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Carbon Fund

Emission Reductions Programme Document (ER-PD)

ER Programme Name and Country:
Ghana Cocoa Forest REDD+ Programme (GCFRP)

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EXECUTIVE SUMMARY

Ghana's cocoa forest + landscape has **one of the highest deforestation rates in Africa**, at **3.2% per annum**. Forest degradation and deforestation across this agro-forest mosaic, which covers 5.9 million ha of Ghana's High Forest Zone (HFZ), is being driven by continued cocoa farm expansion and other types of agriculture, coupled with a recent up-surge in illegal mining and illegal logging.

Historically, over the past hundred years, degradation and deforestation in Ghana's HFZ has been driven by low-yielding, expansive agriculture—predominantly cocoa farming—coupled with the progressive growth of other extractive industries. For much of this time, conversion of forests was not viewed as a problem, but by the mid-nineties it was clear that Ghana's forest reserves were moderately to severely degraded, low-to-no shade cocoa was expanding at the expense of forests and trees, and biodiversity in the landscape had declined precipitously. Concurrent with the loss of forests, Ghana's Cocoa Board and the cocoa private sector also recognized that the country was underperforming in terms of national production, despite the growing area under cocoa.

While the cocoa sector responded with a "High Tech" programme (2000-2010) in an effort to boost yields, little was done to address deforestation and degradation, or the loss of critical ecosystem services. Over the past seven years, the scale of these drivers has increased due to: 1) recent declines in cocoa productivity, causing greater expansion; 2) an increase in illegal logging from a growing domestic demand; and 3) an up-surge in illegal, small-scale mining due to market trends, the availability of foreign and local laborers, and landowners giving up unproductive farms for mining. As a result, **the programme's FRL for the period 2005-2014 shows that the area has lost an average of 138,624 ha of forest each year,** and has produced **over 45.1 million tCO2e emissions on an annual basis** from the combined effects of deforestation and degradation, and taking into account carbon stock enhancement. Conversion of forests to agricultural land was identified as the primary driver of deforestation—114,915 ha of forests per annum (1.15 million ha over the accounting period) was converted to agriculture during the reference period and this accounted for 83 percent of deforestation in the programme area. Of this, conversion to food crops, from which cocoa establishment typically follows, accounted for two-thirds (66%) of forest loss. **Over a quarter (27%) of agriculture conversion resulted from cocoa expansion, making it the single most important commodity driver of deforestation in the programme area**.

These numbers signal a worrisome future for Ghana's high forests and its cocoa sector, as well as for the 12 million people who reside in the landscape and rely, in one way or another, on forest resources and cocoa production for their livelihoods. On the other hand, what is highly encouraging is that **Ghana is now prepared to tackle these issues and significantly reduce deforestation and degradation in this landscape through the Ghana Cocoa Forest REDD+ Programme (GCFRP),** which leverages a strong private sector commitment and investment into a climate-smart cocoa production system and standard, and supported by a suite of policy interventions and reforms.

The GCFRP is a highly ambitious and unique initiative that will be jointly coordinated by the National REDD+ Secretariat (NRS) at the Forestry Commission (FC) and the Ghana Cocoa Board, in partnership with a broad set of private sector, public sector, civil society, traditional authority, and community people. Building from the main interventions laid out in the ER-PIN, the programme's implementation plan is highly detailed and well thought out, following focused brainstorming by technical experts, and extensive consultations for input and information sharing with key stakeholders and partners at all levels.

The GCFRP is now constructed according to 5 key pillars: A) Institutional Coordination and MRV; B) Landscape Planning within HIAs; C) Implementing Climate-Smart Cocoa to Increase Yields; D) Risk

Management and Finance; and E) Legislative and Policy Reforms. The programme will receive oversight from a Joint Coordination Committee (JCC) and day-to-day operations will be the responsibility of a Programme Management Unit (PMU) within the NRS. The programme will be implemented in six Hotspot Intervention Areas (HIAs), covering up to 2.5 million ha, to serve as priority areas for immediate and concentrated interventions at the farm to landscape level. Each HIA will be governed by a local governance board of land owners, land users, local authority entities and community leaders (including minority groups). The HIA will engage with a formal consortium of private sector cocoa companies, NGOs, and government partners who will work together to bring resources to implement activities on the ground.

The GCFRP is a **US$236,727,250 million dollar programme** that over the first five years (2017-2021) aims to **leverage over $121 million dollars of private sector cocoa investment and over $53 million dollars in GoG support, as well modest funding from existing and yet-to-be-sought grants**. An initial discounted cash flow analysis of the CSC investment opportunity shows that the GCFRP makes excellent financial sense in addition to climate sense. A conservative **50% yield increase on cocoa farms to 600 kg/ha** (even greater increases are possible and have been demonstrated) will **realize significant benefits to farmers and to the government**. The **IRR** for the project under this scenario is calculated at **over 438%** and **the NPV at 20% will be over $339 million** over the first 5 years.

As a 20 year programme, the GCFRP **estimates that it could produce a total of 294,395,567 million tCO2e emission reductions (**following the removal of 102,535 million tCO2e placed into risk and uncertainty buffers), **representing a 44% overall reduction against the reference level**. Under a prospective contract with the Carbon Fund to cover the first 5 years of implementation (2017-2021), Ghana estimates that it could generate significant reductions in deforestation and degradation against its reference level and produce just over **10 million tCO2e emission reductions to be transacted under the ERPA**. This is an ambitious but realistic goal given that Ghana will need to reduce its emissions by 14% to reach the reference level. A historical analysis (2005-2014) of deforestation, degradation and carbon stock enhancement across the accounting area was used to develop the programme's FRL based on average annual emissions and removals.

In addition to having a plan for financing and implementing the programme, Ghana also has very strong private sector commitment and investment, as well as unprecidented government cross-sector, civil society and community-based support to the GCFRP. While the NRS and Cocoa Board are co-proponents of the programme, participating ministries and agencies include the MLNR, MESTI, EPA, MoFA, and MC. There is also tremendous private sector commitment from some of the most important cocoa and chocolate companies, including Touton, Mondelez, Olam and Armajaro/Ecom. In addition, the World Cocoa Foundation and its leading member companies recently committed to reduce deforestation in the cocoa supply chain in Ghana and Cote d'Ivoire. Leading international and national NGOs partners include Solidaridad, SNV, Rainforest Alliance, IITA, NCRC, IUCN-Ghana, and Arocha-Ghana. Perhaps most importantly, there is strong support and willingness to engage from traditional leaders, communities, and cocoa farmers across the programme area. From a practical standpoint, developing a results-based programme that engages multiple sectors, institutions and organizations is a significant feat in and of itself for Ghana, and is further evidence that the programme truly does have the high level political commitment and buy-in that is needed.

Tremendous capacity and understanding have been built, and operational systems developed through the country's REDD+ readiness process. This is reflected by the fact that Ghana's R-Package was accepted by the FCPF in September 2016, and the country received a positive independent self-assessment of its REDD+ Readiness to accompany the submission.

The NRS and partners fully understand the existing drivers and barriers to REDD+, particularly in the GCFRP area, and crucial processes are in motion to address critical policy issues, including: perverse tenure and input-supply policies, clarification of carbon rights, adaptation of customary land tenure norms, and revision of legislation to allow Ghana's alternative dispute resolution mechanism to function for REDD+. Furthermore, under the readiness process and through the development of the GCFRP, the NRS has put in place a forest monitoring and MRV system, a safeguard system, an FGRM, and a data management / registry system to be tested in the early stages of programme implementation, and a benefit sharing plan that aims to appreciate, incentive, and support the main stakeholders responsible for producing emission reductions, through carbon and non-carbon benefits.

Ahead of the possible signing of an ERPA in late 2017, implementation of the GCFRP and its focus on transitioning to a climate-smart cocoa production landscape will begin in three Hotspot Intervention Areas with support from the FIP, Touton and SNV, and NCRC and partners taking the lead in different HIAs. The logic and strength of the GCFRP is based on the core concept that cocoa cannot be sustainably produced, and deforestation and degradation drivers cannot be reduced significantly at a project or singular institutional level, which has been the practice to date. Rather, these issues and challenges necessitate a large-scale, integrated approach in order to foster the massive transformational changes in farming practices and land use decision making required to reduce deforestation and degradation, and to drive the growth of forests and trees in the landscape. Therefore, the move to implement the GCFRP is an effort to use a coordinated landscape approach that targets all stakeholders as a strategy to change the BAU and reduce emissions from the landscape, while producing the world's first ever climate-smart cocoa bean.

List of Acronyms

ACR	American Carbon Registry
ADR	Alternative Dispute Resolution
AfDB	African Development Bank
AFOLU	Agriculture Forestry and Land Use
ALOS	Advanced Land Observing Satellite
AOP	Annual Operational Plan
BSM	Benefit Sharing Mechanism
BSP	Benefit Sharing Plan
BSP	Benefit Sharing Plan
CAR	Climate Action Reserve
CAS	Country Approach to Safeguards
CBD	Convention on Biological Diversity
CC	Crown Cover
CCAFS	Climate Change Agriculture and Food Security
CCU	Climate Change Unit
CDM	Clean Development Mechanism
CERSGIS	Centre of Remote Sensing and Geographic Information System
CF	Carbon Fund
CFMP	Community Forestry Management Project
CGD	Complaints and Grievance Desks
CHED	Cocoa Health and Extension Department
CLP	Climate Law and Policy
CMC	Cocoa Marketing Company
CO_2	Carbon Dioxide
COCOBOD	Ghana Cocoa Board
CODAPEC	cocoa Disease and Pest Control Program
COP	Conference of Parties
CORIP	Cocoa Rehabilitation and Improvement Program
CPESDP	Coordinated Programme of Economic and Social Development Policies
CREMAs	Community Resource Management Areas
CRIG	Cocoa Research Institute of Ghana
CSA	Climate Smart Agriculture
CSC	Climate Smart Cocoa
CSE	Carbon Stock Enhancement
CSIR	Council for Scientific and Industrial Research
CSO	Customer Service Officer
CSOs	Civil Society Organisations
CSS	Cocoa Sector Strategy
DAs	District Assemblies
DDRT	District Dispute Resolution Teams
DEM	Digital Elevation Model
DF	Dedicated Fund
DMC	Disaster Monitoring Constellation

DN	Digital Numbers
DRM	Dispute Resolution Mechanism
DRT	Dispute Resolution Team
EA	Environmental Assessment
EC	Energy Commission
EF	Emission Factor
EIA	Environmental Impact Assessment
EMT	Executive Management Team
ENRAC	Environment and Natural Resource Advisory Council
ENREG	Environment and Natural Resource Governance
EPA	Environmental Protection Agency
ERPA	Emission Reduction Programme Agreement
ESMF	Environmental and Social Management Framework
ETM+	Enhance Thematic Mapper
FAO	Food and Agriculture Organization
FC	Forestry Commission
FCPF	Forest Carbon Partnership Facility
FFB	Fresh Fruit Bunches
FGRM	Feedback and Grievance Redress Mechanism
FIP	Forest Investment Programme
FLEGT	Forest Law Enforcement, Governance and Trade
FORIG	Forestry Research Institute of Ghana
FPIC	Free Prior Informed Consent
FRL	Forest Reference Level
FSD	Forest Services Division
FWP	Forest and Wildlife Policy
GADS	Gender in Agriculture Development Strategy
GARSeCT	General Automated Remote Sensing Classification Tool
GCFRP	Ghana Cocoa Forest REDD+ Programme
GCSDS	Ghana Cocoa Sector Development Strategy
GFPS	Ghana Forest Plantation Strategy
GHG	GreenHouse Gas
GIS	Geographic Information System
GLOVIS	Global Visualization Viewer
GoG	Government of Ghana
GPDP	Government Plantation Development Programme,
GSD	Geological Survey Department
GSGDA	Ghana Shared Growth and Development Agenda
GSIF	Ghana Strategic Investment Framework
GT	Ground Truthing
GV	Ground Verification
HFZ	High Forest Zone
HIA	Hotspot Intervention Area
ICT	Information and Communication Technology
IPCC	Intergovernmental Panel on Climate Change
IPM	Integrated Crop and Pest Management

IUCN	International Union for Conservation of Nature
JCC	Joint Coordinating Committee
KNUST	Kwame Nkrumah University of Science and Technology
LAP	Land Administration Project
LBCs	Licensed Buying Companies
LC	Lands Commission
LCDS	Low Carbon Development Strategy
LDF	Logging Damage Factor
LI	Legislative Instrument
LIF	Logging Infrastructure Factor
M&E	Monitoring and Evaluation
MC	Minerals Commission
MED	Monitoring and Evaluation Department,
MESTI	Ministry of Environment, Science, Technology and Innovation
MLNR	Ministry of Lands and Natural Resources
MMDA	Metropolitan Municipal and District Assemblies
MMIP	Multilateral Mining Integrated Project
MMR	Monitoring, Measurement and Reporting
MODIS	Moderate Resolution Imaging Spectro-radiometer
MoE	Ministry of Energy
MoF	Ministry of Finance
MoFA	Ministry of Food and Agriculture
MoP	Manual of Procedures
MoU	Memorandum of Understanding
MRV	Measurement Reporting and Verification
MTR	Mid-Term Report
MTS	Modified Taungya System
NAMAs	Nationally Appropriate Mitigation Actions
NCB	Non-Carbon Benefits
NCCE	National Commission for Civic Education
NCCP	National Climate Change Policy
NCRC	Nature Conservation Research Centre
NDCs	Nationally Determined Contributions
NDPC	National Development Planning Commission
NDRT	Dispute Resolution Team
NDVI	Normalized Difference Vegetation Index
NFF	National Forest Form
NFMS	National Forest Monitoring System
NFPDP	National Forest Plantation Development Programme
NFPDS	National Forest Plantation Development Strategy
NGOs	Non-Governmental Organisations
NHCs	National House of Chiefs
NREG	Natural Resource and Environmental Governance
NREG-TA	Natural Resource and Environmental Governance Technical Assistance
NRM	Natural Resource Management
NRS	National REDD+ Secretariat

NRWG	National REDD+ Working Group
NTFP	Non Timber Forest Products
OASL	Office of the Administrator of Stool Lands
OLI	Operational Land Imager
OP	Operational Policies
PALSAR	Japanese L-band Synthetic Aperture Radars
PAMs	Policies and Measures
PBC	Produce Buying Company
PF	Process Framework
PLR	Policies Laws and Regulations
PMP	Pest Management Plan
PMU	Programme Management Unit
PNDCL	Provisional National Defense Council Law
QA	Quality Assurance
QC	Quality Control
RCC	Regional Coordinating Council
RDRT	Regional Dispute Resolution Team
REDD	Reducing Emissions from Deforestation and Forest Degradation
REL	Reference Emission Level
RL	Reference Level
RMSC	Resource Management Support Centre
RPF	Resettlement Policy Framework
RSPS	Roundtable for Sustainable Oil Palm
SATVI	Soil-Adjusted Total Vegetation Index
SDGs	Sustainable Development Goals
SESA	Strategic Environmental and Social Assessment
SIS	Safeguards Information System
SLM	Sustainable Land Management
SOI	Summary of Information
SOP	Standard Operating Procedures
SPD	Seed Production Department
SRI	Social Responsibility Agreement
SRTM	Shuttle Radar Topography Mission
SSWG	Safeguards Sub-Working Group
TAs	Traditional Authorities
TC	Tasseled Cap
TCC+	Technical Coordinating Committee
TEF	Total Emission Factor
TIFs	Tree Information Forms
TOA	Top of the Atmosphere
UNCCD	United Nations Convention to Combat Desertification
UNFCCC	United Nations Framework Convention on Climate Change
USGS	United States Geological Survey
VCS	Verified Carbon Standard
VPA	Voluntary Partnership Agreement
WD	Wildlife Division

WISDOM	Woodfuel Integrated Supply/Demand Overview Mapping
WRC	Water Resources Commission

1. ENTITIES RESPONSIBLE FOR MANAGEMENT & IMPLEMENTATION OF ER PROGRAMME

1.1 ER Programme entity that is expected to sign the Emission Reduction Payment Agreement (ERPA) with the FCPF Carbon Fund

Name of entity	Ministry of Finance
Type and description of organization	MoF is the Ministry with the authority to sign economic agreements with external entities. It is the sector Ministry to which the Cocoa Board answers and it is the Chair of the Technical Coordinating Committee – Plus (TCC+), which oversees the Natural Resource and Environmental Governance programme that is linked to the REDD+. MoF will be responsible for the high level financial administration of the programme.
Main contact person	Oduro Kwarteng
Title	Director, REAL Sector
Address	P.O. Box MB40 Accra- Ghana
Telephone	+233-244689819
Email	skwateng-amaning@mofep.gov.gh
Website	www.mofep.gov.gh

1.2 Organization(s) responsible for managing the proposed ER Programme

Same entity as ER Programme Entity identified in 1.1 above?	No
If no, please provide details of the organizations(s) that will be managing the proposed ER Programme	
Name of organization	Forestry Commission of Ghana
Type and description of organization	Forestry Commission (FC) is the government institution responsible for the sustainable management of Ghana's forest and wildlife resources. The Climate Change Unit of the FC was established in 2007 with a mandate to manage forestry-sector initiatives related to climate change adaptation and mitigation, including REDD+. It hosts the National REDD+ Secretariat, which is responsible for coordinating Ghana's REDD+ process. The sector ministry for the FC is the Ministry of Lands and Natural Resources (MLNR). In partnership with Ghana's Cocoa Board, the FC will take responsibility for this programme, including its design, management, and implementation.
Organizational or contractual relation between the organization and the ER Programme Entity identified in 1.1 above	Both institutions are agencies of government, instituted by law. The FC resides under the MLNR and is responsible for the management of Ghana's forest estates. The MoF manages the government's central budget and fund allocations. The FC and the Ghana Cocoa Forest REDD+ Programme (GCFRP) will be resourced financially through the MoF. The two institutions are part of the National REDD+ Working Group, which serves as the principal decision-making body on Ghana's REDD+ process.
Main contact person	Mr. Yaw Kwakye
Title	Head, Climate Change Unit; REDD+ Focal Point, National REDD+ Secretariat

