle

[9] According the VM0007 planned deforestation is the Conversion of forest lands to a deforested that is legally permitted. Also Documentation must be available to clearly demonstrate with credible evidence and documentation that indeed the land would have been converted to non-forest use if not for the REDD project.

2) Capacity building for cocoa production; to improve productivity and farmer income from cocoa production and other diversified sustainable income generating activities that maintain forest cover

3) Savings and Internal Lending Schemes; to enable Forest edge communities (FECs) to achieve financial independence

4) Co-management and land-use planning activities; to improve the well-being and resource governance capacity of FECs whilst maintaining a biodiverse forest through co-management and land-use planning activities in the project area and leakage belt

5) Environmental awareness raising; develop and implement an education program to enhance environmental awareness and promote community participation in the management of the GRNP

6) Benefit sharing agreement and distribution; implement and monitor mechanisms that equitably compensate stakeholders and promote incentives for conservation practices in the project zone and offsite zone

For detailed information on the community livelihoods and all leakage prevention activities see the most recent MIR 2020 report.

For the baseline renewal leakage due to the avoided unplanned deforestation in the project area is calculated ex-ante following the steps established in the approved methodology. Ex-post monitoring is reported in the MIR 2020.

4.3.1 Estimation of baseline carbon stock changes and greenhouse gas emissions in the Leakage Belt

The baseline for the Leakage Belt was developed following the BL-UP Module. The same criteria used to estimate the carbon stock changes in the Project Area were used in this step:

Forest strata: Due to limited information on carbon stocks in the Leakage Belt it is conservatively assumed that the Leakage Belt forests have the same carbon stocks as Gola Central/North. This is conservative because Goal Central/North has the highest carbon stocks and is undoubtedly the least disturbed forest in the Reference Region (See Section 4.1, Forest carbon sock).

Post deforestation strata: Farming is the primary livelihood activity for the vast majority of community members all of whom engage in agriculture in a crop fallow cycle (See Section 4.1, Post deforestation strata; Witkowski et al 2012a; Bulte et al 2013).

Carbon stocks and emissions: Carbon stocks for forests and post deforestation land cover were determined in Section 4.1.15 Estimation of carbon stock changes per stratum.

Emissions from carbon stock changes, wood products and biomass burning were also calculated in Section 4.1.19 Calculation of net emissions.

4.3.2 Estimation of the proportions of area deforested by immigrant and local deforestation agents in the baseline

In order to calculate the proportion of deforestation by immigrants in and around the project area ten percent of communities within two kilometers of the park boundary were visited[10]; out of the 125 villages within that radius, 13 were randomly selected. Results from the survey (Witkowski 2012a) are quoted below.

Results from the PRA showed that on average, residents that have recently arrived (within the past 5 years) represent only 3.9% of the population. Where there are migrants, all respondents indicated that the migrants undertake activities in the same way as the villagers do; i.e. the farming practices they use are the same. According to 83% of respondents, strangers were doing subsistence activities, primarily farming, in both swamp and upland areas. 17% of respondents indicate that the migrants undertake commercial activities in addition to the subsistence activities. All respondents indicated that the farm size of migrants is the same (60%) or smaller (40%) than those of villagers. Most people reported that villagers do the same amount or more of activities that cause deforestation than migrants do.[11] No strangers were reported to be farming inside the park (Witkowski 2012a)."

"Activities such as logging and mining tend to attract immigrants to the villages and it appears that villagers do not engage in such activities without the participation of at least a small number of migrants. Through discussions with community members, it was found that the sampled villages (FEC) themselves tend not to be involved in small scale commercial logging as in most cases the required skills, capital and equipment for mining and logging activities comes from outside the villages (Witkowski 2012a)."

From this information the proportion deforested by residents and immigrants in and around the Leakage Belt has remained the same as that reported in the original baseline and PD 2015:

Residents ($PROP_{RES}$) =97.1%

Immigrants ($PROP_{IMM}$) =3.9%

4.3.3 Estimation of Unplanned Deforestation Displaced from the Project Area to the Leakage Belt

4.3.4 Ex ante assessment

According to the LK-ASU, the estimated carbon stock changes and the GHG emitted in the Leakage belt should be multiplied by a factor less than 1, which represents the percentage of deforestation that would be displaced in the Leakage Belt.

As reported in the original PD, the effectiveness of the proposed Gola REDD project in managing leakage relies on REDD financing to continue the implementation of effective leakage prevention programs that increase social wellbeing, reduce the pressures for deforestation, education, alternative livelihoods, and other social development programs (See Tatum-Hume and Witkowski 2013).

[10] All communities within 4km of the park boundaries are known as forest edge communities and lie between the PA boundary and the edge of the LB i.e. within the leakage belt, this meets with the LK-ASU (VMD0010) criteria for sampling communities within 2km of the boundaries of the LB and the PA.

[11] 94% of respondents reported villagers doing more or the same amount of farming as migrants. For logging, plantations, and mining, the percentage of respondents reporting villagers were doing more were 82%, 66%, and 57% respectively.

Net emission in the Leakage Belt are calculated in Section 4.1.19. Over the course of the project implementation it has been found that deforestation in the leakage belt has been about 20% above the historic baseline (i.e. 20% leakage). Reducing below the baseline has been challenging as local inhabitants cannot be expected to significantly change their behavior outside The Project Area. Despite these challenges The Project has made significant progress in identifying alternative livelihood activities and will continue to do so. Table 30 shows a continued 20% leakage over the next 10 years of project implementation that the Gola Project will work to reduce.

Table 30. Estimation of baseline carbon stocks changes and GHG emissions in the Leakage Belt after 2018 ex-ante.

Baseline			$Area_{BSLunplanned}$ - Leakage belt			Total carbon stock change in baseline in LB $\Delta C_{BSL,LK,unplanned}$	deforestation expected to be displaced into the Leakage Belt	Net CO2e emissions due to leakage ΔCLK-ASU-LB
	t	y	ha	t CO2	t non-CO2e (EBiomassBurn)	t CO2e	%	t CO2e
Second Baseline	8	2019	1,709	1,046,407	91,494	1,137,901	20%	215,448
	9	2020	1,709	1,073,296	91,494	1,164,790	20%	221,356
	10	2021	1,709	1,100,184	91,494	1,191,678	20%	227,031
	11	2022	1,709	1,109,047	91,494	1,200,541	20%	229,824
	12	2023	1,709	1,117,910	91,494	1,209,404	20%	233,189
	13	2024	1,709	1,126,773	91,494	1,218,267	20%	236,011
	14	2025	1,709	1,135,637	91,494	1,227,131	20%	238,901
	15	2026	1,709	1,144,500	91,494	1,235,994	20%	242,057
	16	2027	1,709	1,153,363	91,494	1,244,857	20%	245,101
	17	2028	1,709	1,162,226	91,494	1,253,720	20%	247,843

4.3.5 Ex post assessment

Ex post leakage will be assessed following Module M-MON at the validation event. Leakage in the Leakage Belt will be estimated following LK-ASU.

$$\Delta C_{LK-ASU-LB} = \Delta C_{P,LB} - \Delta C_{BSL,LK,unplanned} \quad (1)$$

Where:

$\Delta C_{LK-ASU-LB}$ Net CO_2 emissions due to unplanned deforestation displaced from the project area to the Leakage Belt; t CO_2-e

$\Delta C_{BSL,LK,unplanned}$ Net CO_2 emissions in the baseline from unplanned deforestation in the leakage belt; t CO_2-e

$\Delta C_{P,LB}$ Net greenhouse gas emissions within the leakage belt in the project case t CO_2-e

If $\Delta C_{LK\text{-}ASU\text{-}LB}$ as calculated is <0 then $\Delta C_{LK\text{-}ASU\text{-}LB}$ shall be set equal to 0 (to prevent positive leakage).

4.3.6 Estimation of unplanned deforestation displaced from the project area to outside the Leakage Belt

To assess leakage outside the Leakage Belt the project followed steps a-e in the LK-ASU Module.

Define the total available national forest area (*TOTFOR*).

MODIS land cover for was analyzed for forest area within 5km of all roads and major rivers. Based on current knowledge of Sierra Leona there are no known fully protected forest reserves and national parks (Cuni-Sanchez 2012b; Witkowski 2012; Netzer and Walker 2013 in Section 1.1.1.1). Forest areas under active management were calculated for existing forest reserves (Table 31).

Table 31. Calculation of total available National forest area.

ID	Description	value
AVFOR	Total available national forest area for unplanned deforestation; ha	1,783,800
TOTFOR	Total available national forest area; ha	1,958,350
PROTFOR	Total area of fully protected forests nationally; ha	0
MANFOR	Total area of forests under active management nationally; ha	174,550

$$AVFOR = TOTFOR - PROTFOR - MANFOR \quad (2)$$

Where:

AVFOR Total available national forest area for unplanned deforestation; ha

TOTFOR Total available national forest area; ha

PROTFOR Total area of fully protected forests nationally; ha

MANFOR Total area of forests under active management nationally; ha

Calculate the area of forest in the Leakage Belt as a proportion of the total available national forest area.

Following LK-ASU the proportion of forest available in the leakage belt for unplanned deforestation compared with total national forest is 3.5% (Table 32. The proportional area of forest in the Leakage Belt compared to the total National forest available.).

Table 32. The proportional area of forest in the Leakage Belt compared to the total National forest available.

ID	Description	value
PROPLB	Area of forest available in the Leakage Belt for unplanned deforestation as a proportion of the total national forest area available for unplanned deforestation; proportion	2.7%
LBFOR	Total available forest area for unplanned deforestation in the Leakage Belt; ha (calculated from the original Leakage Belt Forest Cover Benchmark Map)	48,452
AVFOR	Total available national forest area for unplanned deforestation; ha	1,783,800

$$PROP_{LB} = LBFOR / AVFOR \quad (3)$$

Where:

$PROP_{LB}$ Area of forest available in the Leakage Belt for unplanned deforestation as a proportion of the total national forest area available for unplanned deforestation; proportion

LBFOR Total available forest area for unplanned deforestation in the Leakage Belt; ha (calculated from the *Leakage Belt Forest Cover Benchmark Map*)

AVFOR Total available national forest area for unplanned deforestation; ha

Stratify Total available national forest area for unplanned deforestation (AVFOR) by carbon stock.