Address	P.O. Box MB 434, Accra, Ghana
Telephone	+233 302 401210 / 401216 / 401227
Email	ykwakye.hq@fcghana.org ; beemayaw@gmail.com
Website	www.fcghana.org

1.3 Partner agencies and organizations involved in the ER Programme

Name of partner	Contact name, telephone and email	Core capacity and role in the ER Programme
Ghana Cocoa Board (COCOBOD)	Mr. Emmanuel Opoku Acting Director, Cocoa Health and Extension Division Tel: +233-244386890 Email: ea_opoku@yahoo.co.uk	Ghana Cocoa Board is a co-proponent of this programme with the Forestry Commission and together they co-lead the programme. As the government institution responsible for the regulation and management of the cocoa sector, it has the full authority and capacity to do so. Cocoa Board serve as the co-chair, with the Forestry Commission, of a coordination and management committee constituted to lead the design and implementation of the programme
Ministry of Lands and Natural Resources (MLNR)	Musah Abu Juam, Technical Director for Forestry Tel: +233-244362510 Email: abujuam@gmail.com	MLNR is the sector Ministry to which the Forestry Commission reports. It is also responsible for the Ghana's Forest Investment Programme (FIP). MLNR will serve on the programme's Coordination and Management Committee to ensure integration and synergy with FIP projects and related activities. As such, it will play a major role in coordinating, managing and implementing the programme.
Ministry of Environment, Science and Technology (MESTI)	Peter Dery Deputy Director, Climate Change Sustainability Email: peterjdery@yahoo.com	MESTI is the sector ministry with responsibility to formulate, develop, implement, monitor and evaluate environmental policies in Ghana, including the National Climate Change Policy. MESTI has a seat on the NRWG and is a key partner on all aspects of REDD+.
Ministry of Food and Agriculture (MOFA)	Seth Osei Akoto Director of Crops Services Tel: +233 244384493 Email: oakoto2012@gmail.com	MOFA is represented on National REDD+ Working Group (NRWG) and will be responsible for ensuring that extension services and interventions related to food and cash crops including oil palm and citrus align with the goals of Ghana's Cocoa Forest REDD+ Programme.
Environmental Protection Agency (EPA)	Daniel Benefor Tutu Principal Programme Officer Tel: +233-246114652 Email: dbenefor2000@yahoo.co m	EPA is the National Focal Point for Climate Change and is responsible for all National Communication to the UNFCCC. EPA will ensure that the programme's accounting is reflected in the national accounting. It also hosts Ghana's Climate Change Data Hub, which will support elements of data management and registry.
Minerals Commission	Emmanuel Afreh Tel: +233-240936688 Email:	The Minerals Commission (MC) is the government institution responsible for the regulation and management of Ghana's mineral resources. Its sits

	eafreh@hotmail.com	under the MLNR.
Forestry Research Institute of Ghana (FORIG)	Dr. Ernest Foli Principal Scientist Tel: +233 262714148 Email: efoli@hotmail.com; egfoli@gmail.com	FORIG is a research institute under the Council for Scientific and Industrial Research (CSIR) conducting forest and forest products research for social, economic and environmental benefits of society. FORIG will advise the JCC and provide technical guidance on the implementation of field activities and development of appropriate systems for the success of the programme.
Cocoa Research Institute of Ghana(CRIG)	Dr. F.M. Amoah Executive Director Tel: +233-244983278 Email:	CRIG is a subsidiary of Ghana Cocoa Board established as a centre of excellence for developing sustainable, cost effective, socially and environmentally acceptable technologies for the cocoa industry. CRIG is responsible for all cocoa research that provides information and advice on matters relating to the production of cocoa and other mandate crops
National House of Chiefs	Nana Frimpong Anokye Ababio II Paramount Chief for Agona Ashanti Tel:+233-244419905 Email: isaacberko@yahoo.com	The National House of Chiefs is a body of elected representatives from Ghana's Regional Houses of Chiefs that is recognized by the Constitution. It is charged to advice on issues related to culture and chieftaincy, and works towards the codification of customary law. The national house of chiefs will work with the programme to liaise with Paramount chiefs that have jurisdiction over landscapes within the programme area. They are expected to play critical role in the implementation of a Grievance Redress Mechanism and will also provide guidance on issues related to benefit sharing.
Touton	Charles Tellier Ghana Manager Tel: +233-266255519 Email: c.tellier@touton.com	Touton is a cocoa bean trading company that works with the largest licensed buying company in the country; Produce Buying Company (PBC). Touton has started to implement the first comprehensive CSC programme, in line with this programme, for cocoa farms in Ghana. The programme will build on Touton's initiative, which covers 2 main HIAs.
Mondelez	Yaa Peprah Agyeman Amekudzi Country Lead, Cocoa Life Email: yaa.amekudzi@mdlz.com Tel: +233-244289718	In Ghana, Mondelēz International is leading chocolate company supporting cocoa sustainability initiatives on the ground with cocoa farmers and cocoa farming communities. It will be a key stakeholder leading HIA Consortiums and CSC implementation.
World Cocoa Foundation (WCF)	Sander Muilerman Program Manager Climate Smart Cocoa - West Africa World Cocoa Foundation Email: sander.muilerman@worldcocoa.org	The WCF promotes a sustainable cocoa economy through economic, social and environmental development in cocoa-growing communities. WCF**,** is organizing an industry commitment to end deforestation and forest degradation. The initiative will develop in consultation with the relevant cocoa producing country governments, farmers and farmer organizations, civil society organizations, development

	Tel: +233 54 300 1549 www.worldcocoa.org	partners, and other stakeholders, measures to end deforestation and forest degradation, while improving the livelihoods of smallholder farmers working in the cocoa supply chain.
IDH	Jonas Mva Mva Senior Cocoa Program Manager Email: MvaMva@idhtrade.org	Sustainability Trade Initiative (IDH) and The Prince's International Sustainability Unit (ISU) are building on existing efforts to seek alignment and develop a joint framework of action. The framework will leverage existing or create multi-stakeholder coalition that brings together public and private actors, to support the development of a common plan to address deforestation and forest degradation. The overall goal of climate smart cocoa program is to Increase private sector investment and engagement in climate smart cocoa.
Produce Buying Company (PBC)	Nana Agyenim Boateng Ag. Managing Director Tel: +233-208180350	PBC is one of the biggest licensed cocoa buying companies (LBC) in Ghana, and has the greatest geographical presence, being present in every village/society.
Olam	Eric Botwe Business Head, Cocoa Tel: +233-244329508 Email: eric.botwe@olamnet.com	Olam is a leading LBC and cocoa processor that purchases cocoa beans for Ghana Cocoa Board on commission basis. Olam is currently funding and engaged in multiple projects with cocoa farmers including certification, farmer business schools and farmer data management. Olam will play a lead role in implementing this programme in HIAs on the ground with cocoa farmers.
Armajaro / Ecom Ghana Ltd	Victus Dzah Tel: +233-244312158 Email: victus.dzah@ecomtrading.com	Armajaro Ghana / Ecom is one of the leading LBCs and cocoa processors in Ghana. It has numerous sustainability initiatives including Geo-Traceability, which tracks beans along the supply chain, and Source Trust, which brings benefits back to farmers and farming communities.
Solidaridad West Africa	Isaac Gyamfi Managing Director PMB KD 11 Kanda-Accra Tel: +233-544323960 Email: Isaac.gyamfi@solidaridadnetwork.org	Solidaridad West Africa leads implementation of the UTZ Certification standard for cocoa, it is a major partner to the Cocoa Board in replanting and rehabilitating old farms, and it is also active in the Roundtable for Sustainable Oil Palm (RSPS) in Ghana. Solidaridad will be key in implementing activities on the ground in the programme's target landscapes.
Nature Conservation Research Centre(NCRC)	John Mason CEO PO Box KN925, Kaneshie, Accra Tel: +233-264697485 Email: jos091963@gmail.com	Nature Conservation Research Centre (NCRC) is a continental leader in REDD+ and Climate Smart Agriculture, and has played major role to date on both issues in Ghana. It also has extensive expertise in implementing Community Resource Management Areas (CREMAs). NCRC will be a key partner in implementing activities on the ground in the Kakum HIA landscape of Assin North and Assin South.
IUCN – Ghana	Saadia Bobtoya Owusu-	IUCN Ghana will serve as an implementation partner

	Amofah Project Coordinator Mob: +233 264893004 Email: saadia.bobtoya@iucn.org	with its extensive experience in CREMA development, sharing lessons learned from its on-going REDD+ projects on benefit sharing, extension and communication strategies that are pro-poor and gender focused.
SNV	Reuben Ottou Senior Advisor Climate change and REDD+ +233244893528 Emai:rottou@snvworld.org	A key partner of the programme, SNV is leading the development of a country led approach on Safeguards Information Systems and is testing models for developing "low emission development plans" in districts within the GCFRP landscape. These projects also involve the piloting of participatory forest and agroforestry practices.
Arocha Ghana	Daryl E. Bosu Deputy Director - Operations Tel: +233 202555727 Email: daryl.bosu@arocha.org	Arocha Ghana is an NGO that has a strong presence within the GCFRP area on the landscape surrounding the Atewa Range Forest Reserve. Arocha will be a key implementation partner in this HIA landscape, where it has expertise in community-based conservation, ecosystem services and restoration activities.
International Institute of Tropical Agriculture (IITA)	Dr. Richard Asare Senior Scientist Tel: +233-243653504 Email: r.asare@cgiar.org	IITA is a leading international research organization focused on agriculture and tree crop systems with a regional office in Ghana. Through its CCAFS project and agroforestry research agenda, IITA will be a key stakeholder engaged in research and development activities that support CSC practices and implementation, particularly with respect to best practice guidelines and climate change adaptation.
Verified Carbon Standard (VCS)	Toby Janson-Smith Chief Innovative Officer Tel: +12024802282 Email: tjanson@v.c.s.org	VCS provides technical support to ensure that the programme influences and benefits from existing and new international landscape standards, requirements and global best practice. VCS will provide capacity on new, innovative and trusted carbon accounting tools and standards including REDD methodologies.

2. STRATEGIC CONTEXT & RATIONALE FOR THE ER PROGRAMME

2.1 Current status of the Readiness Package and summary of additional achievements of readiness activities in the country

Ghana's R-Package received endorsement from the FCPF Participants Committee at the end of September, 2016. The independent self-assessment carried out on Ghana's REDD+ Readiness Phase indicates that Ghana made significant progress under the REDD+ process. The assessment was guided by the FCPF Readiness Assessment Framework. Table 1, below, gives an overview of the overall assessment indicating significant progress and major achievements as highlighted in the independent assessment document.

As specified in the FCPF Readiness assessment guidelines, a colour-coded system was used to assess progress on each of the questions. A summary score is presented at sub component level based on the responses and scores of questions for each of the sub-components that were received from different stakeholder groups. Overall, the assessment identifies 6 green, 2 yellow and one orange. This represents a solid improvement since the Mid-Term Report (MTR) undertaken in 2014, which identified only one green, 7 yellow, and one red score.

Table 1: R-Package progress summary

R-Package Component / Sub-Component	Assessment Criteria	Assessment Score	Assessment Summary
1. Readiness Organisation and Consultation			
1a. National REDD+ Management Arrangements	1. Accountability and transparency 2. Operating mandate and budget 3. Coordination with national or sector policy frameworks 4. Technical supervision capacity 5. Funds management capacity 6. Feedback and grievance redress mechanism		Generally, there is good progress in terms of the institutional arrangements, accountability and transparency, cross-sectoral co-ordination, technical supervision, staffing and funds management. More work is needed to ensure that funding in the medium to long term is assured and that relevant ministries are fully engaged. Attention is also needed towards the operationalization of the Feedback and Grievance Redress Mechanism
1b. Consultation, Participation, and Outreach	7. Engagement of key stakeholders 8. Consultation process 9. Information sharing 10. Implementation of consultation outcomes		Excellent progress has been made in delivering a thorough communication campaign through a range of channels, and ensuring widespread consultation and participation in the design of key aspects of REDD+ readiness. Information has been shared widely and the inputs of consultative exercises are used to inform and strengthen the development of plans and proposals being developed at the national level.
2. REDD+ Strategy Preparation			
2a. Assessment of Land Use, Land Use Change Drivers, Forest Law, Policy, and Governance	11. Assessment and analysis 12. Prioritization of direct and indirect drivers 13. Links between drivers and REDD+ activities 14. Actions plan to address natural resource rights, land tenure, governance 15. Implications for forest law and policy		Overall assessment of land use and land use change drivers was thorough and built extensively on earlier efforts. The process of developing the REDD+ Strategy encountered some initial setbacks, which have been addressed following concerted inputs from other stakeholders which have led to a more robust version of the document. The linkages between drivers and strategy options are clear and logical. There are on-going efforts to address some of the unresolved issues relating to tree tenure, benefit sharing, livelihoods etc.
2b. REDD+ Strategy Options	16. Presentation and prioritization of strategy options 17. Feasibility assessment 18. Consistency with policies 19. Integration with relevant strategies and policies		The strategy options were selected through a participatory and inclusive process and the direct incorporation of the SESA process meant that options were subjected to an analysis of potential positive and negative impacts and where necessary these could be mitigated. Emission reduction potential was not comprehensively captured in the National REDD+ Strategy process, but has been well elaborated in the Cocoa

			Landscape Emissions Reduction Programme Document
2c. Implementation Framework	20. Adoption of legislation and regulations 21. Transparent and equitable framework 22. National REDD+ information system or registry		Good progress has been made in influencing key national policy development processes but these are yet to be translated into legally binding laws. More work is needed to clarify carbon and tree tenure, to agree on a final model for benefit sharing as well as REDD+ financing arrangements. Although multiple benefit sharing systems currently operate in the forest and wildlife sectors, these have yet to be tested for REDD+. The REDD+ Registry / Data Management System is not yet operational but terms of reference have been developed and the procurement is coming to completion.
2d. Social and Environmental Impacts	23. SESA coordination and integration arrangements 24. Analysis of safeguard issues 25. REDD+ strategy design with respect to impacts 26. Environmental and social management framework		A thorough process was used for identifying potential impacts and risks associated with REDD+ related activities. Where significant negative impacts were identified, activities were either modified, removed or mitigation actions developed to reduce potential downstream impacts. As results based actions through REDD+ have yet to commence, the ESMF is yet to be operationalized.
3. Reference Emissions Level / Reference Levels			
	27. Clear, step-wise methodology 28. Historical data and adjustment for national circumstances 29. Consistency with UNFCCC/IPCC guidance and guidelines		Significant work has been done on the REL/RL that builds on previous support including a major investment from the Japanese government. Additional funding was provided from FCPF following the MTR that allow for completion of REL work at both national and sub-national level (within the GCFRP). The final product meets the requirements under IPCC and UNFCCC methodological guidance
4. Monitoring Systems for Forests and Safeguards			
	30. Documentation of step-wise approach 31. Demonstration of early implementation 32. Institutional arrangements and capacities		The NFMS is yet to be operational, but is closely linked to the design of the REL and will follow the same methodology. The system is in line with latest international thinking and meets IPCC/UNFCCC standards. The design will be able to measure deforestation, degradation and enhancement of carbon stocks. Clear roles and responsibilities have been agreed regarding the operations of the NFMS. However, the system will require significant running

			costs, institutional support and capacity and none of these parameters have been fully tested.
5. Information System for Multiple Benefits, Other Impacts, Governance and Safeguards			
	33. Identification of non-carbon aspects. 34. Monitoring and reporting capabilities 35. Information sharing		Good progress shown with regard to producing a SESA and ESMF, but it has not been operationalized as the REDD+ implementation is yet to start. Plans are at an early stage with regard to the development of a safeguards information system (SIS) with a view to complying fully with UNFCCC requirements.

Significant progress achieved
Progressing well, but further progress required
Further development required
Not yet demonstrating progress

As Ghana transitions from completing readiness to implementation she will continue to make progress in addressing those areas that need improvement and in responding to the concerns and questions that were identified during the self-assessment review. The NRS has put in place a plan and is making progress towards full completion of readiness in line with the roll-out of the GCFRP. Details about these next steps and a description of progress since the self-assessment are noted below:

- ***More work is needed to ensure that funding in the medium to long term is assured***: The Ghana Cocoa Forest REDD+ Programme (GCFRP) now has a solid financial plan that outlines a broad range of funding sources, including investment from the private sector, REDD+ funding in the form of grants (readiness and FIP) and performance-based payments (Carbon Fund), contributions from NGOs and other partners (grants), and Government of Ghana (GoG) support. Overall, the estimated funding gap is relatively small and Ghana is confident that this can be filled. With respect to the national level and other programmes outlined within the REDD+ Strategy, the GoG will continue to support key programmes and activities that align with REDD+.
- ***Relevant Ministries are fully engaged***: Through the design of this programme and its plan for implementation, the specific roles and responsibilities of various stakeholders, including those of other ministries and commissions have become more tangible. At a high level, a broad range of key ministries and agencies are already members of the National REDD+ Working Group (NRWG), and specific roles have also been clarified, including that of the Environmental Protection Agency (EPA), under the Ministry of Environment, Science, Technology and Innovation (MESTI), as being responsible for hosting and operating Ghana’s Climate Change Data Hub (data management and registry system). The role of the Minerals Commission (MC) is also coming into focus as part of the interventions to tackle illegal mining.
- ***Operationalization of the Feedback and Grievance Redress Mechanism (FGRM): A*** proposal for the design of the FGRM was completed under an earlier consultancy in late 2014 and the development of operational modalities for its full implementation is nearing completion following a second conultancy in 2016. It is proposed that the FGRM should be operated using a bottom-up approach and hence, Dispute Resolution Teams, led by the Traditional Authorities and other opinion leaders of high moral standing, in the programme landscape will be set up to work with District Dispute Resolution Focal Persons at the offices of the Forestry Commission (FC). If unresolved, then the case will go to a panel of national arbitrators. Concerns from aggrieved stakeholders will be received, processed and collated at this level and channelled to the FGRM desk at the national level. A series of training activities have been planned for persons designated to be responsible for the CGD at the districts and the regions.

Efforts are being made to link the FLEGT/VPA system for conflict resolution to the FCPF-sponsored FGRM to reduce costs and increase linkages between these two important but inter-linked approaches to improving forest governance. Steps have been initiated to seek a legal amendment to the FC Act to incorporate FGRM.