According to the methodology, the stratification of AVFOR by carbon stock has to be made. However there is very limited information on carbon stocks in other parts of Sierra Leone. Therefore an assessment of current published literature on biomass stocks for the region was conducted. The assessment showed that carbon stocks for leakage belt are slightly higher than the IPCC and EC default values, and lower that one report for Upper Guinea forest by Lewis et al. (2009) (Table 33).

Table 33. Comparison with other published literature for Upper Guinea region of West Africa.

Description	Mg C ha^{-1}	t CO_2e ha^{-1}	Source
West tropical forest IPCC default value	155	568	Penman et al (2003)
Moist tropical forest IPCC default value	130	477	Penman et al (2003)
Tropical rainforest in Africa > 30% canopy cover EC default value	204	748	European Commission (2010)
Tropical moist deciduous forest EC default value	156	572	European Commission (2010)

Mean of 833 x 1 km2 cells overlapping Gola forest extracted from GIS dataset	122.3	448	Baccini et al. (2008)
Mean of 33 plots in undisturbed Upper Guinea forest	195.3	716	Lewis et al. (2009)
Average	160	588	

The report by Lewis et al. (2009) was for forest areas to the south of the project area in Liberia where conditions are increasingly wet and tropical. The vast majority of forests in Sierra Leone are north of the Project Area where conditions are dryer. Based on a biomass map from Saatchi et al. (2011) the biomass of forest areas appears to decrease north of the project area (Figure 20).

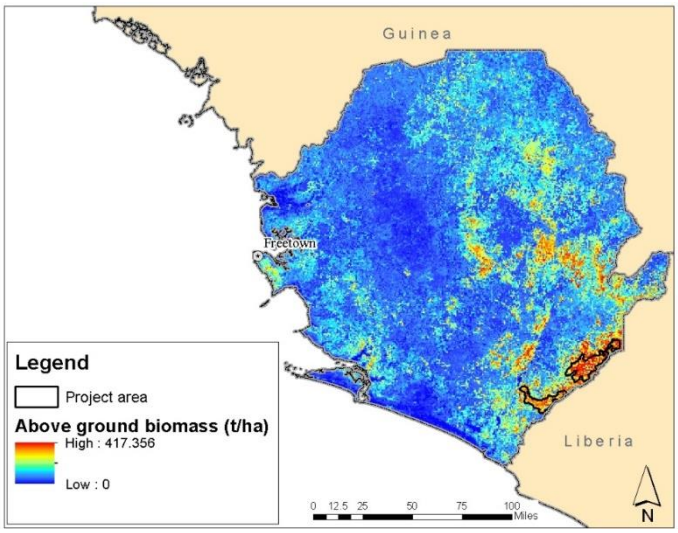


Figure 20. Above ground biomass in Sierra Leone from Saatchi et al. (2011)[12]

This suggests that the forest in the GRNP contains some of the highest biomass forest in Sierra Leone because of its southerly location. Based on this analysis it was thought to be conservative to assume to average biomass from all published literature, 588t CO_2 e ha^{-1} (Table 34).

Table 34. Calculation of the proportion difference in carbon stocks between forests in the Leakage Belt and outside the Leakage Belt in Sierra Leone.

ID	Description	value
PROPCS	The proportional difference in carbon stocks between areas of forest available for unplanned deforestation both inside and outside the Leakage Belt; proportion	89.9%

[12] Saatchi, Sassan S., et al. "Benchmark map of forest carbon stocks in tropical regions across three continents." *Proceedings of the National Academy of Sciences* 108.24 (2011): 9899-9904.

COLB	Area weighted average aboveground tree carbon stock for forests available for unplanned deforestation outside the Leakage Belt; t CO2-e ha-1	588
CLB	Area weighted average aboveground tree carbon stock for forests available for unplanned deforestation inside the Leakage Belt; t CO2-e ha-1	654.7

$$PROP_{CS} = C_{OLB} / C_{LB} \quad (4)$$

Where:

$PROP_{CS}$ The proportional difference in carbon stocks between areas of forest available for unplanned deforestation both inside and outside the Leakage Belt; proportion

C_{OLB} Area weighted average aboveground tree carbon stock for forests available for unplanned deforestation outside the Leakage Belt; t CO_2-e ha^{-1}

C_{LB} Area weighted average aboveground tree carbon stock for forests available for unplanned deforestation inside the Leakage Belt; t CO_2-e ha^{-1}

The proportion of leakage from immigrant population is equal to the immigrating proportion multiplied by the proportion of available national forest area outside the Leakage Belt multiplied by the proportional difference in stocks between forests inside and outside the Leakage Belt (Table 35).

Table 35. The proportion of leakage for areas with immigrant populations

ID	Description	value
LKPROP	Proportional leakage for areas with immigrating populations; proportion	3.4%
PROPIMM	Estimated proportion of baseline deforestation caused by immigrating population; proportion	3.9%
PROPLB	Area of forest available for unplanned deforestation as a proportion of the total national forest area available for unplanned deforestation; proportion	3.5%
PROPCS	The proportional difference in stocks between areas of forest available for unplanned deforestation both inside and outside the Leakage Belt; proportion	89.9%

$$LK_{PROP} = PROP_{IMM} * (1 - PROP_{LB}) * PROP_{CS} \quad (5)$$

Where:

LK_{PROP} Proportional leakage for areas with immigrating populations; proportion

$PROP_{IMM}$ Estimated proportion of baseline deforestation caused by immigrating population; proportion

$PROP_{LB}$ Area of forest available for unplanned deforestation as a proportion of the total national forest area available for unplanned deforestation; proportion

$PROP_{CS}$ The proportional difference in stocks between areas of forest available for unplanned deforestation both inside and outside the Leakage Belt; proportion

Ex-ante leakage from immigrant deforestation agents

Leakage due to the proportion of the baseline deforestation actors who are displaced to areas outside the Leakage Belt is equal to the change in stocks in the baseline scenario minus the change in stocks in the project scenario multiplied by the proportional leakage factor for areas with immigrating populations.

The leakage caused by deforestation actors that will be displaced outside the Leakage Belt is equal to the equation below. The results for the baseline period are presented in Table 36. Net cumulative CO2 emissions due to unplanned deforestation displaced outside the Leakage Belt after 2018..

$$\Delta C_{LK-ASU,OLB} = \left(\Delta C_{BSL,LK,unplanned} - \Delta C_{P,LB}\right) * LK_{PROP} \quad (6)$$

Where:

$\Delta C_{LK\text{-}ASU,OLB}$ Net CO_2 emissions due to unplanned deforestation displaced outside the Leakage Belt ; t CO_2-e

$\Delta C_{BSL,LK,unplanned}$ Net CO_2 equivalent emissions in the baseline from unplanned deforestation in the leakage belt; t CO_2-e

$\Delta C_{P,LB}$ Net CO_2 equivalent emissions within the leakage belt in the project case; t CO_2-e

LK_{PROP} Proportional leakage for areas with immigrating populations; proportion

In each monitoring period the area deforested in the Project Area and Leakage Belt will be assessed as per Module M-MON following sub-steps f-g of LK-ASU.

Table 36. Net cumulative CO_2 emissions due to unplanned deforestation displaced outside the Leakage Belt after 2018.

Baseline			Total carbon stock change in baseline in LB $\Delta C_{BSL,LK,unplanned}$	Net CO2e emissions due to leakage ΔCLK-ASU-LB	LKPROP	Net CO2e emissions due to displaced unplanned deforestation outside LB ΔCLK-ASU,OLB
	t	y	t CO2e	t CO2e	%	t CO2e
Second Baseline	8	2019	1,137,901	215,448	3.4%	7,345
	9	2020	1,164,790	221,356	3.4%	7,546
	10	2021	1,191,678	227,031	3.4%	7,740
	11	2022	1,200,541	229,824	3.4%	7,835
	12	2023	1,209,404	233,189	3.4%	7,950
	13	2024	1,218,267	236,011	3.4%	8,046
	14	2025	1,227,131	238,901	3.4%	8,144
	15	2026	1,235,994	242,057	3.4%	8,252
	16	2027	1,244,857	245,101	3.4%	8,356
	17	2028	1,253,720	247,843	3.4%	8,449

Emissions from leakage prevention activities

Leakage prevention activities are not expected to have emissions from biomass burning or fertilizer use. Where they are use these emissions will be accounted for.

GHGLK,E = 0

Estimation of total leakage due to the displacement of unplanned deforestation

The total GHG emissions due to leakage are finally calculated with the following equation:

Δ CLK-AS,unplanned = Δ CLK-ASU-LB + Δ CLK-ASU,OLB + GHGLK,E

The results for the baseline period are presented in Table 37.

Table 37. Total leakage due to displacement of unplanned deforestation after 2018.

Baseline			Net CO2e emissions due to leakage ΔCLK-ASU-LB	Net CO2e emissions due to displaced unplanned deforestation outside LB ΔCLK-ASU,OLB	Net CO_2e emissions due to displaced unplanned deforestation outside LB $\Delta C_{LK-ASU,OLB}$
	t	y	t CO2e	t CO2e	t CO2e
Second Baseline	8	2019	215,448	7,345	222,793
	9	2020	221,356	7,546	228,902
	10	2021	227,031	7,740	234,770
	11	2022	229,824	7,835	237,659
	12	2023	233,189	7,950	241,139
	13	2024	236,011	8,046	244,057
	14	2025	238,901	8,144	247,045
	15	2026	242,057	8,252	250,309
	16	2027	245,101	8,356	253,457
	17	2028	247,843	8,449	256,292

4.4 Net GHG Emission Reductions and Removals

The total net GHG reductions for the REDD Project are calculated as follows:

CREDD,t = ΔCBSL - ΔCP - ΔCLK

Where,

CREDD,t = Total GHG emission reduction

ΔCBSL = Net emissions under baseline

ΔCP = Net emissions under project scenario

ΔCLK = Net emissions by leakage

The net baseline emissions in the project area have been calculated following Module BL-UP, and are shown in Section 4.1.

The net emissions under the project scenario will be monitored ex-post following M-MON.

Emissions due to leakage inside and outside the leakage belt have been calculated following Module LK-ASU, and are shown in Section 4.3.

4.4.1 Calculation of VCS buffer

The number of credits to be held in a permanent risk buffer is determined as a percentage of the difference between total emission from unplanned deforestation in the baseline (ΔCBSL) and with project scenario (ΔCP). Leakage emissions do not factor into the buffer calculations.