- ***Operationalization of REDD+ Registry:*** A consultant has been hired to develop a data management system / registry for the ERP and this assignment is expected to be completed by mid-2017. This database system will be used for collecting and processing information about emissions, removals, emissions reductions, deforestation and degradation, specific geographical locations where interventions are expected to be implemented, data from forest monitoring, cocoa yields, and other indicators that inform understanding of activities and impacts. All information collected into this system will be uploaded into Ghana's national Climate Change Data Hub, operated by EPA, which will serve as a transparent repository of key information. It will provide a passive link to the SIS for access to information on safeguards, benefit sharing, FGRM, and land and tree tenure.

Table 2: List of key readiness studies and documents and the web links

Readiness studies/documents	Web links
Independent Evaluation of REDD+ Readiness at Mid-Term	https://www.forestcarbonpartnership.org/sites/fcp/files/2014/May/Independent_Evaluation_of_REDD_Readiness_Ghana.pdf
Development of REDD+ Communication Strategy	https://www.forestcarbonpartnership.org/sites/fcp/files/2015/April/REDD%20%20%20Comm%20Strat%20Final%20Doc.pdf
High Level Engagement with Private Sector and State Actors on the Emission Reduction Programme	http://fcghana.org/userfiles/files/REDD%2B/High-Level%20Buy-In%20-%20Final%20Report.pdf
Establishment of Benefit Sharing Mechanism for REDD+ Implementation in Ghana	http://fcghana.org/userfiles/files/REDD%2B/Final%20Report%20REDD%2B%20Benefit%20Sharing%20Ghana.pdf
Development of Measurement, Reporting and Verification System	http://fcghana.org/userfiles/files/REDD%2B/Ghana%20MRV%20Final%20Report%20(ID%2067024).pdf
Environmental and Social Management Framework (ESMF)	http://fcghana.org/userfiles/files/REDD%2B/final%20%20ESMF%20REDD%2B_oct%202014.pdf
Resettlement Policy Framework (RPF)	http://fcghana.org/userfiles/files/REDD%2B/final%20RPF-REDD%2B-oct%202014(1).pdf
Development of Strategic Environmental and Social Assessment (SESA)	http://fcghana.org/userfiles/files/REDD%2B/FINAL%20SESA%20report-18122014.pdf
Development of Dispute Resolution Mechanism (DRM)	http://fcghana.org/userfiles/files/REDD%2B/Final%20final%20DRM%20Report.pdf
Development of REDD+ Strategy	www.forestcarbonpartnership.org/sites/fcp/files/2015/April/Ghana%20National%20REDD%2B%20Strategy%20Final.pdf
Development of an Integrated M&E Framework	https://www.forestcarbonpartnership.org/sites/fcp/files/2015/April/M%26E%20Final%20Draft_March_2014.pdf
Ghana 's Country Approach to Safeguards Roadmap	http://fcghana.org/nrs/phocadownload/Inception-Report-Ghana-REDD_Database_final_April_4_2017.pdf
Recommendations for Addressing the UNFCCC REDD+ Safeguards in Ghana: Identification and Assessment of the Relevant Legal	http://fcghana.org/nrs/phocadownload/DRAFT_Report_legal%20analysis_Ghana_12Jan2017.pdf

Framework	
ERP Forest Reference Level data and methods	http://www.fcghana.org/nrs/index.php/category/5-forest-reference-level-erp-reports
Forest Investment Programme ESMF	http://fcghana.org/nrs/phocadownload/ESMF_Ghana_FIP_Final_13_October%20_2014.pdf
Forest Investment Programme Pest Management Plan	http://fcghana.org/nrs/phocadownload/PMP_Ghana_FIP_%20Draft_Final_%2027_Nov_2014.pdf
Inception Report Ghana REDD+ Database /Information Systems Project	http://fcghana.org/nrs/phocadownload/Inception-Report-Ghana-REDD_Database_final_April_4_2017.pdf

2.2 Ambition and strategic rationale for the ER Programme

2.2.1 Ambition and Significance

For nearly a century, degradation and deforestation in Ghana's High Forest Zone (HFZ) were largely driven by low-yielding, expansive agricultural practices—predominantly cocoa farming—coupled with the progressive growth of extractive industries, like timber production, as well as the illegal practices that tend to accompany them. For much of this time, conversion of forests was not viewed as a problem, but by the mid-nineties it was increasingly clear that Ghana's forest reserves were moderately to severely degraded[1], low/no shade cocoa was expanding at the expense of forests and trees[2], and biodiversity in the HFZ landscape had declined precipitously[3]. Concurrent with the loss of forests, Ghana's Cocoa Board and the cocoa private sector also recognized that the country was underperforming in terms of national production, despite the growing area under cocoa.

While the cocoa sector responded with the "Hi-Tech Programme" in an effort to boost yields, little was done to address deforestation and degradation. As a result, during the decade from 2000-2010 deforestation across the cocoa-forest landscape continue at a rate of approximately 2.1% per annum. More recently, drivers continue to include the expansion of cocoa and other tree crop farms, the loss of trees in these farming systems, illegal logging including illegal chainsaw operations and illegal mining, as originally documented in Ghana's R-PP[4] and described in the National REDD+ Strategy[5]. Unfortunately, over the past six years, the scale of these drivers has increased due to declining cocoa productivity (causing greater expansion), and an upsurge in illegal mining and illegal logging. Due to these changes, it is now estimated that during the reference period, Ghana's deforestation rate has jumped to 3.2 % per annum, and that approximately 138,624 ha of forest are lost each year; forests which are critical to sustaining Ghana's cocoa sector through the provisioning of multiple ecosystem services, as well as the conservation of biodiversity.

In response to the opportunities that have opened up with REDD+ readiness, and in a serious and strategic move to significantly reduce deforestation and degradation across the cocoa forest mosaic landscape, Ghana initiated a sub-national programme in 2014 that aims to reduce emissions through the implementation of a "climate-smart cocoa" programme and sustainability standard, coupled with additional activities in priority areas to reduce the impacts from other drivers. While pursuing a

[1]Hawthorne, W.D, Abu-Juam, M. (1995) Forest Protection in Ghana (with particular reference to vegetation and plant species). doi:IUCN, Gland, Switzerland and Cambridge, U.K

[2] Robert, A. Rice and Russell Greenberg 2000. Cacao Cultivation and the Conservation of Biological Diversity. Ambio Vol. 29 No. 3, Royal Swedish Academy of Sciences 2000. http://orton.catie.ac.cr/repdoc/A3565i/A3565i.pdf

[3] Hansen, C.P. and Treue, T. 2008. Assessing illegal logging in Ghana. International Forestry Review (2008) Volume: 10, Issue: 4, Pages: 573-590. https://www.researchgate.net/publication/232685551_Assessing_illegal_logging_in_Ghana

[4] GoG 2010. Readiness Preparation Proposal (R-PP): Revised Ghana R-PP. Accra, Ghana

[5] GoG 2015 National REDD+ Strategy. http://www.fcghana.org/userfiles/files//REDD+/Ghana's_National_REDD_Strategy_final_draft_210616.pdf

Jurisdictional REDD+ approach, this programme aligns with the main cocoa production landscape and follows the ecological boundaries of the core of the High Forest Zone (HFZ) (5.9 million hectares).

What makes this programme unique in Africa and a global first in the cocoa sector is its goals to produce emission reductions and sustainable, climate-smart cocoa beans from the landscape. By capturing the long ignored environmental externalities from cocoa production (as well as other agricultural and natural resource commodities) into the cost of producing a cocoa bean, while demonstrating emission reductions and compliance with safeguards, Ghana's cocoa sector and private sector companies along the value chain can claim and sell a *truly* sustainable, REDD+, climate-smart product. In rolling out this programme and implementing a Ghana Climate-Smart Cocoa Standard, the aim is to significantly increase farmers' yields through the delivery of improved and expanded access to agronomic resources and other livelihood benefits for more than 6 million rural farmers and forest users, while enhancing resilience to climate change and ensuring the sustainability of supply.

However, given the programme area's average annual emissions over the 10 year time frame and and high rate of deforestation, the GCFRP is ambitious in its goal to significantly reduce deforestation against its 2005-2014 emissions reference level and produce approximately 10 million tons of CO_2e emission reductions across the cocoa forest mosaic landscape over the 5 year ERPA period. Over the full lifetime of the programme (2017-2037), the GCFRP aims to curb escalating deforestation and degradation and reduce total emissions by approximately 295.4 $MTCO_2e$.

The programme's ambition is also evident in its unique and strategic focus on a global commodity—cocoa—and the plan to implement using a cross-sector coordination approach that leverages over US$ 140 million in public-private initiatives and investments in target areas of the programme's landscape, to facilitate a significant financial return to farmers and the government, in addition to climate benefits and sustainable supply of cocoa to cocoa buyers and users. In effect, this means that the programme's co-benefits—including significantly increased yields for farmers, improved tree tenure arrangements and conservation of threatened biodiversity—elevate its value far beyond that of the carbon benefit.

With the increasing attention to issues of global warming in a post Paris-CoP 21 era, industry leaders in the cocoa processing and chocolate sector have used several platforms to indicate their commitment to global efforts to addressing deforestation and forest degradation by targeting action along the commodity supply chain. Given that Ghana first explored the link between cocoa and deforestation as part of an effort led by the Prince's Rainforest Project in 2010, and given that Ghana has been a vocal leader in raising awareness about deforestation in the cocoa production landscape, proponents of the GCFRP were very much heartened that in London, in March 2017, under the patronage of the Prince of Wales a collective industry commitment was made to end deforestation and forest degradation in the global cocoa supply chain, with an initial focus on Côte d'Ivoire and Ghana. (Statement of Intent in Annex 4C). This event was attended by Ghana's Minister for Lands and Natural Resources and the Chief Executive of the Ghana Cocoa Board.

In Ghana, this development is coinciding with heightened interest in environmental sustainability and enhanced forest stewardship at the highest political level, and this awareness is anticipated to translate into strong high-level support for the programme

2.2.2 National Policies and Development Priorities

What makes this programme highly promising is that its ambition is underpinned by a set of new and important policies focused on climate change, low emissions development, and sustainable environmental and natural resource management. Of even greater importance is that the GCFRP presents a clear pathway for implementing and realizing the goals of these policies, at both national and sector levels. Much of the impetus behind these new policies is that the GoG recognizes that climate change and environmental degradation are already negatively affecting the country in myriad ways[6] [7] and that they are likely to continue to hamper Ghana's environmental and socio-economic prospects in the coming decades if major changes are not made. As a result, one of the main goals of the National Climate Change Policy (NCCP) (2012) is to design and implement interventions that increase carbon sinks through improved governance structures, securing forests and natural ecosystems for the maintenance of their ecosystem services and biodiversity, plantation development, and the conservation of trees in farming systems through agroforestry practices. All of these types of interventions are reflected in the GCRFP.

Following the promulgation of the NCCP, Ghana also initiated its Low Carbon Development Strategy (2013), for which the overall objective is to contribute to global climate change mitigation by providing a framework that will ensure climate resilient, equitable, low-emission economic growth and sustainable development, while prioritizing poverty reduction in a pragmatic manner. The GCFRP is also directly aligned with this strategy and will be an important initiative to achieve these goals.

Ghana's Nationally Determined Contributions (NDC), which stem from these two policies, clearly recognizes REDD+ and the GCFRP in particular as one of the leading areas for generating national emission reductions in the medium term, following the conclusion of Ghana's ERPA with the CF. In fact, the GCFRP is widely viewed as being well-positioned to catalyze key actions and investments on the ground to bring about many of the needed changes and performance based results for mitigation as well as adaptation priorities.

At the national level, in addition to these two policies and Ghana's NDC, the GCFRP also aligns with Ghana's Shared Growth and Development Agenda II (2014-2017), Ghana's Environment Policy (2012), and the adoption of Sustainable Development Goals 13 (to take urgent action to combat climate change and its impacts) and 15 (to protect, restore and promote sustainable use of terrestrial ecosystems, sustainably managed forests, combat desertification, reverse land degradation, and halt biodiversity loss).

Once of the most exciting and transformative aspects of the GCFRP is that with respect to key sectors, the GCFPR has not only influenced the *development* of policies, but it is also specifically designed *to facilitate their roll-out* to achieve changes in land-use decision making and resource management on the ground.

For example, as a result of the process to develop and design the programme, in which the Cocoa Board has been designated as a co-implementation agency with the FC (the first time the two institutions are collaborating on a joint initiative), Ghana's draft Cocoa Sector Strategy II, which is awaiting validation, gives a clear demonstration of the Cocoa Board's commitment to promoting environmental sustainability by reducing deforestation and degradation in cocoa growing areas. The strategy document prioritizes the implementation of a climate-smart cocoa production system and standard to be implemented in partnership with the private sector and in line with the country's REDD+ goals. In particular, the strategy is focused on promoting practices that increase yields and

[6] In 2014, it was estimated that the total economic cost of poor environmental management is about 10% of Ghana's GDP (GoG, 2014. Medium Term National Development Policy Framework: Ghana Share Growth Development Agenda (GSGDA); 2014-2017. National Development Planning Commission (NDPC), Policy Framework Volume II). https://s3.amazonaws.com/ndpc-static/pubication/GSGDA+II+2014-2017.pdf

[7] Anim-Kwapong, G.J. and Frimpong, E.B. (no date) Vulnerability of agriculture to climate change. Cocoa Research Institute of Ghana. www.nlcap.net/fileadmin/NCAP/Countries/Ghana

incomes, build resilience and adaptation to climate change, reduce emissions in the cocoa growing landscape, and lead to the integration of shade trees on-farms. The strategy also outlines plans to mainstream gender issues across the value chain, to implement a "Youth in Cocoa" initiative to support the next generation of cocoa farmers, and to address illegal mining in cocoa growing lands.

The Cocoa Sector Strategy I, which spanned 2000-2010 was the main reason that Ghana's Cocoa Board was so successful in increasing yields from 350,000 tons at the turn of the century to a national production high of 1 million tons in 2011, and it is widely believed that the Cocoa Sector Strategy II will play an equally important role in enabling the successful implementation of the GCFRP, including work that is underway to develop a Ghana standard for sustainable and climate-smart cocoa production. In fact, Cocoa Board is now considering the establishment of a Climate Change Unit which would be directly responsible for this programme and its activities, as well as other key initiatives to address threats from climate change.

A committee set up in early 2017 under the new leadership at the Cocoa Board, has been tasked to provide recommendations on the enhancement of cocoa yield across the cocoa production landscapes. This committee highlighted the GCFRP as one of the major interventions to ensure sustainable cocoa production and build climate-resilience for the cocoa sector. Key recommendations furnished by the committee include sustainable intensification of cocoa production practices and the deepening of private sector involvement, which are vital elements in the GCFRP.

The REDD+ readiness process also had a significant influence on the formulation of Ghana's 2012 Forest and Wildlife Policy (FWP), and as the MLNR and the FC now move to design implementation measures and legal instruments, the GCFRP is playing a central role in influencing their design and catalyzing momentum to authorize piloting/testing and ultimately the passage of legislation. For example, tree tenure reforms have been discussed in Ghana for over twenty years with little change, but as a result of this programme and the FIP, reform options have now been recommended and there is consensus among stakeholders about the need to pilot new tree tenure arrangements within the programme landscape, and lawyers at the FC and legal experts are working on a first draft of reforms that address tree tenure.

A key natural resource management mechanism that has been greatly expanded in its scope by REDD+ and supports the devolution of management rights to communities—CREMA—is also positioned to receive full legislative backing under the law through the passage of the Wildlife Resource Management Bill, which is currently before Parliament. The passage of this legislation is highly anticipated by the GCFRP as it will be a critical instrument for implementing the programme on the ground in many locations. The advent of REDD+ and the programme has also influenced the context of the National Forest Plantation Development Strategy (NFPDS) which is the blueprint to guide extensive reforestation and afforestation programmes in the country, and will target areas within the GCFRP landscape.

Of critical importance is that the GCFRP has also initiated the integration and co-implementation of other forestry programmes, including the Forest Law Enforcement, Governance and Trade (FLEGT) Initiative (as part of the Voluntary Partnership Agreement (VPA)), and the overlapping projects under Ghana's FIP. While the synergies were broadly recognized, the process of developing the GCFRP has for the first time resulted in concrete action to leverage these complementary channels for addressing the major drivers of deforestation and degradation in the ER Programme landscape, and for moving forward in a performance-based and climate-smart manner.

More broadly, other sector level policies which the programme complements and aims to help implement include the Gender in Agriculture Development Strategy II (2016), the National Wildfire Policy (2006), the National Tree Crops Policy, the National Climate Smart Agriculture and Food Security Action Plan (2016-2020), the National Buffer Zone Policy (2014), the draft National Bioenergy Policy and the Renewable Energy Act (Act 823), and the Ghana Strategic Investment Framework (GSIF) for Sustainable Land Management (SLM) (2009 – 2015). More information about these policies can be found in Ghana's National REDD+ Strategy (Table 2)

2.2.3 Contribution to REDD+ and National REDD+ Strategy

The vision of Ghana's National REDD+ Strategy is to significantly reduce emissions from deforestation and forest degradation, while at the same time addressing threats that undermine ecosystem services and environmental integrity so as to maximize the co-benefits of the forests, and serve as a pillar of action for the national climate change agenda and a leading pathway towards sustainable, low emissions development.

In terms of realizing REDD+, Ghana's strategy is to focus on the implementation of large scale, sub-national programmes that follow ecological boundaries and are defined by major commodities and drivers of deforestation and degradation, within a set of over-arching activities that areencompassed by the national REDD+ framework. This dual national-jurisdictional approach to implementation enables landscape scale actions and cross-sector collaboration, coupled with private sector participation and community-based mobilization that together is expected to produce collective impacts, while promoting the operational and accounting efficiencies that come from using a single set of systems and processes.

The GCFRP is a key pillar of the National REDD+ Strategy. It is the first programme to be developed and implemented, and it will serve to test many of Ghana's REDD+ systems, processes, and policies, including Ghana's MRV system, the FGRM, the ESMF, and reforms to tree tenure and benefit sharing. As such, the lessons and experiences from implementing and monitoring the GCFRP will directly inform the development and roll-out of the next programmes, including an Emission Reductions Programme for the Shea Landscape of the Northern Savanna Woodland.

2.3 Political commitment

Ghana's ER Programme has received the highest level of political commitment, in addition to receiving strong political and cross-sectoral endorsement from all levels of government. This support started in 2014, when the former President John Dramani Mahama made a speech to Parliament on Ghana's Coordinated Programme of Economic and Social Development Policies (2014-2020): An Agenda for Transformation[8], and stated that, "*Government will also tackle deforestation as part of Ghana's REDD+ strategy to deal with climate change and also integrate water security and climate resilience into development planning processes*". (H.E. John Dramani Mahama, 1st December, 2014). A year later, at the Paris CoP-21, he indicated Ghana's ambition to pursue a low-carbon economy and sustainable development trajectory, of which REDD+ (and the GCFRP) are an important element in tackling climate change.

At the Paris CoP-21, the immediate past Minister of Environment, Science, Technology and Innovation also spoke in direct support of REDD+, stating that,

[8] GoG 2014. Ghana's Coordinated Programme of Economic and Social Development Policies (2014-2020): An agenda for Transformation, by H.E. John Dramani Mahama. http://www.presidency.gov.gh/coord.pdf

> *The ERP is one of the emission reduction initiatives to be implemented in the cocoa landscape of Ghana. With the anticipated support and investment, Ghana's ambitious ERP…is expected to yield over 255 million tons of emission reductions over the life of the programme. Aside from the mitigation benefits of implementing REDD+, the programme is also expected to increase cocoa yields per hectare, leading to a corresponding increase in profits for the farmers, export revenue for the country and a sustainable supply chain for the chocolate industry. In fact, the success and sustainability of this programme hinges largely on the associated non-carbon benefits that will make the implementation of REDD+ sustainable in the long term.* (Hon. Mahama Ayariga, 10th December, 2015)

At the National REDD+ Forum, in November, 2015, the programme was also endorsed by some of Ghana's eminent politicians, including the former President J.A. Kufour, a United Nations Special Envoy for Climate Change, the Minister for Lands and Natural Resources, the Deputy Minister for Environment, Science, Technology and Innovation, and the Chief Executive of the Forestry Commission. In h is speech, former President Kuffour spoke in support of the programme, arguing that, "*In the past, we viewed conversion of forests to agricultural lands as a mark of progress and development. But today, we risk losing our forests all together and therefore we much accept that deforestation and forest degradation in Ghana is unacceptable as the implications are far too serious and the risks too great."*

In September, 2015, Ghana's National REDD+ Secretariat also launched a REDD+ Roadshow campaign to share the concept and critical need for the GCFRP with high level government officials, traditional leaders and private sector leaders, as well as the general public, while also highlighting the social, economic and environmental opportunities that it creates for the country.

The current political administration which came into office following the successful elections held in November 2016 has renewed its commitment to address the environmental challenges that confront the country and undermine its vision for a prosperous future. Since his inauguration, President Akuffo Addo and his political appointees have been consistent in their rhetoric against land use practices that negatively affect environmental quality and have expressed direct support for the core concepts of the GCFRP. In his Presidential Address on the occasion of Ghana's 60th Independence celebration on the 6th of March 2017, he stated; *"It is turning out to be a constant refrain, I know, but, on a day like this, we cannot ignore the state of our environment. We are endangering the very survival of the beautiful and blessed land that our fore-bearers bequeathed to us. The dense forests that were home of varied trees, plants and fauna have been largely wiped out. Today, we import timber for our use, and the description of our land as a tropical forest no longer fits the reality. Our rivers and lakes are disappearing, and those that still exist are all polluted. It bears repeating that we do not own the land, but hold it in trust for generations yet unborn. We have a right to exploit the bounties of the earth and extract the minerals and even redirect the path of rivers, but we do not have the right to denude the land of the plants and fauna nor poison the rivers and lakes".*

In the Budget Statement delivered by the Hon. Minister for Finance on the 2nd of March 2017, he stated that; "*Several broad policy measures to support the cocoa sub-sector will be implemented. These measures are to ensure efficiency through streamlining activities, introduction of new interventions and programmes in order to contribute efficiently to growth in the Cocoa Sector. Government seeks to modernize Ghana's Cocoa Sector and produce climate smart cocoa through increased productivity of farms.*" He further stressed that the private sector is expected to play a pivot role in the drive to modernize the cocoa sector as well as introducing a package to address bottlenecks in the customary land tenure system.

And most recently, in April, 2017, in a statement by His Excellency Vice President Mahamadu Bawumia, at a town hall meeting, he stressed the government's determination to forcefully tackle the threat of environmental degradation, particularly the illegal small-scale mining menace, popularly known as "galamsey". At the meeting, he announced that the GoG had suspended the issuance of mining licenses until illegal mining from galamsey is tackled, and cited the development of a five year multilateral mining integrated project to improve the management of small scale mining to protect the environment.

As is evidenced by Section 1.3, there is strong cross-sectoral, civil society and private sector support and commitment to the programme. Ghana's Cocoa Board is a co-leader of the programme. Participating ministries and agencies of relevance within the NRM space include the MLNR, MESTI, EPA, and MoFA. Private sector and NGO/civil society commitment comes from some of the most important and dominant cocoa buying companies, and the leading NGOs in Ghana, of both local and international origins.
From a practical standpoint, developing a results-based programme that engages multiple sectors, institutions and agencies represents a significant feat in and of itself, and is further evidence that the programme truly does have the high level political commitment and buy-in that is needed, otherwise it would not be moving forward with the cross-sector support.

As shown in Figure 1, the ER Programme is nested within the national REDD+ management architecture, demonstrating the breadth and depth of commitment to the programme. Support to the GCFRP builds off of the previously existing ENRAC, ENREG, and TCC+ bodies, which were established in 2007 to provide cabinet, ministerial, and technical level support, guidance and coordination to environmental and natural resource management projects and programmes. The programme also benefits from the direct oversight of the National REDD+ Working Group (NRWG) and the NRS.

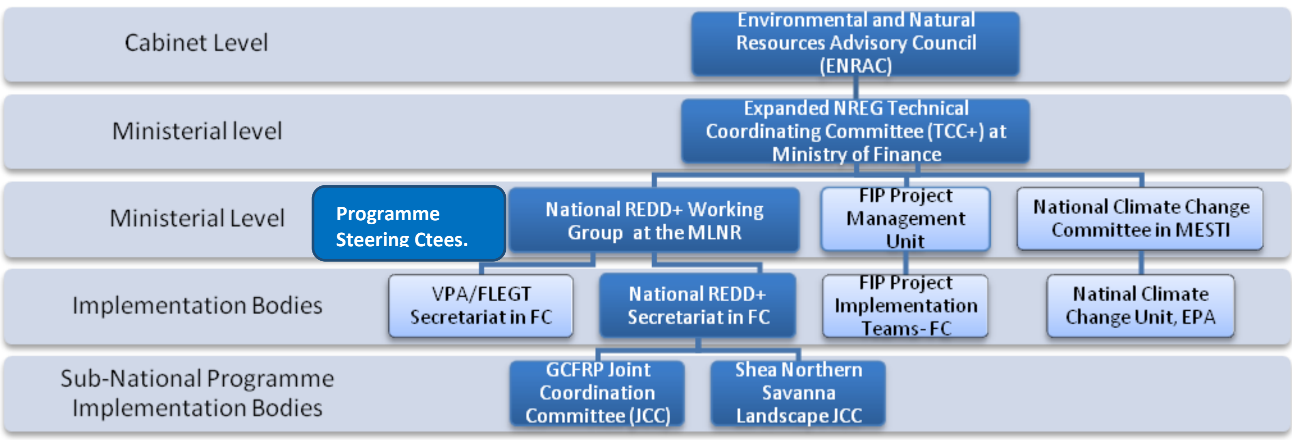

Figure 1: National REDD+ Management Architecture (REDD+ and GCFRP entities in dark blue, linked institutions in light blue

ENRAC is a cabinet level body, chaired by the Vice President of Ghana that was established to preside upon major environmental issues that cannot be resolved at the ministerial level. Its membership includes representatives from the private sector, the National House of Chiefs, and civil society, as well as representatives from relevant ministries. ENRAC does not meet on a regular basis, but is convened in response to the emergence of major environmental challenges that require high-level attention to reach a resolution. With respect to the GCFRP, ENRAC represents a body of last resort that can be called upon to address significant issues, when and if they arise, which other levels of programme governance cannot resolve.

The inter-sectoral **Technical Coordinating Committee-Plus (TCC+)** was established to oversee and guide the policy and institutional coordination of environmental and natural resource governance across the various government institutions. The TCC+ is chaired by the Ministry of Finance (Chief Director) and composed of representatives of various ministries and agencies, as well as civil society representatives. The GCFRP will use FC and MLNR presence on the TCC+ to raise REDD+ and GCFRP issues as needed.

The **National REDD+ Working Group (NRWG)**, which is hosted by the MLNR, was established in 2009 to provide direct guidance to the NRS, the main entity responsible for REDD+ readiness and implementation. The NRWG is a multi-stakeholder body hosted by the MLNR that is responsible for providing advice and guidance on all aspects of REDD+. It is jointly chaired by the Deputy Minister for Lands and Natural Resources and another member elected by the NRWG. The membership of the NRWG is drawn from relevant ministries, departments and agencies (MDAs), private sector, civil society, local communities and landowners/ traditional authorities.

As implementation bodies, the **NRS** sits within the Climate Change Unit (CCU) of the FC and is responsible for overseeing all aspects of REDD+. In 2016, the FC committed to upgrading the CCU to a Directorate as a measure to ensure long term institutional support to REDD+ operations and steps have been initiated in this direction. In becoming a Directorate, the CCU/NRS will be fully empowered, resourced and equipped to support not only this programme, but also future programmes and national-scale coordination and implementation of REDD+. Currently, the CCU/NRS is not part of the FC's Executive Management Team (EMT) where strategic decisions of the FC are taken. In a post-Paris 21 regime where issues of forests and climate change have gained high prominence globally, the FC will need to address the fact that these issues are not yet considered in its strategic decision making processes and planning. The expanding scope and complexity of the responsibilities of the CCU/NRS, and the manner in which it has grown since its inception in 2007 underscore the CCU's growing importance within the FC; warranting an upgrade to a full-fledged Directorate.

With the move to implement REDD+ through programmematic (jurisdictional) approaches, **Programme Steering Committees,** made up of the Chief Executives and/or Technical Directors will be convened on a biannual basis to facilitate the highest level of support and coordination within each agency. **Joint Coordinating Committees (JCCs)** are being established to allow timely and effective interaction and open information sharing between agencies, and to make sure that programme implementation aligns with and is supported by the broader activities and planning processes of the Ministry, the FC and the Cocoa Board. The JCC will guide programme planning, reporting and decision-making to support implementation via the PMUs (see Sections 4.3 and 6.1). For the GCFRP, representatives of the Cocoa Board, NRS and MNLR make up the JCC.

Since climate change is a cross-cutting issue, it will be pertinent to promote synergy and inter-linkages between the CCU and other divisions/units of the FC at the EMT level. For example, agenda setting and planning related to ongoing emission reduction efforts, particularly for the GCFRP, will significantly benefit from the CCU's representation at the EMT, since it hosts the NRS. It will also ensure due recognition of the GCFRP in matters of prioritization of the FC's activities and allocation of resources, especially at a time when the establishment of the **Programme Management Unit (PMU)** for the GCFRP will place even greater demands on the CCU/NRS, necessitating its increased recognition and budgetary support.

The transition to a Directorate, which is expected to be effected by mid 2017, will not require significant additional resources since the current structure of the Unit is adequate in terms of its functionality and capacity as the NRS, and nearly all the staff are on government payroll. This will change with the establishment of the PMU for the GCFRP, but these costs are already budgeted for under the programme (6.2 ER Programme Budget)

3. ER PROGRAMME LOCATION

3.1 Accounting area of the ER Programme

Ghana adopted an ecological zone (eco-zone) approach to define the area in which it plans to roll out REDD+ programmes, including the GCFRP[9]. These eco-zones were designated based on Ghana's nine forest ecosystem types (Figure 2), as defined by Hall and Swaine[10]. Five of the forest ecosystem types—Wet Evergreen, Moist Evergreen, moist semi-deciduous northwest sub-type, moist semi-deciduous south-east sub-type, and upland evergreen—were clustered together, based on their small size and common conditions, to represent a single programmematic eco-zone that is the GCFRP.

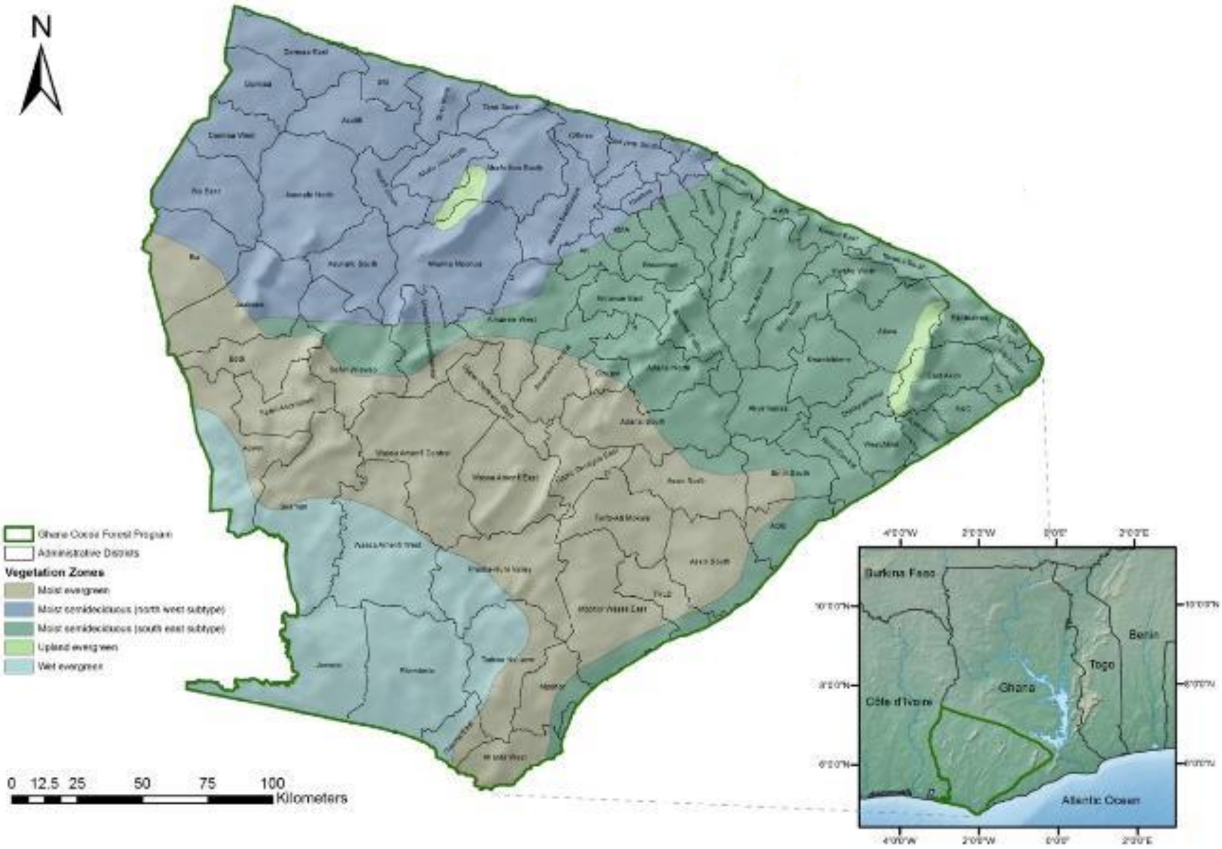

Figure 2: Ghana's forest ecosystem types, ERP area, and administrative regions

The programme area covers 5.92 million ha, is located in the southern third of the country, and forms part of the West Africa Guinean Forest biodiversity hotspot[11]. The programme area overlaps with 92 administrative districts and 5 administrative regions, including the Eastern Region, Central Region, Ashanti Region, Western Region and the Brong-Ahafo Region. However, it does not encompass the full expanse of all of these regions, as the Brong-Ahafo, Ashanti and Eastern regions stretch beyond the boundaries of the GCFRP. Approximately 2.4 million ha (Western Region and part of Brong Ahafo Region) fall within Ghana's Forest Investment Programme (FIP) area.

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[9] As described in Ghana's National REDD+ Strategy.

[10] Hall JB, Swaine MD. 1981. Distribution and ecology of vascular plants in a tropical rain forest: Forest vegetation in Ghana. Springer Netherlands.

[11] GoG, 2002. National Biodiversity Strategy for Ghana, Ministry of Environment and Science (MES), The Republic of Ghana. https://www.cbd.int/doc/world/gh/gh-nbsap-01-en.pdf

3.2 Environmental and social conditions in the Accounting Area of the ER Programme

The programme landscape is a diverse mosaic of different forest and land-use types, including just under 1.6 million ha of closed forest and just over 1.1 million ha of Open Forest that fall within five main forest types,—the Wet Evergreen Forest (387,247 ha), the Moist Evergreen Forest (823,393 thousand ha), the Moist Semi-Deciduous Forest Northwest sub-type (625,845 ha), the Moist Semi-Deciduous Forest southeast sub-type (861,284 ha), and the Upland Evergreen Forest (37,554 ha).

Over 1.27 million ha (21%) of the programme area is gazetted as forest reserves and national parks, both of which are managed by the FC and commonly referred to as the "on-reserve". The majority of the forests within the accounting area are located within the on-reserve. In contrast, the "off-reserve" (all land outside of protected areas) covers approximately 4.65 million ha and is made up of settlements and infrastructure, agricultural lands (including tree crops), fallow lands, and forest patches or high biomass agroforests. There are no national statistics available on the total area under cocoa farming, however it is estimated that across the HFZ, cocoa farms cover 1.8 million ha[12].

The programme area falls within the equatorial climatic zone. It is located between latitude 07°58.5' N and longitude 02°01.3'W, with a mean altitude of 26.3 masl. The south west part of the programme area is the wettest in the country, turning increasingly drier towards the north and east. The programme area experiences two rainfall periods with the major season from March to July and minor season from September to November. The annual rainfall decreases from about 2200 mm in the south-western corner to approximately 1,000 mm towards the northern part of the accounting area. There is a short dry season in August and a longer one between December and March. The relative humidity is always high and is seldom below 85% and characterized by mean monthly minimum and maximum temperatures ranging from 22°C at nightfall to 34°C during the day respectively.