The retention rate is determined according to the risk classification of the project, using the VCS tool for AFOLU of Risk of Non Permanence. According to the calculations, it has a total percentage of 10% buffer (See VCS Risk Report).

$$Buffer_{UNPLANNED} = \left(\begin{array}{l} \left(\Delta C_{BSL,unplanned} - \underset{\substack{t=1 \\ Baseline}}{\sum^{t^*}} \underset{\substack{i=1 \\ Unplanned}}{\sum^{M}} \left(E_{FC,i,t} + N_2O_{direct,i,t} \right) \right) - \\ \left(\Delta C_{P.(UnplannedDeforestationAreas)} - \underset{\substack{t=1 \\ Project}}{\sum^{t^*}} \underset{\substack{i=1 \\ Unplanned}}{\sum^{M}} \left(E_{FC,i,t} + N_2O_{direct,i,t} \right) \right) \end{array} \right) * \left(Buffer\% \right)$$

4.4.2 Uncertainty Analysis

The analysis of uncertainty of carbon stocks was developed according to the Module X-UNC. The purpose of X-UNC is for calculating ex-ante and ex-post a precision level and any deduction in credits for lack of precision following project implementation and monitoring. The module assesses uncertainty in baseline estimations and in estimations of with-project sequestration, emissions and leakage.

A precision target of a 95% confidence interval equal to or less than 15% of the recorded value shall be targeted.

As per X-UNC, Part 1 – Uncertainty in Baseline Estimate:

Step 1: Assess uncertainty in projection of baseline rate of deforestation or degradation.

In this case the UncertaintyBSL,RATE = 0 where the baseline rate is long term (i.e. historic) average.

Step 2: Assess uncertainty of emissions and removals in project area.

Uncertainty should be expressed as the 95% confidence interval as a percentage of the mean. The uncertainty from dead-wood, litter, non-tree, were not analyzed as they are not included in baseline calculations. Fossil fuel combustion and N2O emissions from nitrogen application, were also not analyzed as they are not included in baseline calculations.

Uncertainty in the emissions from biomass burning is captured in the uncertainty of above ground biomass (CAB_Tree,I $Uncertainty_{BSL,SS,i}$).

Uncertainty in the wood products pool is considered undisputedly conservative and therefore Uncertainty =0.

The percent uncertainty for the combined carbon stocks is calculated as the square root of the sum of the squares for all pools divided by the combined carbon stocks:

$$\text{Uncertainty}_{BSL,SS,i} = \frac{\sqrt{\sum_1^n \left(U_{BSL,SS1,i,pool\#} * E_{BSL,SS1,i,pool\#}\right)^2}}{\sum_1^n E_{BSL,SS1,i,pool\#}}$$

Table 38. Assess uncertainty of emissions and removals in project area

Carbon Pool	Strata 1 (GRNP North Block) 95% CI as % of mean	Strata 2 (GRNP South Block) 95% CI as % of mean	Post Deforestation 95% CI as % of mean
CAB_Tree,I ($\text{Uncertainty}_{BSL,SS,i,\ pool\#}$)	6.6%	13.0%	12.8%
CBB_Tree,I ($\text{Uncertainty}_{BSL,SS,i,\ pool\#}$)	6.6%	13.0%	12.8%
CAB_nontree,I ($\text{Uncertainty}_{BSL,SS,i.\ pool\#}$)			
CBB_nontree,I ($\text{Uncertainty}_{BSL,SS,i,\ pool\#}$)			
CLI,I ($\text{Uncertainty}_{BSL,SS,I,pool\#}$)			
CSOC,I ($\text{Uncertainty}_{BSL,SS,I,pool\#}$)	12.1%	12.7%	
CBSL ($\text{Uncertainty}_{BSL,SS,i}$)	4.7%	8.0%	12.8%
Enh ($\text{Uncertainty}_{Enh,i}$)	13.5%		

Step 3: Estimate total uncertainty in baseline scenario

The percent uncertainty across all combined strata is calculated as the square root of the sum of the squares for all strata divided by the sum of the combined carbon stocks:

$$\text{Uncertainty}_{BSL,SS} = \frac{\sqrt{\sum_{i=1}^M \left(U_{BSL,SS1,i} * E_{BSL,SS1,i}\right)^2}}{\sum_{i=1}^M E_{BSL,SS1,i}}$$

The resulting uncertainty across all combined strata is 6.1%.

The allowable uncertainty under this methodology is +/- 15% of CREDD,t at the 95% confidence level. Where this precision level is met then no deduction should result for uncertainty. Therefore no deductions are associated with the GRNP Project, and the Adjusted_CREDD, t = CREDD,t .

Uncertainty ex-post will be updated based on the uncertainty associated with field measurements for carbon stock enhancements.

4.4.3 Calculation of Verified Carbon Units

To estimate the number of Verified Carbon Units (VCUs) for the monitoring period *T = t2-t1*, this methodology uses the following equation:

$$VCU_{t=(Adjusted\_C_{REDD,t_2} - Adjusted\_C_{REDD-t_1})-Buffer_{TOTAL}}$$

Where:

VCU_t Number of Verified Carbon Units at time $T = t_2 - t_1$; VCU

Adjusted_$C_{REDD,t2}$	Cumulative total net GHG emissions reductions at time t_2 adjusted to account for uncertainty; t CO_2-e
Adjusted_$C_{REDD,t1}$	Cumulative total net GHG emissions reductions at time t_1; t CO_2-e
$Buffer_{total}$	Total permanence risk buffer withholding; t CO_2-e

Table 39. Verified carbon units since the project start in 2012. Results for the first baseline period are shown in gray. This PD sets the new baseline after 2018.

Baseline			Estimated baseline emissions or removals $\Delta C_{BSL,PA}$	Estimated project emissions or removals ΔC_P	Estimated leakage emissions or removals ΔC_{LK}	Estimated GHG emissions or removals $C_{REDD,t}$	$Buffer_{unplanned}$	VCU
	t	years	t CO2e	t CO2e	t CO2e	t CO2e	t CO2e	
First Baseline	1	2012	547,616	14,118	113,257	448,477	54,762	393,716
	2	2013	565,487	26,697	116,953	475,231	56,549	418,682
	3	2014	575,584	40,488	119,041	497,031	57,558	439,473
	4	2015	594,536	52,270.37	122,961	523,846	59,454	464,392
	5	2016	607,695	64,276.22	125,682	546,289	60,769	485,519
	6	2017	624,558	75,225.61	129,170	570,614	62,456	508,158
	7	2018	639,888	85,524.86	132,340	593,073	63,989	529,084
Second Baseline	8	2019	1,077,242	101,392.18	222,793	955,841	107,724	848,117
	9	2020	1,106,781	TBD during monitoring event.	228,902	877,879	110,678	767,201
	10	2021	1,135,154		234,770	900,384	113,515	786,868
	11	2022	1,149,121		237,659	911,462	114,912	796,550
	12	2023	1,165,946		241,139	924,807	116,595	808,213
	13	2024	1,180,057		244,057	936,000	118,006	817,994
	14	2025	1,194,504		247,045	947,459	119,450	828,009
	15	2026	1,210,284		250,309	959,975	121,028	838,947
	16	2027	1,225,507		253,457	972,050	122,551	849,499
	17	2028	1,239,214		256,292	982,922	123,921	859,001

The results of this assessment estimate that the Gola REDD project will generate an average annual VCU of 820,040 from 2018 through 2028 totaling 8,200,398 VCU over the 10 year crediting period established with the second baseline assessment. This includes a 10% buffer deduction, and assumes a high 20% leakage over the entire period, and does not include enhancement in Gola South.

5 MONITORING

5.1 Data and Parameters Available at Validation

Data / Parameter	Regional Forest Cover / Non-Forest Cover Benchmark Map
Data unit	N/A
Description	Map that shows the location of forest and non-forest areas in the Reference Region RRD at the beginning of the accreditation.
Source of data	Landsat satellite imagery and ALOS PALSAR if available See Mitchard 2012 and Teuten 2019 and 2020
Value applied:	
Justification of choice of data or description of measurement methods and procedures applied	The Landsat images have an adequate resolution (30m) and they are available to all public. Three maps over the last 10 years are available 2007, 2011 and 2018. Cloud cover over the project boundaries was reduced to 0%. All land cover maps are >90% accurate.
Purpose of Data	*The Landsat imagery was used for all the purposed listed below:* • *Determination of baseline scenario* • *Calculation of baseline emissions* • *Calculation of project emissions* • *Calculation of leakage*
Comments	All forest areas are considered the same forest type, a mix of tropical evergreen to moist semi-deciduous. Stratification of the project area is based on management history and not forest type. Non-forest areas are predominantly crop fallow. Because the cop fallow has the highest biomass of any non-forest area in the region it is conservative to assume all non-forest is crop fallow.

Data / Parameter	Project Forest Cover Benchmark Map
Data unit	N/A

Description	Map showing the location of forest within the project area at the beginning of each monitoring period. The benchmark map will show the deforested areas at each monitoring event
Source of data	Landsat satellite imagery and ALOS PALSAR if available (see notes in Section 4.1.3)
Value applied:	
Justification of choice of data or description of measurement methods and procedures applied	The Landsat images have an adequate resolution and they are an available tool to all public. All land cover maps are >90% accurate. Maps will be created at minimum ten years prior to baseline renewal. See Mitchard 2012 and Teuten 2019 and 2020
Purpose of Data	*The project area forest benchmark map for 2018 is used to:* • *Determine baseline scenario (AFOLU projects only)* • *Calculate baseline emissions* • *Calculate project emissions*
Comments	All forest areas are considered the same forest type, a mix of tropical evergreen to moist semi-deciduous. Stratification of the project area is based on management history and not forest type. Non-forest area are predominantly crop fallow. Because the cop fallow has the highest biomass of any non-forest area in the region it is conservative to assume all non-forest is crop fallow.

Data / Parameter	Leakage Belt Forest Cover Benchmark Map
Data unit	
Description	Map showing the location of forest within the leakage belt at the beginning of each monitoring period. The benchmark map will show the deforested areas at each monitoring event
Source of data	Landsat satellite imagery and ALOS PALSAR if available
Value applied:	N/A
Justification of choice of data or description of measurement methods and procedures applied	The Landsat images have an adequate resolution and they are an available tool to all public. All land cover maps are >90% accurate. Maps will be created at minimum ten years prior to baseline renewal. For more information see Mitchard 2012.
Purpose of Data	*The leakage belt forest cover bench mark map is used to:*

	• *Calculate project emissions* • *Calculate leakage*
Comments	All forest areas are considered the same forest type, a mix of tropical evergreen to moist semi-deciduous. Stratification of the project area is based on management history and not forest type. Non-forest area are predominantly crop fallow. Because the cop fallow has the highest biomass of any non-forest area in the region it is conservative to assume all non-forest is crop fallow.

Data / Parameter	Ai
Data unit	ha
Description	Area of stratum i
Source of data	Landsat satellite imagery and ALOS PALSAR if available See Mitchard 2012 and Teuten 2019 and 2020
Value applied:	*N/A*
Justification of choice of data or description of measurement methods and procedures applied	The area of stratum was decided based on Landsat imagery and historic harvest intensity. The Landsat images were used to map forest and non-forest. See Mitchard 2012 and Teuten 2019 and 2020. The harvest intensity was based on historic logging concession areas and the forest inventory in 2006 updated in 2015. The forest inventory found significantly lower (and growing) stocks in Goal South compared to Golan North/Central. This was the basis for stratification.
Purpose of Data	*The forest strata was used to:* • *Determine baseline scenario (AFOLU projects only)* • *Calculate baseline emissions* • *Calculate project emissions*
Comments	Ex-ante it is assumed that strata area will remain constant.

Data / Parameter	ARRD,unplanned,hrp
Data unit	ha
Description	Total area deforested during the historical reference period in the RRD

Source of data	Landsat satellite imagery and ALOS PALSAR if available See Mitchard 2012 and Teuten 2019 and 2020
Value applied:	*N/A*
Justification of choice of data or description of measurement methods and procedures applied	Landsat imagery was used to determine the total area deforested during the historic reference period 2007-2018. The Landsat images have the adequate resolution and they are a free and available tool to all public. Frequency at a minimum every 10 years prior to baseline renewal.
Purpose of Data	*The total area deforested during the historic reference period was used to:* • *Determine baseline scenario (AFOLU projects only)* • *Calculate baseline emissions*
Comments	Monitored for the purpose of baseline revisions

Data / Parameter	CF
Data unit	t C t-1 d.m.
Description	Carbon fraction of dry matter
Source of data	Value taken from IPCC 2006 INV GLs AFOLU Chapter 4 Table 4.3
Value applied:	0.47 t C t-1 d.m
Justification of choice of data or description of measurement methods and procedures applied	Default value 0.47 t C t-1 d.m. can be used, or species specific values from the literature (e.g. IPCC 2006 INV GLs AFOLU Chapter 4 Table 4.3)
Purpose of Data	*The Carbon fraction for dry wood was used to:* • *Calculate baseline emissions* • *Calculate project emissions* • *Calculate leakage*
Comments	

Data / Parameter	CFj
Data unit	t C t_{-1} d.m.
Description	Carbon fraction of biomass for tree species j
Source of data	Species- or family-specific values from the literature (e.g. IPCC 2006 INV GLs AFOLU Chapter 4 Table 4.3) shall be

	used if available, otherwise default value of 0.47 t C t-1 d.m. can be used.
Value applied:	0.47 t C t-1 d.m
Justification of choice of data or description of measurement methods and procedures applied	Default value 0.47 t C t-1 d.m. can be used, or species specific values from the literature (e.g. IPCC 2006 INV GLs AFOLU Chapter 4 Table 4.3)
Purpose of Data	*The Carbon fraction for dry wood was used to:* • *Calculate baseline emissions* • *Calculate project emissions* • *Calculate leakage*
Comments	Where new species are encountered in the course of monitoring, new carbon fraction values must be sourced from the literature or otherwise use the default value.

Data / Parameter	Dj
Data unit	t d.m. m-3 .
Description	Basic wood density in t d.m. m^{-3} for species *j*.
Source of data	Wood density data were gathered from published databases (Chave et al. 2009; Zanne et al. 2009; Henry et al. 2010). For 30 species, no species- or genus-specific data were available. The mean wood density of all recorded species was 0.59 g cm^{-3}.
Value applied:	*N/A*
Justification of choice of data or description of measurement methods and procedures applied	Wood density data were gathered from published databases (Chave et al. 2009; Zanne et al. 2009; Henry et al. 2010) and were available for 59.4 % of recorded tree species (65.2 % of trees). If species-specific data were not available we used, in order of priority, the genus mean (26.1% of trees), the mean of all other known species in the same plot (8.5% of trees), the mean of all other known genera in the same plot if no species were identified (0.01%) or the family mean (0.005%). For 30 species, no species- or genus-specific data were available. The mean wood density of all recorded species was 0.59 g cm^{-3}.
Purpose of Data	• *The basic wood density was used to:Calculate baseline emissions* • *Calculate project emissions* • *Calculate leakage*

Comments	

Data / Parameter	Dmn
Data unit	t d.m.m-3
Description	Mean wood density of commercially harvested species
Source of data	N/A (for all wood densities see parameter Dj)
Value applied:	*N/A*
Justification of choice of data or description of measurement methods and procedures applied	*N/A*
Purpose of Data	*N/A*
Comments	

Data / Parameter	fj (X,Y)
Data unit	t d.m. tree-1
Description	Allometric equation for species j linking measured tree variable(s) to aboveground biomass of living trees, expressed as t d.m. tree-1
Source of data	Formulas have been taken from: - Chave, J, et. al. 2005. Tree allometry and improved estimation of carbon stocks and balance in tropical forests. Oecología 145: 87-99. The final model selected for above-ground biomass is the model for moist forest found in Chave et al. (2005) based on DBH, height and wood density. $Exp(-2.977 + \ln(\rho D^2 H))$ $\exp(-1.576 + 2.179 \ln(D) + 0.198$
Value applied:	$Exp(-2.977 + \ln(\rho D^2 H))$ $\exp(-1.576 + 2.179 \ln(D) + 0.198$
Justification of choice of data or description of measurement methods and procedures applied	The applicability of the selected model from Chave et al. (2005) was tested using a 'limited measurements' approach (see VMD0001). The data used for the limited measurements analysis consist of a random sample of 100 trees (with DBH>20cm) taken from the survey data of 2005 – 2007. Stem volume and biomass were calculated following VMD0001. Out of the sample of 100 measurements, 60 of the trees have a greater biomass when using the Chave et

	al. (2005) equation than the volume*BEF approach. This is within the limits set in VMD0001, confirming the validity of the model for Gola Forest.
Purpose of Data	*The allometric equation for tree biomass was used to:* • *Calculate baseline emissions* • *Calculate project emissions* • *Calculate leakage*
Comments	

5.2 Data and Parameters Monitored

Data / Parameter	Project Forest Cover Monitoring Map
Data unit	ha
Description	Map showing the location of forest land within the project area at the beginning of each monitoring period. If within the Project Area some forest land is cleared, the benchmark map must show the deforested areas at each monitoring event
Source of data	Landsat imagery and ALOS PALSAR if available or other similar Satellite images and field verification of deforested areas if any (GPS). See Mitchard 2012 and Teuten 2019 and 2020
Description of measurement methods and procedures to be applied	By using satellite images and remote sensing to map forest and non-forest covering the Project Area it would be determined if there are any variations in the forest in the project area. All maps will be >90% accurate.
Frequency of monitoring/recording	Every 5 years (or less) with images. Verification of deforested areas will be continually monitored in field by the project staff.
Value applied:	*N/A*
Monitoring equipment	Landsat imagery and ALOS PALSAR if available (see notes in Section 4.2) or other similar. Remote sensing software (e.g. ENVI)
QA/QC procedures to be applied	Field based accuracy assessment including accuracy assessment from high resolution imagery (<10m).
Purpose of data	*Indicate one of the following:* • *Calculation of project emissions*
Calculation method	N/A

Comments	

Data / Parameter	Leakage Belt Forest Cover Monitoring Map
Data unit	ha
Description	Map showing the location of forest land within the leakage belt at the beginning of each monitoring period. If within the Project Area some forest land is cleared, the benchmark map must show the deforested areas at each monitoring event
Source of data	Landsat and ALOS PALSAR if available imagery or other similar. See Mitchard 2012 and Teuten 2019 and 2020 Satellite images and field verification of deforested areas if any (GPS).
Description of measurement methods and procedures to be applied	By using satellite images and remote sensing to map forest and non-forest covering the Project Area it would be determined if there are any variations in the forest in the project area. All maps will be >90% accurate.
Frequency of monitoring/recording	Every 5 years (or less) with images. Verification of deforested areas will be continually monitored in field by the project staff.
Value applied:	*N/A*
Monitoring equipment	Landsat and ALOS PALSAR if available (see notes in Section 4.2)imagery or other similar. Remote sensing software (e.g. ENVI)
QA/QC procedures to be applied	Field based accuracy assessment including accuracy assessment from high resolution imagery (<10m).
Purpose of data	*Indicate one of the following:* • *Calculation of leakage*
Calculation method	*N/A*
Comments	

Data / Parameter	Degradation PRA Results
Data unit	
Description	The PRA will be executed from interviews and/or surveys to local actors with the purpose of identifying the existence of degradation potential within the area of the project due to: - Extraction of firewood. - Illegal logging

	If ≥ 10% of the surveys indicate that there is a risk of degradation then the procedures to verify and estimate the degradation should be executed. An additional result of the PRA would be the penetration distance that should be applied to calculate the area with degradation potential (buffer area).
Source of data	PRA
Description of measurement methods and procedures to be applied	The PRA will be conducted every 2 years. If the results indicate that the project area has no pressure from this type of degradation, then it will be assumed that: $\Delta Cp,Deg,i,t = 0$. If the results of the PRA indicate that there is potential for degradation, then it must: - Obtain a "penetration distance" in the PRA (distance that the degradation agents can enter from the nearest access points). - Identify the most important access points to the vulnerable area. - From said points, draw the distances and create a Buffer Area with a width equal to length. - Transects will be established to evaluate the buffer zone. The assessed area should not be lesser than 1% of the buffer area. - If stumps are not found (harvested trees), then it is assumed that $\Delta Cp,Deg,i,t = 0$ and the assessment is repeated every 2 years. - If stumps are found, then a systematic assessment is carried out. For this, plots are distributed systematically, being the area to assess ≥ 3% of the buffer area. - Take into account the diameter of the stumps, which will be assumed as their DBH. If they were very large (e.g. due to buttresses), then the species of the stump is identified and standing trees of the same species are located. Afterwards, their DBH and stump diameter are measured and a ratio between DBH/stump diameter is calculated. With this ratio, the DBH from the stump diameter of the cleared individuals that were found is estimated. With the DBH data, the carbon stock of the harvested trees is calculated, using the allometric equation that was employed for the estimation of the tree carbon stocks in the baseline (Chavé 2005 Equation -- $Exp(-2.977 + \ln(\rho D^2 H))$ $\exp(-1.576 + 2.179 \ln(D) + 0.198)$. - It will be assumed that all stock will be lost to the atmosphere.
Frequency of monitoring/recording	This assessment will be repeated every 5 years.
Value applied:	*N/A*
Monitoring equipment	*N/A*
QA/QC procedures to be applied	*N/A*