Climate related events like high velocity winds, cyclones or hurricanes are quite rare in Ghana[13] and do not pose a significant threat to the ER Programme. Flooding has caused significant damage and loss of life in Ghana in recent years, however these events are largely confined to urban or semi-urban areas and are as much the result of blocked and clogged waterways and the loss of wetlands to development, as they are due to high incidences of rainfall in short time periods.

Drought often manifests in the programme area and across Ghana's entire HFZ. Major reductions and changes in spatio-temporal rainfall patterns across the programme area are well documented over the past 45 years, with significant reductions in annual rainfall at multiple locations, including that of Kumasi, where annual rainfall declined by more than 250 mm from the period 1951-1970 to the period 1980-2000[14]. More recent research also argues strongly that Ghana has been in a period of prolonged, low intensity drought since the 1970s[15][16]. This drying is driving a shift in the floristic and functional composition of the forests across the programme area, but surprisingly some argue that it is also driving an increase in biomass due to the selection of more drought tolerant species[17].

[12] NCRC & Forest Trends. 2011. The Case and Pathway towards a Climate-Smart Cocoa Future for Ghana. Climate-Smart Cocoa Working Group, Accra.

[13] Atlantic hurricanes rarely affect West Africa because the associated easterly winds carry the storms away from the continent, and storms in this region tend to be weak. (Adapted from "List of West Africa Hurricanes", Wikipedia, January 26, 2016. https://en.wikipedia.org/wiki/List_of_West_Africa_hurricanes)

[14] Owusu, K and Waylen, P.R. 2009 Trends in Spatio-Temporal Rainfal Variability in Ghana (1951- 2000) Weathetr 64:5 115-120

[15]Fauset, S., Baker, T.R., Lewis, S.L., Feldpausch, T.R., Affum-Baffoe, K., Foli, G.E., Hamer, K.C., and Swaine, M.D. 2012. Drought-induced shifts in the floristic and functional composition of tropical forests in Ghana. Ecology Letters (2012) doi: 10.1111/j.1461-0248.2012.01834.x

[16]Dai, A. 2011. Drought under global warming: a review. *Wiley Interdisciplip. Rev. Clim. Change, 2, 45-65.*

[17] Footnote 18

There is consensus amongst experts that cocoa is vulnerable to climate change, however adaptability and resilience will depend on a cocoa farm's locations within the landscape. Modeling of climatic and soil data shows that the majority of areas will be able to cope or adjust, while other areas may need to transition to new production systems or altered practices[18].

During years of more punctuated drought events, the forests in the programme area have also experienced fires. Historically, Ghana's most notable fire event is the 1983 fires in which thousands of hectares of forest reserves, cocoa farms, and other lands burned across the high forest and transitional zones due to two years of severe drought and an El Nino event. However, farmers in the programme area have since been documented as possessing dynamic knowledge about how to best manage and avoid fires in their farming practices[19].

The soils of the HFZ are generally developed from the rock of the Birimian system which consists mainly of argillaceous sediments metamorphosed into phyllite[20]. The south western part of the programme area has highly desaturated ferrallitic soils (Forest Oxysols and Oxysol-Ochrosol intergrade) that lack available minerals and are considered to be unsuitable for cocoa production. Moderately desaturated ferrallitic soils (Forest Ochrosols) are considered to be more suitable for cocoa and are primarily found in parts of the Eastern and Ashanti regions within the programme area. Slightly desaturated ferrallitic soils (Forest Ochrosol-Rubrisol intergrade) that have a high cation exchange capacity and are generally well-drained and deep are highly suitable soils for growing cocoa. Within the programme area, they are found in limited parts of the Ashanti Region, northern Western Region, and the southern parts of the Brong-Ahafo Region.

The protected forests within the ERP area contain more than 2,100 plant species, of which 23 species are endemic[21], and 730 are tree species[22] . Trees and woody climbers endemic to the ER Programme area include *Alsodeiopsis chippii, Bonamia vignei, Bowringia discolour, Cola umbractilis, Hymenostegia gracilipes, Monocyclanthus vignei,* and *Uvariopsis globiflora*[23]. There are over 200 species of mammals in the forests of the ER Programme area, many of which are rare or endangered, including the Bongo (*Tragelaphsus eurycerus)* Ogilby's duiker (*Cephalophus ogilbys),* West African golden cat (*Profelis aurata*)*, c*himpanzee *(Pan troglodytes),* Geoffroy's pied colobus (*Colobus vellerosus*), Diana monkey (*Cercopithecus diana* rolloway), forest elephant *(Loxodonta africana cyclotis)*, giant pangolin (*Manis gigantean*), and the *p*ygmy hippopotamus *(Choeropsis liberiensis)*[24]. The programme area also supports about 74 species of bats, 37 species of rodents, a variety of reptiles, and over 200 bird species[25]. The ER Programme area is identified as the landscape of endemism for at least twenty-three species of butterflies, three species of frogs (*Hyperloius baumanni, H. fusciventris* and *H. sylvaticus*) and one species of lizard (*Agama sylvanus*). Bia National Park, the Atewa Range Forest Reserve, and Ankasa National Park are particularly important locations for endemism and as national "hotspots" of biodiversity.

Similar to the diverse mosaic of the ERP environment, social conditions in the ER Programme area are vibrant, culturally rich and economically diverse. Ghana's national population, as of the 2010 National Census was just over 24.6 million people, with an average annual growth rate of 2.5%, and

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[18] Bunn C., Laderach, P., Quaye, A., Muilerman, S., Lundy, M. 2015. Bittersweet chocolate: the climate change impacts on cocoa production in Ghana. Story Map (http://arcg.is/1Sg047s). International Center for Tropical Agriculture (CIAT).
[19] Amissah, L., Kyereh, B., Agyeman, V.K. 2010. Wildfire incidence and management in the forest transition zone of Ghana: Farmers' perspectives. *Ghana Journal of Forestry*, Volume 26:61-73.
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[23] Footnote 14.
[24]; Footnote 14; Mensah-Ntiamoah**.** 1989. Pre-feasibility study on wildlife potentials in the Kakum.
[25] IUCN 1992. The Conservation Atlas of Tropical Forests: Africa World Conservation Union, Macmillan, U.K.

an increase in population density from 79 people per square km in 2000 to 103 per square km in 2010[26]. The total population of the ER Programme area is just over 12 million people[27], with an almost even urban-rural divide. Kumasi, the capital of the Ashanti Region, is the largest urban centre and has a population of approximately 2 million people. The average rural population density is 103 per km^2, and the accounting area has a slightly higher proportion of women to men, and approximately one third to one half of the inhabitants of the districts have migrated from somewhere else in the country. National statistics suggest that over 70% of the population is literate and 75% is economically active, with the majority of people engaged both formally and informally in the agriculture and forestry sectors[28]. Cocoa farming, other tree crop farming (oil palm, rubber, citrus), and food crop farming are the main agricultural activities in the rural areas.

The socio-cultural diversity within the GCFRP area is very high. The Akan meta-ethnic group is the largest ethnic-linguistic group in the programme area, with over two thirds of the population speaking an Akan dialect[29] (e.g. Twi, Ashanti, Fante, Bono) and belonging to one of many Akan sub-groups (e.g. Ashanti, Akuapem, Akyem, Akwamu, Ahanta, Bono, Fante, Nzema, Kwahu and Sefwi) that originate from across Ghana's HFZ and are its landowners. There are seven other populations represented in significant numbers in the programme area that derive from other parts of the country. They include Ewes, Ga-Dangbes, Mole-Dagbanis, Gurmas, Guans, Grusi and Mandi[30], and can all be further divided into sub-groups. Over the last century, the migrations in which people moved across the programme area or from other regions of the country were supported, for the most part, by open traditional systems that allowed for and even encouraged migrant settlers to help "develop" the forest land. As a result, farming and forest-fringe communities in the ER Programme area are ethnically diverse and the traditional governance structures function to support and enable these heterogeneous communities.

Across the programme's landscape, the main stakeholders with ties to the land and its resources include the following groups:

- **Land owners**: The traditional authorities (chiefs and their representatives) and family land owners who control the majority of the land in the GCFRP area.
- **Land-users**: Predominantly smallholders with long term lease-hold or rental agreements with the landowners to cultivate the land for subsistence or economic purposes. Though traditional in their structure and conditions, most "migrant" farmers who rent or lease land maintain strong user-rights to the land and agricultural resources once they have cleared land and established farms. This is especially true when cultivation involves the planting of tree crops.
- **Forestry Commission**: As enshrined in the 1992 Constitution, the GoG has the legal mandate to manage Ghana's natural resources on behalf of the people, including its timber and forest resources. As such, the FC has the legal right and responsibility to manage Ghana's forest reserves and national parks, as well as timber trees in the off-reserve landscape.
- **Other Government Entities**: Many government agencies and institutions are present and working in the ER Programme landscape, including the local District Assemblies, agricultural extension services, and regulatory bodies. Though they do not own the land or its resources, they play key roles in determining land use and in supporting decision making and information sharing.
- **Women**: Though they are integral members of all of the above groups, the role of women in the social structure, and the nature of their relationships and access to resources means that they represent a unique stakeholder group that has distinct roles in land-use decision making processes, resolution of disputes, and traditional governance systems. For example, women serve as Queen Mothers and are responsible to select the Chiefs, they are farmers and forest users who typically operate with more

[26] Ghana Statistical Service 2012. 2010 Population and Housing Census (PHC), Final Result. http://www.statsghana.gov.gh/docfiles/2010phc/2010_POPULATION_AND_HOUSING_CENSUS_FINAL_RESULTS.pdf
[27] This figure was arrived at based upon assessment of population data from the 2010 National Census data for those districts situated within the programme area.
[28] Ghana Statistical Service, 2010 Population and Housing Census (http://www.statsghana.gov.gh/censuses.html)
[29] Ghana Statistical Service, 2010 Population and Housing Census (http://www.statsghana.gov.gh/censuses.html)
[30] GSS 2010 Census; Ghana Web—Ethnic Groups (http://www.ghanaweb.com/GhanaHomePage/tribes/)

limited financial and labor resources, they are often the main decision makers in the household, if not the head of the household, and in addition to farming are responsible for maintaining the household.

- **Minority populations:** Minority groups also require consideration due to their migrant status and differentiated rights. For example, migrant farmers and laborers are key stakeholders because the associated rights regimes affect how decisions are made with respect to the land, trees, and forests. For migrant farmers, under the traditional governance systems, symbolic “chiefs” of other ethnic groups are often formally recognized by the land owners and by their fellow community members to lead a particular ethnic group and to liaise with the sitting rulers and decision makers. However, some minority groups who practices pastoral activities, like the Fulani, are more frequently associated with major conflicts and therefore require special attention as stakeholders if such incidences are to be reduced.
- **Private sector**: Agricultural companies and service providers represent another very important stakeholder in the landscape due to their investments and operations on the ground. Specifically, their investment and role is in the cultivation, purchase, extension, training and/or monitoring of cocoa, oil palm and other tree crops or food crops.

4. DESCRIPTOIN OF ACTIONS AND INTERVENTIONS TO BE IMPLEMENTED UNDER THE PROPOSED PROGRAMME

4.1 Analysis of drivers and underlying causes of deforestation and forest degradation, and existing activities that can lead to conservation or enhancement of forest carbon stocks

The GCFRP landscape is endowed with many agricultural and natural resources that are vital to the national economy and to people's livelihoods. The main agricultural resources[31] in the programme area include cocoa, palm oil, rubber, citrus, and food crops like plantain and cassava. The main natural resources found within the accounting area that contribute to the economy are gold[32] and timber. In 2015, the top foreign exchange earners for the country were gold, oil, and cocoa[33].

Due to Ghana's high economic dependence on natural resources, the country now has one of the highest deforestation rates in Africa, at 3.2% per annum. Unlike other REDD+ countries facing frontier deforestation, Ghana's deforestation pathway is one of incremental degradation leading to deforestation and the R-PP identifies the principal drivers of deforestation and degradation, in order of relevance, as including[34]:

1) Uncontrolled agricultural expansion at the expense of forests;
2) Over-harvesting and illegal harvesting of wood;
3) Population and development pressure; and
4) Mining and mineral exploitation.

The underlying causes of these drivers were identified as forest industry over-capacity, policy and market failures, population growth, increasing demand for agriculture and wood products, low-tech farming systems that continue to rely on 'slash and burn' farming methods, and a burgeoning mining and (illegal mining) sector. The R-PP further identifies agricultural expansion (50%) as being predominantly attributed to cocoa cultivation systems, and thus distinguishes cocoa farming as one of the most significant drivers of deforestation across the high forest zone of the country[35].

Following the completion of Ghana's R-PP, it became increasingly clear that the rates of forest loss and drivers and agents of deforestation and degradation varied depending upon the eco-zone. During the development of the ER-PIN, a high level group of technical experts from the forestry and cocoa sectors conducted a detailed assessment of the main drivers and agents of emissions acting within the on-reserve and off-reserve landscape of the GCFRP (Table 3).

And most recently, in the assessment undertaken for the development of the forest reference level for the GCFRP area, the conversion of forests to agriculture land was identified as the primary driver of deforestation in the programme area. The assessment indicates that about 110,000 ha of forests

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[31] Despite its importance, the contribution of Ghana's agricultural sector (including forestry) to GDP in 2014 was 21.4%, lower than in previous years but reflective of an economy that has entered middle income status and has started producing oil.

[32] The mining sector remains a strong contributor to foreign direct investment at 37% and mining contributes 1.7% of Ghana's GDP. (Ghana Chamber of Mines, 2015. Mining in Ghana – What future can we expect? International Council on Mining and Metals. Mining: Partnerships for Development July 2015). http://www.tabforestmines.com/wp-content/uploads/2015/10/Ghana-Chamber-of-Mines-report.pdf

[33] Bank of Ghana, 2015. Summary of Macroeconomic and Financial Data. http://myjoyonline.com/docs/56588sum-data.pdf

[34] GoG, 2010. Readiness Preparation Proposal Ghana: Revised Ghana R-PP. Accra, Ghana. https://forestcarbonpartnership.org/sites/forestcarbonpartnership.org/files/Documents/PDF/Jan2011/Revised_Ghana_R-PP_2_Dec-2010.pdf

per annum (1.65 million ha over the reference period) was converted to agricultural land during the reference period and this accounted for 83 percent of deforestation in the programme area.

Out of the total area deforested for agriculture, 66 percent was from food crop cultivation and 27 percent was from cocoa expansion, making cocoa the single most important commodity driver of deforestation in the programme area. The remaining 7% was from citrus, oil palm and rubber expansion. Further, the establishment of a cocoa farm is typically preceded by the planting of food crops as initial shade cover, so it is likely that a significant proportion of food crop land becomes cocoa land.

In the closed forest (on-reserve), cocoa and food crops were evenly responsible for forest loss (78% together). In the Open Forest, deforestation were driven by food crop expansion (63%), cocoa expansion (15%) and grassland (15%), which includes young fallows and is linked to food crop production. Table 14, in Section 8.3.2 provides a matrix of all land-use types driving deforestation.

Table 3: Drivers and agents of deforestation and degradation in the GCFRP

Drivers of Deforestation & Agents
Land Use Type: Protected Forest (Forest Reserve, National Park, Globally Significant Biodiversity Area)
Encroachment of low/no shade cocoa systems and associated food crops into protected forests by cocoa farmers.
Illegal logging in Forest Reserves by timber companies and chainsaw operators, legal logging by timber companies.
Illegal mining by small-scale miners (galamsey), as well as legal mining by mining companies and small-scale miners.
Land Use Type: Off-Reserve (Forests, Fallows & Trees in Landscape)
Elimination of shade trees from the cocoa system and other natural trees on-farm by cocoa farmers, chainsaw operators, and timber contractors
Logging in off-reserve concessions by logging companies.
Illegal mining by illegal small-scale miners (galamsey), as well as legal mining by mining companies and small-scale miners.
Replanting cocoa in over-aged, high shade cocoa farms by cocoa farmers as promoted by sector-wide rehabilitation and replanting efforts.
Expansion of cocoa into off-reserve forest or forest fallows by cocoa farmers.
Expansion of other tree crops and food crops into off-reserve forests or forest fallows by food crop farmers, as well as oil palm, rubber, and citrus farmers, often promoted by industry goals and packages.
Drivers of Degradation
Land Use Type: Protected Forests (e.g. Forest Reserve, National Park, Globally Significant Biodiversity Area)
Encroachment of cocoa systems into protected forests by cocoa farmers.
Legal logging by timber companies and illegal logging by timber companies and chainsaw operators.
Land Use Type: Off-Reserve (Forests, Fallows & Trees in Landscape)
Reduction in shade trees on cocoa farms and in the farming system.

*Protected forest is typically "Closed Forest" and Off-Reserve forest is typically "Open Forest"

The underlying causes of these drivers broadly stems from sector policies (e.g. tree tenure policies) and traditional norms ("abunu" sharecropping does not favor rehabilitation of old cocoa farms) that create perverse incentives and promote expansion; the prioritization of economic growth with only limited regard for environmental sustainability (e.g. agriculture and mining sectors); increased market prices and demand (cocoa, oil palm, rubber, gold, domestic timber); lack of coordination and collaboration within and between sectors; ineffective law enforcement and a total lack of land-use planning in rural areas.

This has therefore resulted in the continued conversion of lands and expansion of cocoa and other crops at the expense of forest, trees, and ecosystem services. For example, Ghana is the world's second largest producer of cocoa beans, but average farm yields remain low, estimated at 400 kg/ha. The vast majority of Ghanaian cocoa is grown within the GCFRP area by about 800,000 smallholder farm families. National cocoa production has increased from approximately 399,691 tons in the 2001/2002 season to a national production peak in 2011/2012 of 1 million tons, but in the ensuing years production has declined to 740,000 tons in 2014/2015 and 680,000 tons in 2015/2016 (Figure 3). Though yield gains have been achieved across this period as a result of the sector programmes aimed at increasing input supply (High Tech), disease and pest control (CODAPEC), and replanting and rehabilitation (CORIP), national production gains have also resulted from area expansion, which aligns with Ghana's increasing deforestation trends in the landscape. Thus, people's dependence on this sector for their livelihood is very high[36].