Purpose of data	*Indicate one of the following:* • *Calculation of project emissions*
Calculation method	
Comments	

Data / Parameter	Result of Limited Degradation Survey
Data unit	
Description	This will be sampled by surveying several transects of known length and width across the access-buffer area (equal in area to at least 1% of ADeg,i) to check whether new tree stumps are evident or not.
Source of data	PRA
Description of measurement methods and procedures to be applied	*N/A*
Frequency of monitoring/recording	Will be repeated each time the PRA indicates a potential for degradation
Value applied:	*N/A*
Monitoring equipment	GPS Measuring tape DBH tape Camera Data collection sheets Other required equipment
QA/QC procedures to be applied	Blind checks will be conducted by field team leads. Hot checks will be conducted by other field staff on a regular basis.
Purpose of data	*Indicate one of the following:* • *Calculation of project emissions*
Calculation method	N/A
Comments	

Data / Parameter	ADefPA,i,u,t
Data unit	ha
Description	Area of recorded deforestation in the project area in stratum i converted to land use u at time t

Source of data	Landsat satellite images and ALOS PALSAR if available. See Mitchard 2012 and Teuten 2019 and 2020
Description of measurement methods and procedures to be applied	The images used will be compatible with the ones already used in the estimations ex-ante in order to be compared.
Frequency of monitoring/recording	The data will be assesses at least every 5 years or if verification occurs
Value applied:	*N/A*
Monitoring equipment	Landsat imagery and ALOS PALSAR if available. Remote sensing software (e.g. ENVI) See Mitchard 2012 and Teuten 2019 and 2020
QA/QC procedures to be applied	Field based accuracy assessment including accuracy assessment from high resolution imagery (<10m).
Purpose of data	*Indicate one of the following:* • *Calculation of project emissions*
Calculation method	*N/A*
Comments	According to what has been observed on each monitoring, it has been considered to be zero for project scenario.

Data / Parameter	ADefLB,i,u,t
Data unit	ha
Description	Area of recorded deforestation in the leakage belt in stratum i converted to land use u at time t
Source of data	Landsat satellite images and ALOS PALSAR if available (see notes in Section 4.2).
Description of measurement methods and procedures to be applied	The images used will be compatible with the ones already used in the estimations ex-ante in order to be compared.
Frequency of monitoring/recording	The data will be assesses at least every 5 years or if verification occurs
Value applied:	*N/A*
Monitoring equipment	Landsat imagery and ALOS PALSAR if available (see notes in Section 4.2)or other similar. Remote sensing software (e.g. ENVI)
QA/QC procedures to be applied	Field based accuracy assessment including accuracy assessment from high resolution imagery (<10m).

Purpose of data	*Indicate one of the following:* • *Calculation of leakage*
Calculation method	*N/A*
Comments	

Data / Parameter	ADECKS,I,t
Data unit	ha
Description	Area of logging decks in stratum i at time t
Source of data	Landsat satellite images.
Description of measurement methods and procedures to be applied	*N/A*
Frequency of monitoring/recording	*N/A*
Value applied:	*N/A*
Monitoring equipment	*N/A*
QA/QC procedures to be applied	*N/A*
Purpose of data	*N/A*
Calculation method	*N/A*
Comments	

Data / Parameter	ADegW,i
Data unit	ha
Description	Area potentially impacted by degradation processes in stratum i
Source of data	*PRA*
Description of measurement methods and procedures to be applied	The PRA will be executed from interviews and/or surveys to local actors with the purpose of identifying the existence of degradation potential within the area of the project due to: - Extraction of firewood. - Illegal logging

	If ≥ 10% of the surveys indicate that there is a risk of degradation then the procedures to verify and estimate the degradation should be executed. An additional result of the PRA would be the penetration distance that should be applied to calculate the area with degradation potential (buffer area).
Frequency of monitoring/recording	*Every 2 years*
Value applied:	*N/A*
Monitoring equipment	*N/A*
QA/QC procedures to be applied	*N/A*
Purpose of data	• *Indicate one of the following: Calculation of project emissions*
Calculation method	The PRA will be conducted every 2 years. If the results indicate that the project area has no pressure from this type of degradation, then it will be assumed that: $\Delta Cp,Deg,i,t = 0$. If the results of the PRA indicate that there is potential for degradation, then it must: - Obtain a "penetration distance" in the PRA (distance that the degradation agents can enter from the nearest access points). - Identify the most important access points to the vulnerable area. - From said points, draw the distances and create a Buffer Area with a width equal to length. - Transects will be established to evaluate the buffer zone. The assessed area should not be lesser than 1% of the buffer area. - If stumps are not found (harvested trees), then it is assumed that $\Delta Cp,Deg,i,t = 0$ and the assessment is repeated every 2 years. - If stumps are found, then a systematic assessment is carried out. For this, plots are distributed systematically, being the area to assess ≥ 3% of the buffer area. - Take into account the diameter of the stumps, which will be assumed as their DBH. If they were very large (e.g. due to buttresses), then the species of the stump is identified and standing trees of the same species are located. Afterwards, their DBH and stump diameter are measured and a ratio between DBH/stump diameter is calculated. With this ratio, the DBH from the stump diameter of the cleared individuals that were found is estimated.

	With the DBH data, the carbon stock of the harvested trees is calculated, using the allometric equation that was employed for the estimation of the tree carbon stocks in the baseline (Chavé 2005 Equation -- $Exp(-2.977 + \ln(\rho D^2 H))$ $\exp(-1.576 + 2.179 \ln(D) + 0.198)$. - It will be assumed that all stock will be lost to the atmosphere.
Comments	

Data / Parameter	ADistPA,q,i,t
Data unit	ha
Description	Area impacted by natural disturbance in the project stratum *i* converted to natural disturbance stratum *q* at time *t*; ha
Source of data	Satellite images, field monitoring and: - United States Geologic Society (USGS) and Incorporated Research Institute for Seismology (IRIS) Seismic Monitor[13]. - National Oceanic and Atmospheric Administration (NOAA) National Climate Data Center, International Best Track Archive for Climate Stewardship (IBTrACS)[14]. - MODIS Active Fire and Burned Area Product[15].
Description of measurement methods and procedures to be applied	Any disturbance detected will be evaluated with Landsat imagery and ground verification using a GPS.
Frequency of monitoring/recording	This will be monitored on an annual basis.
Value applied:	*N/A*
Monitoring equipment	United States Geologic Society (USGS) and Incorporated Research Institute for Seismology (IRIS) Seismic Monitor[16]. - National Oceanic and Atmospheric Administration (NOAA) National Climate Data Center, International Best Track Archive for Climate Stewardship (IBTrACS)[17]. MODIS Active Fire and Burned Area Product[18].

[13] http://www.iris.edu/dms/seismon.htm

[14] http://www.ncdc.noaa.gov/oa/ibtracs/index.php?name=ibtracs-data

[15] http://modis-fire.umd.edu/index.html

[16] http://www.iris.edu/dms/seismon.htm

[17] http://www.ncdc.noaa.gov/oa/ibtracs/index.php?name=ibtracs-data

[18] http://modis-fire.umd.edu/index.html

QA/QC procedures to be applied	*N/A*
Purpose of data	*Indicate one of the following:* • *Calculation of leakage*
Calculation method	*N/A*
Comments	Ex-anti estimation of disturbance have been assessed based on the historic incidence

Data / Parameter	AROAD,i,t
Data unit	ha
Description	Area of roads in stratum i at time t
Source of data	Field measurements or reported measurements such as post-harvest assessment reports and post-harvest maps that are based on field measurements
Description of measurement methods and procedures to be applied	No logging N/A
Frequency of monitoring/recording	*N/A*
Value applied:	*N/A*
Monitoring equipment	*N/A*
QA/QC procedures to be applied	*N/A*
Purpose of data	*N/A*
Calculation method	*N/A*
Comments	*N/A*

Data / Parameter	ARRL,forest,t
Data unit	ha
Description	Remaining area of forest in RRL at time t
Source of data	Landsat satellite imagery and ALOS PALSAR if available

Description of measurement methods and procedures to be applied	Landsat imagery or other similar. Remote sensing software (e.g. ENVI)
Frequency of monitoring/recording	Remaining forest area will be updated at least every 5 years or at verification.
Value applied:	*N/A*
Monitoring equipment	- Landsat imagery and ALOS PALSAR if available or other similar. - Remote sensing software (e.g. ENVI)
QA/QC procedures to be applied	Field based accuracy assessment including accuracy assessment from high resolution imagery (<10m)
Purpose of data	• *Indicate one of the following: Calculation of project emissions* • *Calculation of leakage*
Calculation method	N/A
Comments	Ex-anti estimation has been made of deforestation in the project case following BL-UP

Data / Parameter	*APi*
Data unit	ha
Description	Total area of degradation sample plots in stratum i
Source of data	Ground measurement
Description of measurement methods and procedures to be applied	*See parameter PRA*
Frequency of monitoring/recording	*Every 2 years*
Value applied:	*N/A*
Monitoring equipment	*N/A*
QA/QC procedures to be applied	*N/A*
Purpose of data	*Indicate one of the following:* • *Calculation of project emissions*

Calculation method	*N/A*
Comments	

Data / Parameter	CDegW,i,t
Data unit	t CO2-e
Description	Biomass carbon of trees cut and removed through illegal logging and fuelwood and charcoal extraction degradation process from plots measured in stratum i at time t
Source of data	Field measurement
Description of measurement methods and procedures to be applied	The diameter of all tree stumps is the designated plots will be measured and conservatively assumed to be the same as the DBH. If the stump is a large buttress, several individuals of the same species nearby will be identified and a ratio of the diameter at DBH to the diameter of buttress at the same height above ground as the measured stumps will be determined. This ratio will be applied to the measured stumps to estimate the likely DBH of the cut tree. The above and below ground carbon stock of each harvested tree will be estimated using the same allometric regression equation and root to shoot ratio used in the module for estimating the carbon pool in trees (CP-AB) in the baseline scenario.
Frequency of monitoring/recording	Must be monitored at least every 5 years or if verification occurs on a frequency of less than every 5 years examination must occur prior to any verification event
Value applied:	*N/A*
Monitoring equipment	GPS Measuring tape DBH tape Camera Data collection sheets Other required equipment
QA/QC procedures to be applied	Blind check will be conducted by field team leads. Hot checks will be conducted by other field staff on a regular basis.
Purpose of data	• *Indicate one of the following: Calculation of project emissions*
Calculation method	*N/A*

Comments	This will only occur if the Degradation PRA Results indicate logging is occurring.