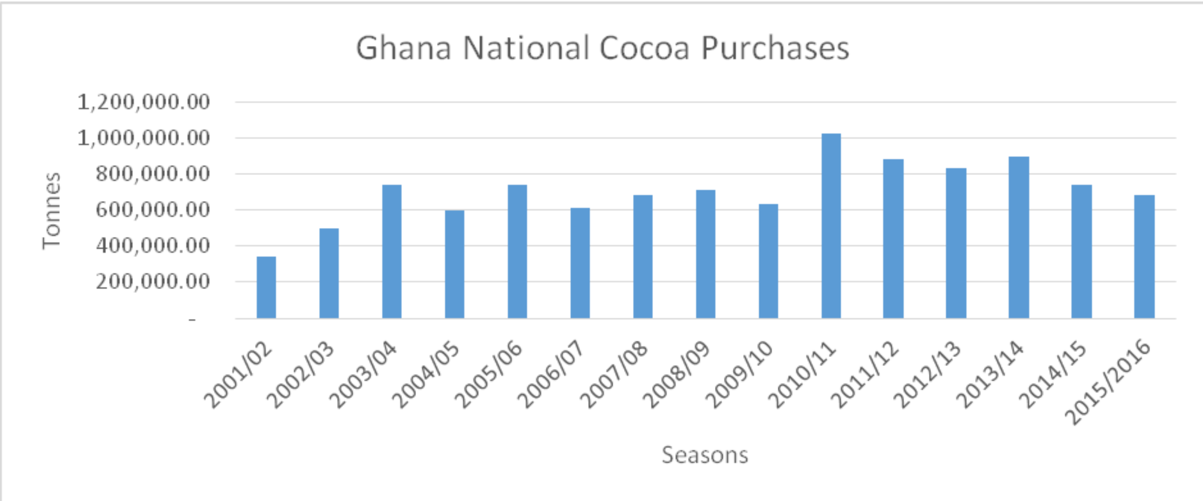

Figure 3: National cocoa purchases from 2001/02 to 2015/2016

The problem of illegal small-scale mining (galamsey) is one example of how the influence and impact of drivers can change in a short period of time. Though illegal mining has always occurred in Ghana and was mentioned in the R-PP, its escalation post-2012 has brought it to the forefront as a clear driver of land-use change, degradation, and pollution in the GCFRP area. As such, Ghana's National REDD+ Strategy lists illegal small-scale mining as a serious driver, though the scale of its impact is not as significant as agricultural expansion[37] because more hectares of cocoa farms are being mined for gold than forest land. Nonetheless, the increase in legal and illegal gold mining across the GCFRP area has come as a result of a global jump in the price of gold, government regularization of some degree of small-scale mining, the implementation of large scale infrastructure projects that brought foreign laborers (e.g. the Bui Dam, funded by the AfDB with Chinese contractors), and the increasing availability of machines and foreign expertise.

Timber stocks in Ghana are on the decline as a result of the dwindling forest resource base[38], but despite the decline in export revenue from the forestry sector, the domestic demand for timber has been increasing over time, and with it illegal logging. For example, Hansen *et al*. (2012) documented how Ghana has exceeded its annual allowable cut by six times in the domestic market alone[39].

[36] World Bank. 2013. Ghana: Cocoa Supply Chain Risk Assessment. Washington, D.C. https://openknowledge.worldbank.org/handle/10986/16516
[37] NCRC 2016. Ghana Cocoa Forest REDD+ Programme – Draft Implementation Plan Report. http://www.fcghana.org/userfiles/files/redd/GCFRP_draft_Implementation_Plan_2016.pdf
[38] Oduro, K.A., Mohren, G.M.J., Affum-Baffoe K., and Kyereh, B. 2014. Trends in timber production systems in the high forest zone of Ghana, International Forestry Review 16(3):289-300
[39] Hansen, C.P., Damnyag, L., Obiri, B.D., and Carlsen, K. 2012. Revisiting illegal logging and the size of the domestic timber market: the case of Ghana. *International Forestry Review,* (14(1), 39-49.

Oil palm, rubber and other tree crops like citrus are also important commodities produced within the accounting area. Though comparatively these commodities have yet to cause significant emissions, both rubber and oil palm are in a period of expansion and could pose a future threat to off-reserve forests and high biomass fallows and secondary forests. For example, oil palm cultivation covers over 400,000 ha in the GCFRP area, and production is currently in an expansion phase as the sector tries to meet a national palm oil deficit of 35,000 tons and a regional deficit of 850,000 tons. It is estimated that independent smallholders are producing over 1.2 million metric tons of fresh fruit bunches (FFB) per year and estates processing over 400,000 metric tons[40].

Because Ghana defined the boundaries of the GCFRP based upon ecological boundaries, there are few significant drivers or policies focused outside of the accounting area that could increase emissions within the accounting area. The farming systems and natural resources located outside of the programme's boundaries tend to be ecologically and climatically limited, and the related policies are also limited in their geographic scope.

Ghana does have policies and activities in place that could contribute to the conservation or enhancement of carbon stocks in the programme area.

- *Ghana's Land Administration Project* (LAP) commenced in 2003 and seeks to implement the policy actions recommended in the National Land Policy of 1999 over a 15-25 year period with an aim of addressing the challenges associated with the land sector in Ghana. Land use planning features strongly in Ghana's LAP and is being spearheaded by the Town and Country Planning Department. However, work thus far has focused on spatial planning for human settlements and urban development with very limited attention to rural areas and other land uses – agriculture, forestry, mining etc. Therefore, there is still a strong need for the GCFRP to pioneer landscape level land-use planning and the accompanying institutional and public-private sector coordination across the cocoa-forest landscape.
- *Ghana's FIP* will implement projects in the Western and Brong-Ahafo regions that support the establishment of biodiversity corridors, tree planting for appropriate shade management in cocoa farms, as well as plantation development.
- *Ghana's Forest Plantation Strategy* (2016-2040) aims to promote the restoration of degraded forest lands through the development of commercial forest plantations, smallholder plantations, enrichment planting, and incorporation of trees on farm.
- *The FLEGT-VPA* process, in which Ghana has committed to developing a timber legality assurance system so it can verify legal timber products, for both international and domestic markets, has progressed to the 'joint assessment of the legality assurance system'. Once it is demonstrated that the system is fully operational, as described in the VPA, a recommendation can be made for Ghana to start issuing FLEGT licenses for export to EU countries.
- *The Ghana Cocoa Sector Development Strategy II* is currently awaiting validation. It is expected that this strategy document will provide overarching guidance towards enhancing sustainability of cocoa production in Ghana through the development of a Ghana Standard that leads to yield improvement, an increase in shade cover in cocoa farming systems to recommended levels and the prevention of the expansion of cocoa into forested areas, and forest reserves in particular.
- The Africa Palm Oil Initiative which is being coordinated by Proforest aims at sustainable palm oil production in 8 African countries including Ghana. In Ghana, palm oil cultivation is practiced at small and large-scales by smallholders and corporations respectively, and both are present within the ERP programme area. MoFA and several stakeholders including other

[40] Ministry of Food and Agriculture 2011. Master plan Study on the Oil Palm Industry in Ghana. Final Report. MASDAR, November 2011. https://drive.google.com/a/st.ug.edu.gh/file/d/0B4fn1Fz6J8K9djY5X1JlaHVyeUE/view

agencies of state, private sector players and palm oil farmers are working together to ensure that the supply chain of this important industry is made more sustainable and climate-smart..

4.2 Assessment of major barriers to REDD+

The decision to pursue a jurisdictional, programmatic strategy to mitigate the main drivers of deforestation and degradation was largely influenced by the recognition that the barriers can only be addressed at a landscape scale, because they are landscape-wide issues. These barriers include the lack of coordination and planning amongst implementing agencies, companies, organizations and governance bodies across the cocoa and forestry sectors, which has allowed institutions to work in contrast to one another. In addition, farmers' and forest users' decision-making is still being driven by economic and policy constraints, including limited access to resources (information, economic, agronomic), tree tenure regimes that do not incentivize retention of trees on-farm, and land-use arrangements that promote extensive practices. The lack of resources and capacity to support effective law enforcement, have also left the forests highly susceptible to wanton exploitation. And the total absence of land use planning in rural areas has meant that there is no reflection or planning about how resources should be managed.

Mining is increasingly becoming a driver of deforestation in the programme area. The incidence of legal/ illegal surface mining with deleterious impacts on cocoa farms, forest cover and water resources has increased over the past few years driven primarily by a myriad of factors which have been outlined below. Although, curbing illegal mining activities is primarily a national security concern, the GCFRP implementation will partly focus on piloting approaches towards addressing barriers that have worsened illegal mining activities within the selected HIAs. In addition, the programme will also keenly follow and collaborate with other measures targeted at addressing the barriers and threats associated with illegal mining activities and being spearheaded by relevant state institutions including the MC and agencies responsible for national security. All of these barriers are further described in Table 4Table 4.

The Government of Ghana has announced an ambitious plan to tighten regulation of small-scale mining in Ghana, with special attention given to the banning of "galamsey". This is in response to a massive groundswell of public outrage at the phenomenon being championed by the mainstream media in Ghana and other civil society groups. The NRS has also played an important role in raising awareness about the effects of illegal mining. In September 2016, the NRS launched the regional REDD Eye Campaign, which was held at Anyinam near Atewa Forest Reserve, in Eastern Region, under the theme "Promoting Youth Awareness and Involvement in REDD+ Actions" to draw attention to the destructive nature of galamsey.

In April, 2017, as part of steps by government to address illegal mining and associated deforestation and degradation, an ultimatum was set for illegal miners to vacate illegal mining sites across the country by the 19th of April. The ultimatum has now taken effect and mining equipment used in the illicit operations has already been surrendered or impounded. The target group has so far been cooperative and the various state security agencies are enforcing the ban within the limits of the law.

The MLFM has also recently launched the Multilateral Mining Integrated Project (MMIP) to strengthen the enforcement of mining regulations and also to mitigate and remediate the environmental damage caused by mining, with the support of development partners.

The logic and strength of the GCFRP is that it is built upon the concept that these drivers and barriers cannot be addressed at a project or singular institutional level, which has been the practice to date, but necessitate a large-scale, integrated approach in order to foster the large-scale changes in farming practices and land use decision making required to reduce deforestation and degradation, and to foster the growth of forests and trees in the off-reserve farming landscape. Therefore, the development of the GCFRP is an effort to use a coordinated landscape approach that targets all stakeholders as a strategy to change the business-as-usual and reduce emissions from the landscape.

Table 4: Major barriers to achieving REDD+ and CSE and progress in overcoming these barriers

Drivers	Existing Barriers to REDD+ and CSE	Progress in Overcoming Barriers
Cocoa farm (and food crop farm) encroachment and expansion.	**Lack of sector coordination**: Institutional culture has discouraged collaboration or coordination on the ground. The culture of government institutions, scope of responsibility, limited resources, and desire to retain control over the institutional "territory" has in many ways prevented government bodies, like the Cocoa Board and the FC, from working together. The inward focus of project by the private sector, civil society, and government initiatives has meant that there has been very limited coordination of resources across the landscape. The private sector and civil society are investing substantial resources into cocoa projects and programmes however collaboration among them is low.	**Collaboration in target landscapes and across institutions**: The main barrier, which this programme will address, is the inward oriented, short term project-driven mentality of these initiatives, and competition between private sector players, which has prevented initiatives from thinking and working at a landscape, sector-wide scale. A strong and inclusive REDD+ readiness process and the drafting of the ER-PIN and design of the ERPD have already led to increased coordination between sectors. The FIP is also contributing to this shift. There is a new, positive outlook carrying forward, however, more progress is required. Key private sector companies, like Touton, Olam, Mondelez, and Armajaro are also showing a desire to collaborate in target landscapes.
	Ineffective law enforcement: Within the FC there is limited capacity and resources to monitor and enforce boundaries, and to pursue cases within the courts. Communities and Traditional Authorities have few incentives to protect forests due to the absence of benefits and accountability to do so.	**Improving law enforcement** will come from combining hard and soft approaches in tandem. Expanding law enforcement capacity is a priority of the programme and resources have been allocated to support its enhancement. The soft approach, which is even more important, will come through the leadership of traditional leaders and the development of HIA management plans that will reduce encroachment by giving communities the power and responsibility to create rules, resulting in the adoption of district by-laws, that will be monitored locally.
	Ineffective cocoa sector certification and policies: Within the cocoa sector, there is not a common definition of sustainability and landscape issues and emissions have never truly been addressed. Consequently, deforestation has continued relatively unabated, despite the implementation of numerous "sustainability" projects and certification initiatives. Extension systems, which operate under public-private partnerships, have very high implementation costs and therefore the majority of farmers do not receive access to any form of extension. Even farmers who want to follow best practices lack easy access to financial resources. Further,	Steps that are being taken to develop a **Ghana Climate-Smart Cocoa Sustainability Standard** will ensure that deforestation and landscape emissions are taken into account, and the HIA model will reduce implementation costs. The commitment, leadership and investment from the private sector and Cocoa Board will lead to major improvements in the system. Through the CSC Standard resilience to climate change will be improved.

	poor implementation of government's input-supply policy has resulted in a recent fall in yields. Farmers who do practice recommended practices and invest in inputs on-farm are also at high risk from losses due to climate change.	
	Low cocoa yields: It is cheaper for farmers to expand/encroach in order to exploit the forest rent than to invest in inputs and other best practices. Farmers have limited access to key farming inputs and extension on best practices that could otherwise increase yields, as described above.	**Models and systems to improve yields have been demonstrated by the private sector**, but the GCFRP will enable them to be scaled out to many more farmers. **FIP** activities in target HIAs will provide an early start to the roll-out climate-smart cocoa practices.
	Lack of land-use planning in rural areas: In the absence of landscape level land-use planning, cocoa farmers and land owners can expand or encroach into forest areas with few consequences.	Implementation of the **HIAs** will lead to the development of landscape management plans. The **FIP** is expected to help address this barrier with its focus on CREMA establishment and land use planning in target HIA landscapes. Ghana's **Land Administration Project (LAP)** has the potential to help address these barriers as well.
Illegal logging	**Ineffective law enforcement**: There have been limited financial resources and capacity of FC to effectively monitor, enforce or prosecute the laws. Community members and leaders are not authorized nor incentivized to support law enforcement.	See **improving law enforcement** above. **FLEGT-VPA**: Ghana has made significant progress on its FLEGT-VPA, even leading an initiative to include domestic timber, but it has yet to receive authorization for a full roll out. This is expected to happen in the near future.
	Market demand: The domestic demand for timber is very high and cannot be met by the annual allowable cut. Thus contractors often exceed their permits or yields without consequences and chainsaw operators are incentivized to cut trees within forest reserves or farms to meet the market demand.	**Ghana Forest Plantation Strategy:** The GFPS is going through final validation. With the private sector and Ghana budgetary support that is expected to follow, the strategy will help to reduce demand from illegal sources by providing a major new source of domestic timber, while also supporting carbon stock enhancement in the GCFRP area, which will meet domestic timber and climate goals.
	Perverse or ineffective formal and customary policies: Farmers and community members ignore or enable illegal logging because they do not have economic rights to trees.	**Tree tenure reform** is underway and recommended reform options will be tested within HIAs.
	Market demand: Due to the global price of gold, the promise of high economic return from mining drives these practices.	The international gold price peaked at a ten year high in 2012, but has been declining ever since. In addition, many of the surface mining opportunities in the GCFRP landscape have been exhausted. The programme expects that the surge in illegal small-scale mining will therefore decline significantly.
	Ineffective law enforcement and institutional weaknesses: Illegal small-scale mining is a national security threat due to the level of conflict that can and has ensued, and thus is not a barrier that the programme can hope to address without national security bodies taking the leading and enforcing the full implementation of the law.	Nonetheless, GCFRP **collaboration with the MC** has begun and it is expected that land use planning in HIAs will help to address this challenge.
	Low cocoa yield: Low economic returns from cocoa farming and other practices due to depleted soils and lack of access to economic	The programme is designed to address the problem of low yields and to ensure financially sustainable HIA landscapes.

Legal and illegal small-scale mining	and agronomic resources often drive farmers to allow conversion of cocoa farms to small-scale gold mines.	
	Lack of land-use planning in rural areas: In the absence of landscape level land-use planning, individuals can convert their lands to mining when and as they wish. This remains a majorbarrier to addressing the mining issue.	**Collaboration in target landscapes and across institutions**: See response in Cocoa farm encroachment and expansion section above.
	A **myopic focus on maximizing mining revenues** by actors, including the government, without due consideration of the negative and in some situations irreversible environmental impacts,	The GCFRP can shed much needed light on this issue at multiple levels and will champion sustainable options in HIAs.
	Challenges with the governance framework on mining including an under-resourced Commission, inadequate compensation and transparency concerns that drive key stakeholders, including unemployed youth, to undertake illegal mining activities. The lack of land use planning and absence of interventions to support best practices also contributes.	See response above as to how programme will indirectly tackle this barrier. The **Cocoa Board has launched a new initiative to target youth in cocoa farming**, which give them new options
Elimination of shade trees in cocoa farms and other lands	**Perverse or ineffective formal and customary policies**: Farmers have no economic/ management rights to economic trees, and receive no benefits when they are legally harvested by others. Contracts granted in cocoa farms causes damage to cocoa trees, with little to no compensation for farmers, and illegal chain-sawing of trees in farms further exacerbates the problem. It is widely recognized that Ghana's tree tenure regime creates a perverse incentive to remove trees from the farming system.	See **Tree Tenure Reform in Illegal Logging** above. **FIP** is designed to address some of these issues, both by encouraging good shade management in cocoa farms (climate-smart cocoa) with access to shade tree seedlings, as well as piloting of tree tenure reforms.
	Low cocoa yield: There has been a lack of information about the ecological benefits of shade trees in cocoa farms and many farmers have a negative perception of some shade tree species. As a result, many farmers eliminate shade trees in an effort to increase yields.	Directly addressed by the programme.
Replanting over-aged high shade/ high biomass cocoa farms	**Perverse or ineffective formal and customary policies**: The cocoa sector policy to replant/rehabilitate old cocoa farms has failed to conserve high biomass in many of these farms. Currently the policy promotes farmers to reduce or eliminate mature shade tree canopies, resulting in significant loss of biomass, through the recommended replanting practices.	**CSC Good Practices guidelines** to be promoted under the Standard, coupled with land use planning in HIAs will address this.
	Lack of land-use planning in rural areas: The absence of landscape level land-use planning has meant that land owners and land users often convert such lands to lower biomass uses.	**HIA landscape land use planning** will address this.
	Low cocoa yield: Low cocoa yield pushes farmers to rehabilitate old farms and in doing so remove the shade tree canopy.	See responses given above.