5.3 Monitoring Plan

Revision of the baseline

The Baseline will be reassessed every ten years (when the project baseline must be revisited) or every five years where conditions trigger[24] more frequent baseline renewal based on the methods written in the Methodology Module VMD0007:

- Calculate the area of each land cover category (i.e. forest and non-forest) within the project area and, where required, the leakage belt.
- Update the Forest Cover Benchmark Maps for the reference region, project area and leakage belt.
- Estimate the total area deforested during the historical reference period in the reference region for rate - *RRD* (*ARRD,unplanned,hrp*).

Monitoring project activities

The project activities that are described in section 1.11 will make up the management plan for the project. The Management Plan will be reviewed and where appropriate revised every 5 years. The implementation of the activities occurs through the development of Annual Operating plans. Each activity is devolved to the relevant sub-department and the superintendents of each sub-department are responsible for developing, implementing and monitoring the work plans for members of staff to carry out the activities. The work is supported by the technical advisors for each sub-department. For example, the activities of the Park rangers are overseen by the Superintendent of Park Operations and supported by the technical advisors. The Park operations team uses the software MIST (Management Information system), which is a database management system designed for conservation management needs, to collate information gathered by Park rangers on which areas of the project area they visited, which dates and what threats were encountered etc. This ensures effective and efficient monitoring of Park Operations and activities. The Community Development team is responsible for implementing all of the activities described in Section 1.11 that involve local stakeholders. A Community Monitoring Plan has been developed to monitor all the chosen indicators of this component of the project (Henman 2013) and surveys and standard operating procedures that will be used to gather information throughout the lifetime of the project are currently being developed. The third area of activities surrounds the research work that will be carried out for measuring and enhancing biodiversity in and around the project area. A monitoring plan has been developed (Hillers and Tatum-Hume 2013) and the methodologies and protocols to collect the required data are under development and will be available to the auditor for review.

Organizational structure, responsibilities, and competencies

Data generation, storage, and reporting

Generation, recording, storing, aggregating, collating and reporting of data will be conducted by the team responsible for each aspect of the monitoring activities as described above. All data that is gathered is stored into the relevant files on a central database in the project office in Kenema. The database is backed up every week on to external hard drives. The database is shared and stored in the UK offices of the RSPB (who provides technical support to the management team) as a backup. It is the Superintendents and the Technical Advisors of each sub-department who are responsible for ensuring that their teams data is correctly entered and stored in the data base and that reports are produced at the required time intervals. Field data and survey responses are also stored as paper versions in the Kenema office and where appropriate are electronically scanned and stored on the central database.

All documents and records pertaining to the Gola REDD project will be kept by the project proponent for at least 2 years after the end of the projects crediting period.

Data generation, storage and reporting

Data Generation, Storage, Archiving and reporting

Park Ops Field data, Monthly progress reports
Forest Rangers &- Surveys and GPS to mgment, bi-annual
Technical advisor- MIST database at project office synthesis reports

Social monitoring Field data Monthly progress reports
CD team & technical- Activity and longitudinal surveys, to mgment, bi-annual
Advisor activity data synthesis reports
- Excel databases at project office

Biodiversity monitoring Field data Monthly progress reports
Research team & technical- Surveysto mgment, bi-annual
Advisor- Excel databases at project office synthesis reports

GIS information- Geo-databases Annual reports
RSPB and field support Analysis of imagery etc
From research team &- Arc view, MODIS etc databases
Data management staffheld by RSPB and shared with
office

END USES AND USERS OF INFORMATION
Information will be compiled into different formats for reporting to; - GRCLG Directors and Members - Local stakeholders (dissemination to local communities, regional and local Government, NGO forums, research groups) - For verification reports - For forestry division/MAFFS/NPAA - Publication

Monitoring greenhouse gas emissions and removals

In order to calculate the net greenhouse gas emissions in the project case in the project area and the leakage belt a 3 step procedure will be applied (as per M-MON).

STEP 1. Selection and analyses of sources of land-use and land-cover (LU/LC) change data

Medium resolution remotely sensed spatial data shall be used (30m x 30m resolution or less, such as Landsat, Resourcesat-1 or Spot sensor data). In general, the same source of remotely sensed data and data analysis techniques must be used within the period for which the baseline is fixed. If remotely sensed data have become available from new and higher resolution sources (e.g. from a different sensor system) during this period then it is possible to change the source of the remotely sensed data. Equally if the same source is no longer available (e.g. due to satellites or sensors going out of service) an alternate source may be used. A change in source data may only occur if the images based on interpretation of the new data overlap the images based on interpretation of the old data by at least 1 year and they cross calibrate to acceptable levels based on commonly used methods in the remote sensing community.

Monitoring of the Project Area and Leakage Belt will be conducted using the same methods and sensors as was used in the development of the baseline to create land cover maps with forest non-forest classification ≥90% accuracy (BL-UP Part 2). This includes Landsat (or most similar dataset to Landsat) and ALOS PALSAR if available at the time of verification. It will be carried out by the RSPBs conservation data management team by a GIS analyst. If for any reason the sensors that were used for the baseline are not available, the most similar sensor type will be used to replace it.

For the calculation of each category of land use change:

- The area of each category within the project area will be calculated in the project area and leakage belt
- The forest cover maps of reference for the project area and leakage belt will be updated.
- The remaining forest area within the project zone will be updated.

Following M-MON the data will be collected for the entire reference region and will be no more or less than 1 year from the data of baseline renewal. The entire Project Area and Leakage Belt will be available for the year that monitoring and verification occurs.

Processing LU/LC Change Data

All remote sensed data will be prepared for analysis using geometric correction and geo-referencing and cloud and shadow detection and removal that are scientifically approved methods (i.e. following guidance from GOLFC-GOLD). Processing should follow the same methods used in the development of the baseline (Mitchard 2012 and Teuten 2019 and 2020)

Post-processing and accuracy assessment

Post processing will follow M-MON guidance and strict scientifically approved methods. This will include mapping areas of change and calculating the area of each category in both the Project Area and Leakage Belt following the same or similar methods used to establish the baseline (Mitchard 2012 and Teuten 2019 and 2020). This will enable the updating of the forest cover benchmark maps and updating the remaining area of forest in the RRL.

To avoid issues of cloud cover obscuring the image, we will use multi-date images for the remote sensing analysis to ensure less than 10% cloud cover.

To reduce small isolated areas from being classified as deforested a 5x5 majority rule filter will be applied to the final land cover map, along with boundary clean filter (Mitchard 2012 and Teuten 2019 and 2020).

A detailed accuracy assessment will be conducted and all efforts will be made to achieve the required 90% accuracy of the overall classification.

Change detection

To assess land cover change a “combined” (i.e. cross-tabulation) should be used to create a single map where each pixel represented a unique combination of class over the entire period. The maps that are combined will be classified into 3 classes forest, non-forest and water. All pixels that are classified as “water” at any of the time points should be reclassified into a single water class to avoid accounting for deforestation as the conversion of forest to water.

Step 2 Interpretation and Analysis

Monitoring deforestation

Monitoring of emission resulting from deforestation that occurs in the Project Area and Leakage Belt will be conducted following common good practice in the remote sensing field, and every effort will be made to follow the same methods as were used in the baseline (BL-UP). Following from Step 1 “Selection and analyses of sources of land-use and land-cover (LU/LC) change data” will produce an estimate of the emissions resulting from any deforestation that occurs within the project area and leakage belt ($\Delta CP,Def,i,t$).

The calculation of net carbon stock change as a result of deforestation will follow M-MON and any other referenced VM0007 Modules (e.g. CP-W).

Monitoring degradation

Monitoring Degradation through of trees for illegal timber of fuelwood and charcoal

Emissions due to extraction of trees will be monitored and emissions estimated. Due to the anticipated high deforestation rate in the leakage belt modules BF-DFW and LK-DFW may need to be used in the future once the baseline is reassessed. A Participatory Rural Appraisal (PRA) will be conducted in order to determine whether degradation occurs. In this sense, these steps will be followed:

A PRA will be conducted every 2 years by the Community Development team. If the results indicate that the project area has no pressure from this type of degradation, then it will be assumed that: $\Delta C_{p,Deg,i,t} = 0$.

If the results of the PRA indicate that there is potential for degradation, then the team will:

Obtain a "penetration distance" in the PRA (distance that the degradation agents can enter from the nearest access points).

Identify the most important access points to the vulnerable area.

From said points, draw the distances and create a Buffer Area with a width equal to length.

Establish transects to evaluate the buffer zone. The assessed area should not be lesser than 1% of the buffer area.

If stumps are not found (harvested trees), then it is assumed that $\Delta C_{p,Deg,i,t} = 0$ and the assessment is repeated every 2 years.

If stumps are found, then a systematic assessment will be carried out. For this, plots are distributed systematically, being the area to assess ≥ 3% of the buffer area.

Take into account the diameter of the stumps, which will be assumed as their DBH. If they were very large (e.g. due to buttresses), then the species of the stump is identified and standing trees of the same species are located. Afterwards, their DBH and stump diameter are measured and a ratio between DBH/stump diameter is calculated. With this ratio, the DBH from the stump diameter of the cleared individuals that were found is estimated.

With the DBH data, the carbon stock of the harvested trees is calculated, using the allometric equation that was employed for the estimation of the tree carbon stocks in the baseline (Chavé Equation).

It will be assumed that all stock will be lost to the atmosphere.

This assessment must be repeated every 5 years.

Monitoring degradation due to selective logging

Selective logging is not expected to occur in the project area. However, if such activities are initiated, methods delineated in M-MON will be followed.

Monitoring areas undergoing natural disturbance

Disturbance in the project area, such as tectonic activity (earthquake, landslide, volcano), extreme weather (hurricane), pest, drought, or fire will be monitored on an annual basis, using a variety of remote sensing data types and in on the ground knowledge. Tectonic activity and landslides are rare in the Project Area, but it will be monitored on an annual basis through the United States Geologic Society (USGS) and Incorporated Research Institute for Seismology (IRIS) Seismic Monitor[25]. Any earthquakes will also be monitored through reports on the ground. All the data will be downloaded and written-up on an annual basis and stored with all other documentation collected for monitoring. If an event has occurred that could have affected carbon stocks in the Project Area or Leakage Belt the project will investigate the extent of the damage though satellite imagery. Landsat satellite imagery will be downloaded and every effort to accurately delineate and forest loss will be implemented. If Landsat is not available or sufficient, other remote sensing data will be investigated. Any event will also be investigated on the ground by field crews. Field crews will assess the extent and carbon loss on the ground through field measurements. The quantification of carbon stock changes will follow M-MON.

Landslides are not a major natural risk in the project area[26]. However, monitoring of these events will be done annually through visual interpretation of Landsat imagery and information obtained on the ground from field crews during the frequent patrols of the project area. All the data will be downloaded and written-up on an annual basis and stored with all other documentation collected for monitoring.

Extreme weather and drought, will also be monitored on an annual basis through National Oceanic and Atmospheric Administration (NOAA) National Climate Data Center, International Best Track Archive for Climate Stewardship (IBTrACS)[27]. Any extreme weather events and drought will also be monitored through reports on the ground. All the data will be downloaded and written-up on an annual basis and stored with all other documentation collected for monitoring. If an event has occurred that could have effected carbon stocks in the Project Area or Leakage Belt the project will investigate the extent of the damage though satellite imagery. Landsat satellite imagery will be downloaded and every effort to accurately delineate and forest loss will be implemented. If Landsat is not available or sufficient, other remote sensing data will be investigated. Any event will also be investigated on the ground by field crews. Field crews will assess the extent and carbon loss on the ground through field measurements. The quantification of carbon stock changes will follow M-MON.

Pests, are unknown to cause major forest die-back in the Project Area, however every effort will be made to monitor it. There are no current monitoring methods in Sierra Leone for pests. The GRNP project staff will make every effort to monitor this on the ground. If an event has occurred that could have effected carbon stocks in the Project Area or Leakage Belt the project will investigate the extent of the damage though satellite imagery. Landsat satellite imagery will be downloaded and every effort to accurately delineate and forest loss will be implemented. If Landsat is not available or sufficient, other remote sensing data will be investigated. Any event will also be investigated on the ground by field crews. Field crews will assess the extent and carbon loss on the ground through field measurements. The quantification of carbon stock changes will follow M-MON.

Fire will be monitored on an annual basis through assessments of MODIS Active Fire and Burned Area Product. Because the MODIS data can be very sensitive to even small controlled burns from slash and

burn agriculture this data will be cross referenced with visual inspection of burned areas in Landsat imagery for every year. Fire will also be monitored through reports on the ground. All the data will be downloaded and written-up on an annual basis and stored with all other documentation collected for monitoring. If an event has occurred that could have affected carbon stocks in the Project Area or Leakage Belt the project will investigate the extent of the damage though satellite imagery. Landsat satellite imagery will be used to accurately delineate the area of forest loss. If Landsat is not available or sufficient, other remote sensing data will be investigated. Any event will also be investigated on the ground by field crews. Field crews will assess the extent and carbon loss on the ground through field measurements. The quantification of carbon stock changes will follow M-MON.

Monitoring areas undergoing carbon stock enhancement

The Gola REDD Project intends to monitor forest carbon stock enhancement in the stratum Gola South.

It is not anticipated that any of Gola South will be subject to degradation. However PRA will be conducted to ensure this is not occurring (See Monitoring Degradation).

Carbon stock enhancements will be measured based on permanent plots established in 2012 and revisited in 2018 (Tatum-Hume et al 2013b, Swinfield 2020). Enhancements will be monitored following M-MON. All the plots will be re-measured following the Standard Operating Procedures for Carbon Stock Enhancement (See appendices folder)..

Monitoring project emissions

Emissions from non-CO_2 due to biomass burning is conservatively expected to occur in all areas of deforestation during the project's life. These non-CO_2 emissions have also been accounted for in the baseline.

Emissions from N_2O as a result of nitrogen application is not expected to occur in the project case as fertilizers will not be used as part of the agricultural project activities (increases in production focus on cultivation and post-production techniques). No monitoring will therefore be required. If any N_2O is applied in the project case these will be accounted and monitored.

Emission from fossil fuel combustion is not accounted for in the baseline and therefore is not required to be accounted for in the project case. Also emission from fossil fuel combustion, a result of using project vehicles for project activities, is not significant as it results in less than 5% of net anthropogenic removals by sinks, whichever is lower.

Step 3 - Documentation

A consistent time-series analysis of land-use change and the associated emission will be monitored following M-MON steps 1-2. The procedures for steps 1-2 will be documented including:

Data sources and pre-processing: Type, resolution, source and acquisition date of the remotely sensed data (and other data) used; geometric, radiometric and other corrections performed, if any; spectral

bands and indexes used (such as NDVI); projection and parameters used to geo-reference the images; error estimate of the geometric correction; software and software version used to perform tasks; etc.

Data classification: Definition of the classes and categories; classification approach and classification algorithms; coordinates and description of the ground-truth data collected for training purposes; ancillary data used in the classification, if any; software and software version used to perform the classification; additional spatial data and analysis used for post-classification analysis, including class subdivisions using non-spectral criteria, if any; etc.

Classification accuracy assessment: Accuracy assessment technique used; coordinates and description of the ground-truth data collected for classification accuracy assessment; and final classification accuracy assessment.

Changes in Data sources and pre-processing / Data classification: If in subsequent periods changes will be made to the original data or use of data:

Each change and its justification must be explained and recorded; and

When data from new satellites are used documentation must follow a) to c) above

Monitoring leakage

As per step 4 of Module LK-ASU "Estimation of unplanned deforestation displaced from the project area to outside the Leakage Belt" the area deforested in the leakage belt will be monitored in each monitoring period (*ADefLB,i,t*). The same methods for monitoring deforestation in the project area will be used for the leakage belt.

The leakage belt will be monitored each time the project area is monitored (*ADefPA,i,t*), which will be at least every 5 years or if verification occurs on a frequency of less than every 5 years examination must occur prior to any verification event.

The data and parameters measured in for the leakage belt at each monitoring period include:

MANFOR: Total area of forests under active management nationally

PROPRES: Estimated proportion of baseline deforestation caused by population that has been resident for ≥5 years

PROTFOR: Total area of fully protected forests nationally

TOTFOR: Total available national forest area

APPENDIX

REFERENCES

ARTP (2010) Across the River project. Across the river; a trans-boundary peace park for Sierra Leone and Liberia. Project summary

BCP project. 2009. Project proposal to GEF. Available at http://www.thegef.org/gef/sites/thegef.org/files/repository/Sierra_Leone_Biodiversity_Conservation_Project.pdf Accessed on 17th July 2012 (Pdf)

BSAP: National Biodiversity Strategy and Action Plan for Sierra Leone. 2003. Available at: http://www.cbd.int/doc/world/sl/sl-nbsap-01-en.pdf (Accessed 18th January 2013)

Bulte E., Kontoleon A., List J., Mokuwa E., Richards P., Turley T. and Voors M. 2013. REDD+ socio-economic descriptive analysis Sierra Leone. Cambridge-Wageningen social science group. (pdf)

Chave, J., Andalo, C, Brown, S., Cairns, M., Chambers, J., Eamus, H., Fromard, Higuchi, Kira, Lescure, Nelson, Ogawa, Puig, Rie´ra, Yamakura. 2005. Tree allometry and improved estimation. *Ecosystem Ecology*. 145: 87–99.

Chave, J.,Coomes, D.,Jansen, S., Lewis,S., Nathan G. Swenson, Amy E and Zannes. 2009. Towards a worldwide wood economics spectrum. *Ecology Letters.* 12: 351–366

Climate Focus. 2011. Gola Forest REDD project, Analysis of legal issues (Pdf)

Cluff Gold. 2010. A review of the Baomahun gold exploration project, Sierra Leone (Pdf)

Cole, N.H.A. 1993. Floristic Associations in the Gola Rainforests: a proposed biosphere reserve. Journal of Pure and Applied Science. 2:35-50

Cuni-Sanchez, A 2012c GOLA REDD PROJECT Soil sampling report.(pdf)

Daily Mail. 2012. Steve Cosser Interview: Pay-TV tycoon's troubled battle for Africa's mineral riches (Pdf)

Davies, M. 2006. Sustainable Financing for Protected areas in Sierra Leone. RSPB publication for the World Bank GEF project: Wildlife protection and biodiversity conservation in Sierra Leone (Pdf)

Davies, G and Richards, P. 1991. Rainforest in Mende life. A report to ESCOR (Pdf)

DFID (Department for International Development (UK)). 2012. Operational Plan for Sierra Leone 2011-2015. (Pdf)

EC. 2010. Study on the evolution of some deforestation drivers and their potential impacts on the costs of an avoiding deforestation scheme

Eco-securities. 2008. An Assessment of the Carbon Offset Potential of the Gola Forest Conservation Project. (Pdf)

EPA. 2008. Environmental Protection Agency Act. (Pdf)

EU. 2007. Country strategy paper and National Indicative Programme 2008-2013. Available at http://ec.europa.eu/development/icenter/repository/scanned_sl_csp10_en.pdf Accessed on 17th July 2012.

FAO Global Forest Resource Assessment, 2010

Fofanah, A. 2012. Government of Sierra Leone regulations report. Gola Rainforest Conservation LG. Unpublished Report.

Forestry Act. 1988. Sierra Leone Forestry Act (Pdf)

Forestry Division Strategic Plan. 2012-2014 (Pdf)

Forestry Regulations 1990 (Pdf)

Garnett, K. 2012. Overview of the Forestry Sector presentation (Pdf)

Gibbs, H.K., A.S. Ruesch, F. Achard, M.K. Clayton, P. Holmgren, N. Ramankutty, and J.A. Foley. 2010. Tropical forests were the primary sources of new agricultural land in the 1980s and 1990s. Proceedings of the National Academy of Sciences Vol. 107 p16732-16737.

Gleave, M.B., 1996. The length of the fallow period in tropical fallow farming systems: a discussion with evidence from Sierra Leone. Geographical J. 162 (1), 14–24.