4.3 Description and justification of the planned actions and interventions under the ER Programme that lead to emission reductions and/or removals

Building from the main interventions laid out in the ER-PIN, focused brainstorming by technical experts, and input based on the experiences and ideas of key stakeholders and partners, Ghana has constructed a set of priority interventions and activities that are arranged according to 5 key pillars. These activities and concepts are not new ideas, but represent well-tested and adopted models, activities, and practices. The programme's implementation plan therefore builds upon what has been shown to work and brings them together to operate in concert across the landscape. It is expected that these actions and interventions will lead to emission reductions and removals in the GCFRP landscape.

This section provides an overview of the main interventions and activities that will be implemented to set the programme in motion and enable it to achieve its goals. These interventions and activities are organized according to the programme's 5 main pillars: A) Institutional Coordination and MRV; B) Landscape Planning within HIAs; C) Increasing Yields via Climate-Smart Cocoa; D) Risk Management and Finance; and E) Legislative and Policy Reforms (Figure 4). These pillars are based on the original pillars described in Ghana's ER-PIN but reflect a new degree of thought and experienced reflection on what it will take to make the GCFRP implementable and successful.

These interventions are further elaborated through a narrative description that provides the specific details about who is responsible for the interventions, the associated sub-activities, and the logic that underpins them.

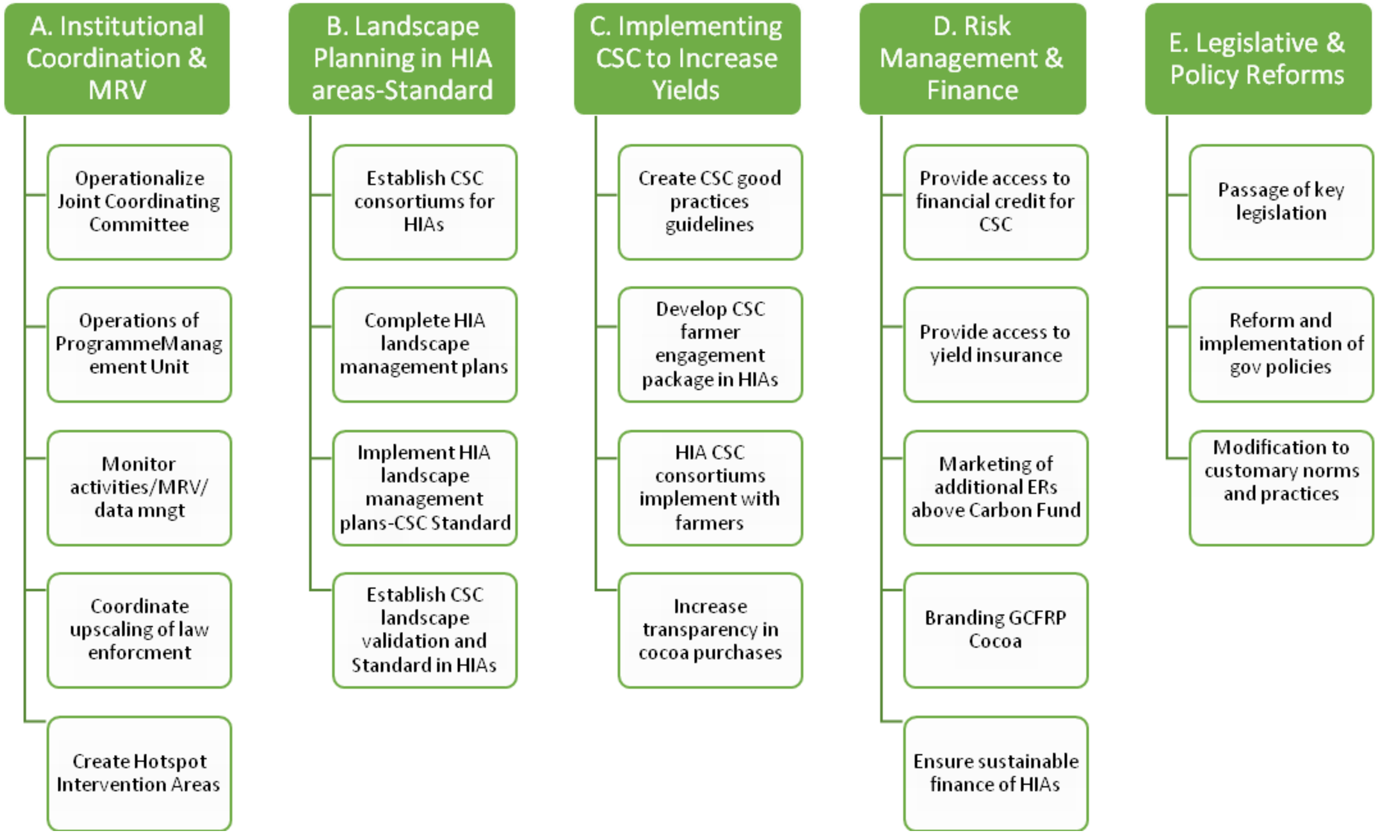

Figure 4: Implementation plan and intervention and activities

A. Institutional Coordination & MRV

Ghana views institutional roles and arrangements as a key part of the implementation plan, however three of the five main elements of this part of the plan, including; A1) Operationalizing the Joint Coordinating Committee, A2) Establish and Support Operations of the PMU, and A3) GCFRP Activity Monitoring/MRV/Data Management are described in Section 6.1—Institutional and Implementation Arrangements—and not in the present section.

A1. Operationalizing Joint Coordinating Committee (JCC)

See 6.1 Institutional and Implementation Arrangements

A2. Establish and support operations of Programme Management Unit (PMU)

See Section 6.1

A3. GCFRP activity monitoring/MRV/Data management system

See Section 6.1

A4. Law enforcement within the GCFRP area

To successfully achieve emission reductions within the GCFRP area, enhanced attention and significant financial support will be given to the FC (FSD and WD district offices) to reduce illegal activities associated with mining (galamsey), chainsaw operations, and to a lesser extent bushfires. This will come through new collaborations with communities and other government agencies (MC), improved monitoring techniques and expanded operations, and a significant scaling up of human and financial resources to support the full implementation of forestry and natural resource laws through arrests and prosecution of perpetrators.

Within the HIAs, monitoring of deforestation and degradation activities and trends will happen through an approach that combines remote sensing with on-the-ground observations using existing structures and facilities within the RMSC. In line with HIA consortium agreements, partnerships will be established between FSD and Wildlife staff, the HIA governance board (see A5, below) and other consortium members to enable frequent patrols and monitoring. These collaborations and agreements will be developed such that community members can play a key role (under the authority of the FC) in monitoring and reporting illegal activities to the authorities.

If the prevalence of illegal activities is high, resources will mobilized from within the programme law enforcement budget to FC district/regional offices to support swift reactions and enforcement of the laws. This could be in the form of increasing the number/strength of FC Rapid Response Unit teams, increasing the number of lawyers to prosecute violations of the law (both in district courts and in Accra), or increasing support to fire volunteer teams. The RRU was established to combat illegal forest operations within the forest estate, and provide timely response in halting (disrupt and suppress) organized forest and wildlife crime to eventually reduce forest and wildlife offences. However "soft" approaches to sustaining resources such as increasing benefits through tree tenure reforms and higher level community involvement in resource management would also be adopted since "hard" law enforcement techniques are fraught with some limitations, and can only be successful if coupled with community engagement and co-monitoring[41].

[41] A recent study by Franck and Hansen (2014) assesses the effectiveness of Ghana's FC task forces in reducing illegal logging and makes recommendations which align with the programme's law enforcement implementation plans.

At the community level, sensitizations on laws and illegal vs. legal activities will also take place. Most importantly, however, the traditional authorities will be asked to take a strong role in enforcing traditional norms and practices and deterring illegal activities. When fully engaged on an issue, the power of traditional leaders and land owners to influence outcomes is very strong. Through the traditional systems, each HIA constitutions will incorporate land use plans that eliminate the opportunity for illegal land use practices and result in the establishment of local rules that outlaw activities related to illegal logging, mining and/or bush fires. These rules will be backed by district level by-laws, which enable arrests and prosecutions to take place locally. Through existing CREMAs, Ghana has already demonstrated many successful community-based law enforcement outcomes from this model. It is not a new concept, but a tested practice.
In areas that fall outside of the first set of HIAs, increases in deforestation and degradation will be monitored from annual remote sensing analysis or identified by regional and district level FSD and WD offices. Where deforestation and degradation events emerge, the GCFRP will make resources available to the FC and other partners to be able to respond to the threats in a timely and effective manner.

The Forestry Commission has a long-standing tradition of managing forest reserves guided by management plans that set out clear management objectives and the basis for actions and measures necessary for achieving them. This approach has remained the practice up to now and the FC makes continuous efforts to revise these management plans over time (the latest being the 2014 revised management plans) to accommodate changing situations and exploit available opportunities e.g. VPA-FLEGT, REDD+, Forest Certification.

There are also a number of toolkits and codes that provide guidance for forest managers and administrators to facilitate and promote sound forest management practice in Ghana, including the Forest Protection Strategy, FC Logging Manual and the set of Manual of Procedures (MoP). There are also Biodiversity Management Plans for selected reserves designated as Globally Significant Biodiversity Areas due to their high levels of biological diversity determined through scientific field assessments. The FC has also instituted penalties and other measures of deterrence including the withdrawal of "Property Mark" (authorization for timber firms to operate legally) as well as fines for breach of forest regulations.

Outside the gazetted forest reserves where the FC’s control is limited, timber salvage operations are regulated using existing forest laws and codes (e.g. MoPs). Efforts to introduce a Legislative Instrument (LI))—Timber Resources Management and Legality Licensing Regulation 2016—to strengthen regulation of timber operations off-reserve are far advanced.

A5. Creation of CSC Hotspot Intervention Areas

The programme has identified 9 possible Hotspot Intervention Areas (HIAs) (Figure 5), of which approximately 6 are in the process of being selected through consultations to serve as priority areas for immediate concentrated interventions at the farm to landscape level. These areas have been delineated as groups of districts and selected based on the assessment and comparison of key parameters such as: (i) deforestation trends and drivers of deforestation, (ii) cocoa production, (iii) and population.

In order to ensure a manageable intervention landscape sizes, it was decided that in the initial implementation phase (first 5 years (2017-2021)), the HIAs should cover about 200,000 ha each and all together account for approximately 30%-40% or 2 million – 2.5 million ha (maximum) of the total GCFRP area. Estimates based on the FRL and estimated forest carbon stocks within the HIAs suggests that each HIA would need to reduce approximately 1,300 ha of deforestation to reach the FREL and an additional 1,700 ha to attain the projected ERs for the programme. This estimate did not include reductions from degradation or removals from CSE.

Table 5 provides a general breakdown of the nine proposed HIAs, including districts, regions, area, and total HIA area. The programme has already identified 4 HIAs where efforts have already begun, and the remaining HIAs and their consortiums will be identified in the coming months.

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- The "Suaman Sefwi-Akontonbra Aowin" HIA Consortium (#8) is being led by the FIP team, with FC, Cocoa Board, and other ministries and agencies.
- The "Juabeso-Bia" HIA Consortium (#9) is being led by Touton/PBC with SNV, Agro-Eco and other stakeholders.
- The "Adansi South Adansi North" HIA Consortium (#6) is being led by NCRC with Touton/PBC, Man & Nature, Oxford Univ. and other partners.
- The "Asunafo North Asunafo South Asutifi" HIA Consortium (#7) is being led by Mondelez and UNDP.

The implementation of priority activities in each HIA will rely on a consortium of stakeholders (HIA CSC Consortium[42]) who live, work, or have investments within the landscape, and have an interest in the area. The landscape itself will be managed by an HIA Governance Body made up of local land-users, land owners and traditional authorities who organize themselves into a government recognized NRM structure, like that of the CREMA, which accords them the right to manage their natural resources for their benefit.

Table 5: Possible Hotspot Intervention Areas (HIAs) for the GCFRP

HIA & **Districts**	**Region**	**Capital**	**Total Area (ha) / Area**
#1			**365,673**
Ahafo Ano South	Ashanti	Mankranso	120,098
Atwima Mponua	Ashanti	Nyinahin	168,433
Atwima Nwabiagya	Ashanti	Nkawie	77,142
#2			**245,976**
Kwaebibirem	Eastern	Kade	72,975
Asante Akim South	Ashanti	Juaso	115,524
Birim North	Eastern	New Abirim	57,477
#3			**209,495**
Bibiani/Anwiaso/ Bekwai	Western	Bibiani	82,067
Sefwi Wiawso	Western	Sefwi Wiawso	127,428
#4			**216,965**
Atiwa	Eastern	Kwaben Town	99,116
Denkyembour	Eastern	Akwatia	48,251
East Akim	Eastern	Kibi	69,597

[42] Though CSC primarily refers to climate-smart cocoa, it encompasses the broader concept of transitioning land use practices and production system across the HFZ to a to a climate smart, low emissions landscape that supports sustainable production system. Therefore, where other tree crops (like oil palm or rubber) or land use practices (like illegal mining) are contributing to deforestation and degradation (or other types of emissions), the same concepts, structures, and steps will apply.

#5			**212,862**
Assin South	Central	Nsuaem Kyekyewere	113,777
Assin North	Central	Assin Fosu	99,086
#6			**212,767**
Adansi South	Ashanti	New Edubiase	129,694
Adansi North	Ashanti	Fomena	83,073
#7			**328,512**
Asutifi	Brong Ahafo	Kenyasi No. 1	93,665
Asunafo South	Brong Ahafo	Kukom	78,175
Asunafo North	Brong Ahafo	Goaso	156,672
#8			**376,993**
Suaman	Western	Enchi	177,077
Sefwi-Akontobra	Western	Akontombra	71,663
Aowin	Western	Dadieso	128,253
#9			**243,561**
Juabeso	Western	Juabeso	134,086
Bia	Western	Old Debiso	109,474

*HIA colors align with the boundaries shown on Figure 5, below.

The Consortiums and the HIA Governance Bodies will establish how best to coordinate all activities related to the programme in their HIA's. The PMU and the HIA Consortium will carry on a participatory process to build the HIA governance and implementation structure at each location. This process can take time but will happen in concert with the implementation of key activities to reduce deforestation and degradation, and will not delay implementation or require a new readiness process, per se. Depending on the status of any existing work on-going in the area, the programme will support community entry processes and key stakeholders engagement meetings with traditional authorities, district assemblies, LBCs, and farmers. Following successful negotiation of HIA initiation, the programme will support the requisite steps to establish management boards, prepare HIA constitution and hold regular HIA governance meetings.

Key decisions of the HIA Governance Board will be to determine how best to make the transition to a climate-smart, no deforestation cocoa production programme. Key activities will involve landscape planning, zoning land use practices, approving CSC practices to be adopted by farmers in the HIA, financial planning and management structures and reaching agreements with the HIA CSC Consortium. Appropriate levels of communications with all stakeholders will be achieved through durbars, local FM radio announcements and other media.

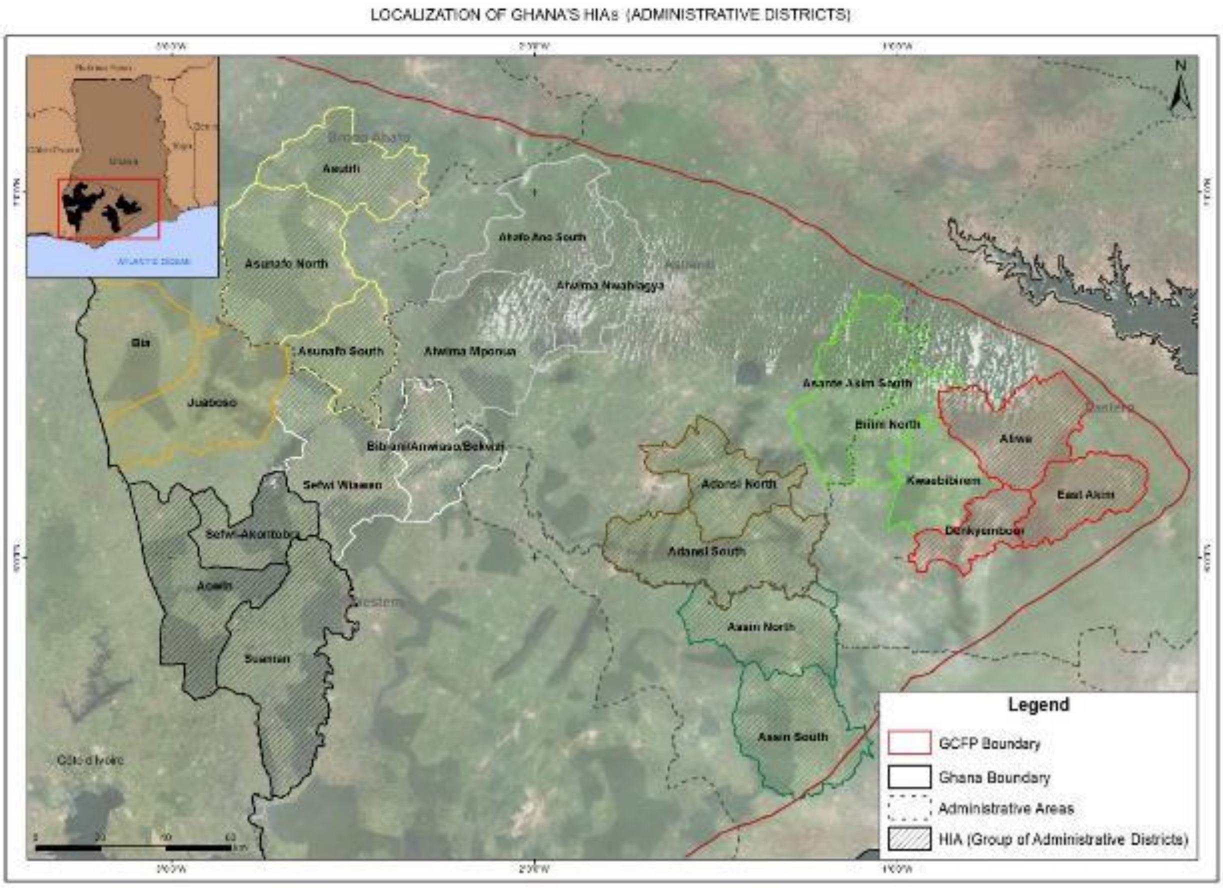

Figure 5: Nine proposed HIAs for the GCFRP[43]

B. Landscape Planning within HIA areas

B1. Establish CSC consortium for each HIA

Landscape planning within HIAs will happen through the HIA Consortiums of key stakeholders and in collaboration with the HIA Governance Board. The essence of a consortium is to ensure that all of the major stakeholders, actors, and entities existing or operating in the landscape are working together towards a common goal of reducing deforestation and degradation, and not operating in isolation, or worse, in contradiction to this goal. Only through the establishment of a consortium can the GCFRP hope to achieve landscape-scale impacts on the ground.