Global Witness. 2010. A near miss? Lessons learnt from the allocation of mining licenses in the Gola Forest Reserve of Sierra Leone. Available at: http://www.globalwitness.org/library/near-miss-lessons-learnt-allocation-mining-licences-gola-forest-reserve-sierra-leone Accessed on 17 July 2011 (Pdf)

Goodman L. 2008. REDD alert in Sierra Leone. Counting the cost of conservation and comparing it to avoided deforestation carbon credits. Unpublished MSc thesis (Pdf)

Government of Sierra Leone. 2010. Millennium Development Goals Progress Report. (Pdf)

Government of Sierra Leone budget 2009-2013. (Pdf)

Green Scenery Report. 2011. The Socofin land deal – Missing out on best practices (Pdf)

Greig-Gran M. 2008. The cost of avoiding deforestation. Update of the report prepared for the Stern Review of the economics of climate change. Available at: http://pubs.iied.org/pdfs/G02489.pdf Accessed on 17th July 2012.

Hall, J.B. and Swaine, M.D. (1976). Classification and ecology of closed-canopy forest in Ghana. *Journal of Ecology* 64: 913-951.

Henman A (2013) Gola Rainforest REDD Project CCB Standard Community Monitoring Plan. Climate Adapt (pdf)

Henry, M., Besnardd, A., Asantee, W., Eshunf, J., Adu-Bredug, S., Valentinic, R.,Bernouxb, M., Saint-André, L. 2010. Wood density, phytomass variations within and among trees, and allometric equations in a tropical rainforest of Africa. Forest Ecology and Management 260 (2010) 1375–1388

Hipkiss A. 2012. Review of Gola funding potential. RSPB (Pdf)

Ickowitz, A. 2006. Shifting Cultivation and Deforestation in Tropical Africa: Critical Reflections. Development and Change 37(3): 599–626

ICMM (International Council on Mining and Metals). 2012. The role of mining in National economies. (pdf)

Iles M., Savill P. and Koker G. 1993. Gola Forest Reserves, Sierra Leone: Interim management plan. Unpublished manuscript, Forestry Division, Sierra Leone

Internal Displacement Monitoring Center. Website dated 2004 . Available at; http://www.internal-displacement.org/8025708F004CE90B/%28httpCountrySummaries%29/0372C6E093AFEFEB802570C00056B6D0?OpenDocument&count=10000 (Accessed 22nd January 2013) (Pdf)

IUCN. 2006. Sustainable Financing of Protected Areas A global review of challenges and options (Pdf)

Jongkind, C.C.H. 2004. Checklist of Upper Guinea forest species. Pp447-477 in: Poorter, L., Bongers, F., Kouame, F.N. and Hawthorne, W.D. (eds.) Biodiversity of West African forests: an ecological atlas of woody plant species. CABI Publishing, Wallingford.

Kenema District Council. 2012. Kenema District Council Development Plan (Pdf)

Klop, E., Lindsell, J., Siaka, A. 2008. Biodiversity of Gola Forest, Sierra Leone. Gola Forest Program (Pdf)

Klop, E. 2012 Carbon Stock Baseline Surveys 2006 – 2007. Gola REDD Project

Koker, G. 2011. Management Effectiveness Tracking Tool for Outamba-Kilimi National Park. BCP project (Pdf)

Koroma E. B. 2009. Statement by President of Sierra Leone for the 2009 UN climate change summit. Available at: http://www.youtube.com/watch?v=jRIQEoMINfE Accessed 17th July 2012 (Pdf)

Koroma E. B. 2011. Statement by President of Sierra Leone for the 2011 official opening of the GRNP (Pdf)

Lewis et al. 2009. Supplementary Information. Nature. African Forests Carbon supplement.

Lindsell, J and Klop, K. 2012. Spatial and temporal variation of carbon stocks in a lowland tropical forest in West Africa. Journal of Forest Ecology and Management 289 10–17 (Pdf)

Marris et al 2013 Gola Rainforest National Park Boundary Demarcation Report. Gola Redd Project pdf

McClanahan, Paige. 2011. Africa Rising: Carbon credits save Sierra Leone's Gola Rainforest. Christian Science article. Accessed from; http://www.csmonitor.com/World/Africa/Africa-Monitor/2011/1209/Africa-Rising-Carbon-credits-save-Sierra-Leone-s-Gola-Rainforest 13th July 2013 (Pdf)

MINEO Consortium. 2000. Review of potential environmental and social impact of mining. Available at: http://www2.brgm.fr/mineo/UserNeed/IMPACTS.pdf. Accessed 4 September 2012

MIR (2015) The Gola REDD Project – Monitoring Report to the VCS. Gola Rainforest Conservation LG (pdf).

MIR (2020) The Gola REDD Project – Monitoring Report to the VCS. Gola Rainforest Conservation LG (pdf).

Mitchard, E. T. A., Saatchi, S. S., White, L. J. T., Abernethy, K. A., Jeffery, K. J., Lewis, S. L., Collins, M., Lefsky, M. A., Leal, M. E., Woodhouse, I. H., and Meir, P.(2012): Mapping tropical forest biomass with radar and spaceborne LiDAR in Lopé National Park, Gabon: overcoming problems of high biomass and persistent cloud, Biogeosciences, 9, 179–191, https://doi.org/10.5194/bg-9-179-2012

Myers, N., R.A. Mittermeier, C.G. Mittermeier, G.A.B. da Fonseca and J. Kent (2000): Biodiversity hotspots for conservation priorities. Nature 403: 853-858. (Pdf)

NBSAP. National Biodiversity Strategy and Action Plan for Sierra Leone. 2003. Available at: http://www.cbd.int/doc/world/sl/sl-nbsap-01-en.pdf (Accessed 17th July 2012) (Pdf)

NPAA. National Protected Area Authority Act. 2012. (Pdf)

National Recovery Strategy. 2002. Report from the Government of Sierra Leone (Pdf)

National Rice Development Strategy. 2009 (Pdf)

National Recovery Strategy. 2002. Report from the Government of Sierra Leone (Pdf)

Netzer, M. and Walker, S. 2013 Gola REDD project Baseline Report Application of VM0007 BL-UP: Winrock International

NSADP. 2009. National Sustainable Agriculture Development Plan 2010-2030 Sierra Leone (Pdf)

Peters, P. et al. 2010. Youth employment in Sierra Leone; Sustainable livelihood opportunities in a post conflict setting. World Bank Report 2009. Available at: http://issuu.com/world.bank.publications/docs/9780821378229 (Accessed 4th September 2012) (Pdf)

Project Document (2015) The Gola REDD Project – Project Description. Gola Rainforest Conservation LG (pdf).

PRSP. Poverty Reduction Strategy Paper. 2005. An agenda for change; Republic of Sierra Leone (Pdf)

PRSPII. Poverty Reduction Strategy Paper II. 2008. An Agenda for Change. Republic of Sierra Leone (Pdf)

Saatchi S.S, et al. (2011). "Benchmark map of forest carbon stocks in tropical regions across three continents." *Proceedings of the National Academy of Sciences* 108.24 (2011): 9899-9904.

Showers, C. 2012 Land use Practices and Forest Reserve Management in Sierra Leone. Gola REDD Project (pdf)

Sierra Leone draft forest policy. 2010. Government of Sierra Leone. (Pdf)

SLIEPA. Agri Business Sector Presentation. Available at http://www.sliepa.org/downloads/agribusiness-sector-presentation (Accessed 4th September 2012) (Pdf)

Statehouse Communications Unit, GOSL. 2011. Press Release (Pdf)

Swinfield, T. 2020 Change in carbon at Gola South. Gola Rainforest Conservation LG. Unpublished report.

Tatum-Hume, E, Lloyd, R, & Witkowski,K (2013a) Gola REDD Project Stakeholder Engagement Report (pdf)

Tatum-Hume, E. Klop, E. and Cuni-Sanchez, A. 2013b Gola Rainforest National Park Proposed VCS REDD Project Baseline Carbon Stock Report 2012

Tatum-Hume, E & Witkowski, K 2013 Synthesis Report on the social impact assessment for the Gola REDD project Unpublished report.

UNDP. 2011. Human Development Report. Sustainability and Equity: A Better Future for All (Pdf)

Union of Concerned Scientists. 2011. The root of the problem; What's driving tropical deforestation today? Available at http://www.ucsusa.org/assets/documents/global_warming/UCS_RootoftheProblem_DriversofDeforestation_FullReport.pdf (Accessed 5th September 2012) (Pdf)

UNDP. 2007. Sierra Leone Human Development Report 2007. Available at: http://hdr.undp.org/en/reports/national/africa/sierraleone/name,3115,en.html (Accessed 17th July 2012) (Pdf)

UNDP. 2011. Human Development report; Sustainability and Equity. (Pdf)

UNDP. 2012. Human Development Index statistics. Taken from UNDP website; http://hdrstats.undp.org/en/countries/profiles/SLE.html. Accessed 16th April 2013

Unwin, A. H. 1909. Forests and Forestry problems in Sierra Leone. Waterlow & sons limited, London wall, London

USAID. 2007. 118/119 Biodiversity and Tropical Forest Assessment for Sierra Leone. Available at: http://www.encapafrica.org/documents/biofor/Sierra_Leone_118_119_July_2007.pdf (Accessed on 18th January 2013) (Pdf)

White, J A. 1972. Forest Inventory of the Gola Forest Reserves. Report to the Government of Sierra Leone, FAO, Rome

Wilson, N.W. 1965. Geology and mineral resources of part of the Gola forest reserves, Sierra Leone. *Bulletin No. 4, Geological Survey of Sierra Leone, Government of Sierra Leone*

Witkowski, K. et al 2012a Forest Edge Community Household Survey and Key Informant Interview Report, Gola Redd Project. pdf

Witkowski, K., Kanneh, F., and Tatum-Hume, E. 2012c Gola REDD Project Context Report. Gola Redd Project. Pdf

World Bank. 2010. Sierra Leone at a glance. Available at http://devdata.worldbank.org/AAG/sle_aag.pdf (Accessed on 17th July 2012) (Pdf)

WHH. 2011. REDD Scoping study (Pdf)

Wildlife Conservation Act. 1972. Government of Sierra Leone. (Pdf)

Zanne, A., Lopez-Gonzalez, G., Coomes, D.A., Ilic, J., Jansen, S., Lewis, S.L., Miller, R.B.,Swenson, N.G., Wiemann, M.C. and Chave, J. (2009). Data from: Towards a worldwide wood economics spectrum, Dryad Digital Repository.