The first step, which in line with A5, above, is therefore to identify the key stakeholders (traditional authorities, LBCs, CSO, farmers associations, government agencies) in each HIA so as to facilitate their engagement with the GCFRP in the HIA. Work has been completed to identify some of the major NGO and private sector programme partners that are active and operating in the programme area and administrative districts. However, The NRS and PMU will need to ensure that all key HIA stakeholders have been identified and then move to conclude formal agreements that establish clear roles and responsibilities of the consortium partners. This will require initial meetings with each stakeholder, followed by broader meetings and discussions before moving to specific negotiations and the conclusion of written agreements.

[43] GCFRP Implementation Plan

B2. Complete HIA Landscape Management Plans

In order to ensure full buy-in and agreement on landscape management, each HIA will need to complete an HIA Management Plan (HIA-MP). A recommended process has been developed, but adaptations will likely be needed. The programme will support all aspects of this process including mapping farms, forest reserves and other land uses within the HIA. This is reflected in the GCFRP budget. Analysis will be undertaken of the land uses and areas of deforestation/degradation and possible enhancement areas. Negotiation processes with all stakeholders will be supported to determine the CSC options and strategies appropriate to the HIA that will result in reduced emissions. The outcome from this process will be the preparation of a landscape management plan for each HIA. Following the drafting of this plan, the programme will support a public review/validation process at the HIA level. The outcome from this process will be the delivery of a consensus plan with strong traditional leadership support and endorsement by the Forestry Commission and the Cocoa Board.

There is widespread agreement in Ghana that developing and implementing landscape management plans will one of the main activities that will work towards reducing deforestation. Outside of urban areas, there is virtually no landscape level land-use planning. Initiating this process through HIA governance boards and consortiums is expected to help address the cocoa expansion, as well as expansion of illegal mining.

B3. Implement HIA Management Plans

Implementation of the landscape management plan will involve broad awareness creation and trainings on CSC with community leaders and opinion leaders, conducting regular patrols of the HIA through community-based efforts with FC/WD officials (as necessary), undertaking land-use enhancement activities together with HIA leaders, implementing CSC practices (Pillar C), and negotiating grandfathering arrangements for irregular land uses.

B4. Establish CSC landscape level validation and CSC Sustainability Standard in HIAs

An important step for establishing "Climate Smart Cocoa" initiatives in the GCFRP landscape is structuring criteria, parameters, and procedures that connect good-practices for cocoa production with accounting strategies for the emission reductions generated in the HIA landscapes. The data management system and the MRV system are being designed such that performance can be linked to HIA landscapes. The procedures for assessing good-practices and accounting methods should be organized and presented through a "Technical Protocol for CSC validation". The protocol, which could also be referred to as a Standard, will be presented for public consultation and afterwards tested.

It is critical to note that the main purpose of the GCFRP and CSC should not be to only focus on the farm level outcomes, as even the most coordinated tool for assessment of good productive practices at the farm level (the cocoa certification standards) does not provide procedures for accounting deforestation in the landscape beyond the farm level. As has been observed, despite the focus on certification, deforestation rates across the landscape and within areas targeted with certification have increased dramatically. Therefore, the CSC strategy across HIAs takes a broader view of the benefits and impacts of good-productive practices in the landscape. The purpose of the Standard is therefore to incentivize and validate a landscape approach to cocoa farming, resulting in cocoa beans that demonstrate livelihood, reduced deforestation and climate benefits.

After piloting the Protocol in one HIA area, the document should be updated, incorporating lessons learned and new comments and reviews. The final version will then be applied across the other HIA and then the entire GCFRP area, generating indicators and indices for assessing the impacts and the efficiency of the GCFRP for reducing deforestation in the HFZ.

As a last step, the PMU may use a third-party auditing and verification process to assess the implementation of the Protocol by the HIA Consortiums, its applicability, as well as the results and performance of the GCFRP. Work is set to begin on this with key partners, including FC and Cocoa Board (government), Touton (private sector), Solidaridad and NCRC (NGOs) and the Verified Carbon Standard (VCS).

C. Increasing Yields via CSC

While the GCFRP aims to reduce the increasing rate of deforestation and forest degradation in the country, and in doing so demonstrate significant emission reductions over time, the programme's ability to demonstrate emission reductions rests upon hundreds of thousands of cocoa farmers and forest users changing their practices on the ground. This is no simple undertaking, and therefore the benefits to these land-users and land owners must be significant, clear, and sustainable. The central logic of the programme is therefore to support cocoa farmers to significantly increase their on-farm cocoa production (and income) by giving them access to a suite of critical farming resources. Provision of these resources and the resulting yield increases at the farm level are the dominant benefit to people in the programme and therefore this pillar is of critical importance.

A process is underway, led by Cocoa Board and the NRS, to establish a uniform definition and understanding of what "climate-smart cocoa" constitutes. Extensive work has already been completed that advances the dialogue,[44] including a recent study which shows that shade can have a positive impact on yields[45]. As a result, the main principles and elements are well understood. In Ghana, climate-smart agriculture practices broadly encompass all land-use practices that promote climate change mitigation and adaptation, while supporting sustainable livelihoods. More specifically, CSC supports the adoption of "best farming practices", as recommended by CRIG, to enable intensification and/or diversification resulting in increased yields and incomes, while also supporting mitigation and adaptation in the landscape through appropriate shade cover and a halt to expansion into forest areas. The box below summarizes some of the key practices and activities that will underpin CSC in the GCFRP landscape.

Table 6: Key CSC practices and landscape activities

On-Farm intensification	Landscape and livelihood measures
Plant using improved cocoa planting material	End to cocoa farm encroachment into forested areas.
Planting in rows at 3mx3m spacing	Rehabilitate over-aged cocoa farms but maintain shade trees.
Weeding	Landscape management plans that identify appropriate and inappropriate cocoa growing areas/soils).
Pruning and chupon removal	Promote diversification strategies (e.g. NTFPs, individual woodlots) that support alternatives livelihoods.

[44] See CCAFS "Mainstreaming climate-smart cocoa productionin Ghana". https://ccafs.cgiar.org/blog/mainstreaming-climate-smart-practices-cocoa-production-ghana#.WPpNbcZBrIU; and Forest Trends & NCRC, "Understanding and defining climate-smart cocoa: Extension, practices, yields and farming practices. http://www.forest-trends.org/documents/files/doc_4359.pdf

[45] Asare, R., Asare, R.A., Asante, W.A., Markussen, B., Raebild, A. 2016. *Influences of shading and fertilization on on-farm yields of cocoa in Ghana.* Expl. Agric. (1-16). Cambridge University Press.

Fertilizer application	Implement MMRV of deforestation & degradation in landscape.
Appropriate spraying for pest & disease control	In climate-change future, in some areas, support cocoa adaptation measures or transition to new tree crops.
Manage 18-20 matures shade trees per hectare of recommended species	Possible climate-change measures- grafting and drip irrigation
Possible advanced measures- hand pollination	

C1. Ghana CSC Good-Practices Guidelines (on-farm and off-farm)

Many organizations, companies and institutions are now interested in or are already applying climate smart cocoa projects and practices, as evidenced by Touton, Olam, Mondelez, IITA, SNV, NCRC, the FIP and other partners. However, to ensure uniformity and programmatic impact, the GCFRP will establish CSC Good Practices Guidelines that cover both on-farm and off-farm practices and activities aimed at increasing yields and incomes, contributing to mitigation, and enabling adaptation and resilience.

An expert working group, led by Ghana's Cocoa Board, has been identified to review existing best practice recommendations for yield increases and sustainable cocoa farming, and assess landscape trends related to cocoa expansion, deforestation/degradation and climate change so as to draft the GCFRP CSC Good-Practice Guidelines. This draft will then be shared with major cocoa sector stakeholders and HIA consortium members (Implementing Partners) and consultations held so as to receive comments and critical input on the guidelines. With agreement, the expert working group will finalize the guidelines and consortium members and implementing partners will apply them in the HIAs.

The CSC Good-Practice Guidelines must address cocoa farming practices on-farm (e.g. farm establishment, planting material and sources, inputs and pest control, weeding, pruning, shade management) and respond to off-farm trends and actions that contribute to forest degradation and deforestation and increase threats to the forest and farming system (e.g. climate change, fires, etc). The guidelines should also support the monitoring of activities that are contrary to a CSC landscape—unplanned cocoa farm expansion, illegal cocoa encroachment into forest reserves, removal of mature trees during farm establishment, etc. It must also identify mitigation and adaptation measures that will enhance the resilience and sustainability of cocoa farming systems in the future.

C2. CSC Farmer Engagement Package in HIAs

The main benefit to farmers in the GCFRP will be their access to critical farming resources, resulting in increased yields and incomes. Therefore, each HIA CSC Consortium must put together a CSC farmer engagement package that gives farmers access to the agronomic, economic and knowledge resources to be able to achieve and maintain substantial yield increases. The logic is that access to the CSC package will come in exchange for farmers' compliance with the CSC Good-Practice Guidelines and the HIA's management plan, developed through the land use planning process and as supported by the Constitution.

The roles and responsibilities that align with the distribution of the package to farmers will be negotiated by the HIA Consortium members. It is possible that responsibilities could be shared between different members. For example an LBC, an NGO, and CHED could all provide extension services. It is also possible that each member will serve distinct roles given their unique technical and financial capacities. However, the consortium will need to ensure that over time, the package can be extended to all farmers within the HIA who want to engage.

The engagement package will include the following resources and benefits. Most of these resources are already available to farmers, however, not necessarily in a full package or at the scale required to achieve the needed impacts.

<u>Access to planting materials:</u> Cocoa farmers within each HIA will have access to hybrid cocoa seeds, seedlings, or other types of planting material that are recommended under the CSC Good-Practice Guidelines.

<u>Access to inputs:</u> A rapid assessment, coupled with information from previous initiatives, research and analysis, will determine soil fertility conditions and the dominant pests and diseases within the HIA. Based on needs, cocoa farmers within each HIA will have access to fertilizer (organic or inorganic) and pest/disease management products so that they can reduce losses and increase productivity on farm.

<u>Access to technical extension:</u> Cocoa farmers within each HIA will have access to technical extension and training opportunities to enable them to understand and follow the CSC Good-Practice Guidelines, improve their practices, and increase yields. A number of different extension, training, and/or demonstration models are available to some farmers, including farmer field schools, promoters or extension agents, and agricultural service providers. All of these models have proven successful in significantly increasing yields with different groups of farmers, however within the HIAs the main objective will be to ensure that all farmers who want to participate have access to training and extension.

<u>Access to business extension:</u> Cocoa farmers within each HIA will have access to professionalization services or business training opportunities so that interested farmers can realize and maximize benefits from yield increases through improved record keeping and financial literacy, enhanced professional capacity, and more detailed planning of their farm management.

<u>Access to financial and risk products:</u> While financial and risk management product remain limited in scale (credit) or non-existent (CSC insurance product), cocoa farmers within each HIA require access to credit facilities and risk management products to enable them to invest in recommended practices, purchase products and labor at the right time in the season, and reduce losses as a result of weather based events. Following the activities outlined in Section D, HIA consortium members and cocoa sector stakeholders will need to take immediate actions to develop a CSC insurance product. Once developed, cocoa farmers within each HIA will have access to credit facilities to support their farming practices and management decisions, and to an insurance product that will reduce the considerable risk of losses associated with changing rainfall patterns and temperatures.

<u>Access to shade tree planting material and promotion of assisted natural regeneration and maintaining mature shade trees:</u> Farmers within each HIA will be encouraged to maintain mature trees during land preparation/cocoa rehabilitation so as to conserve carbon stocks and provide recommended shade cover to their cocoa trees (18-20 per ha). Where on-farm shade cover does not exist or is inadequate, consortium members will promote assisted natural regeneration of shade trees into farms, and famers will have access to shade tree planting material.

<u>Premium price on CSC bean:</u> The aim is for cocoa farmers within the HIAs that have access to the CSC resource package, follow the CSC Good-Practice Guidelines, and adhere to the HIA's management plan and constitution to receive a premium price for the cocoa beans that they produce. Negotiations are being planned to discuss this opportunity with major international cocoa/chocolate

stakeholders. Consortium members, led by key LBCs, other cocoa companies, and/or NGOs, will need to engage with chocolate companies to negotiate a premium that validates the value of the GCFRP's climate smart beans. The basic purchase model for the HIA would involve cocoa purchased from registered farmers under contract to the Consortium following the official Cocoa Board price for the current season. In addition to the official price, each registered farmer would receive a Climate Smart bonus equal to 15% and the HIA Governance Board in which the cocoa bean was grown would receive payment of 10% for its role in the programme success and the funds would be invested in a trust fund. Bonuses would be paid annually on completion of all purchasing.

C3. HIA CSC Consortium implement package with cocoa farmers

The implementation process must begin through outreach and engagement within the HIA area. This includes adherence to traditional protocols and meetings with traditional leaders to introduce the programme and its broad aims. Following these traditional protocols, several workshops would be organized with local stakeholders to properly introduce the programme.

As part of this outreach, farmers will receive full, prior information about the CSC package and programme before being asked to make commitments to participate. Farmers who agree to participate in the programme are registered with the consortium and commit to implement the approved CSC Good-Practice guidelines and adhere to the HIA landscape management plan. As described above (Section C 2.3), farmers who are registered in the programme receive appropriate training from consortium members after their induction and at least every 2 years following induction. Farmers who successfully implement the guidelines are also entitled to receive a set of incentives (Engagement Package) including technical assistance, risk management tools (credit and insurance) and access to farm inputs. However, farmers who fail to implement the guidelines are withdrawn from receiving the programme supports. The HIA consortium member LBC(s) would benefit by developing farmer level contacts and would enter contracts with each farmer or via farmer groupings or associations.

Initial engagement would be followed by intensive training of every interested farmer and HIA member about the programme principles. The programme would begin registration of all committed cocoa farmers. GPS coordinates, area polygons and essential production model of all registered farms would be collected. All farms data would be entered on a GIS mapping of the target area which would confirm if any farms are inside the legal boundaries of established forest reserves. Any farms inside the legal boundaries of forest reserves would be identified for negotiated exit over an agreed time period, with re-establishment on alternate lands designated by the community/CREMA.

At the conclusion of the training and registration a Farmers Contract would be signed between the farmer, the HIA Governance Board and the licensed buying company consortium. All registered cocoa farmers would receive a photo ID card, an executed contract and regular training.

C4. Increase transparency in cocoa purchases

Since the 2004/2005 season, Ghana's Cocoa Board has guaranteed farmers a producer price of 70% of the F.O.B. price. In 2016, Ghanaian cocoa farmers were to receive GhC 425 per 64kg bag of cocoa, reflecting 74% of the net F.O.B. However, many farmers never received this price due to the un-transparent practices of cocoa purchasing clerks at the community/society level who tamper with their scales, resulting in documented losses.

In communities surrounding Assin Fosu, in Central Region, for example, single sales of beans (not cumulative) resulted in weight losses to farmers that ranged from 5%-60%, with a median of 12% and mean of 16%. The economic losses associated with reduced weights ranged from GhC13 to

GhC285, with a median of GhC80 and a mean of GhC95[46]. Consequently, the single easiest way to increase farmers' income (and thus give them a benefit from the programme) is to ensure that farmers are paid fairly for the cocoa beans that they produce.

To increase transparency in cocoa purchases, the HIA consortium, and particularly the LBCs within the consortium will ensure that their purchasing clerks are adequately and fairly compensated for buying cocoa beans, they will ensure that all scales used for weighing cocoa beans are set accurately and they will spot check sales to check for compliance.

D. Risk Management/Finance

D1. Access to financial credit for CSC

One of the main strategies for reducing deforestation in the programme area is to increase funding and credit channels to foster good-practices for implementing climate smart cocoa production. The main goal is to allow the achievement of a "premium product" that attends to corporative demands for more sustainable supply-chains and products that are not leading to deforestation, forest degradation or poor social and labor conditions.

As a fundamental first step, the PMU will map available finance sources and credits lines that are already being accessed by farmers or could be accessed so as to channel vital credit to producers implementing CSC. Depending on the outcome of this mapping exercise, the PMU will work with experts and existing financial institutions to foster new credit programmes or increase the accessibility of current programme to farmers. The PMU will then work with industry experts to create a new facility or fund geared towards the development of more innovative and sustainable business plans focused on producing premium climate smart products. The GCFRP will take steps to explore financial "guarantees" for Consortium members, investors, and stakeholders engaged in the roll out or adoption of CSC programmes.

D2. Access to yield insurances

Currently, one of the main threats to sustained adoption of recommended practices and application of inputs is climate change. Farmer associations and organizations that provide extension and inputs to farmers have already found that when farmers make investments into their farms but then fail to realize the expected productivity gains due to long dry periods or low rainfall the farmers tends to abandon future investments and practices to avoid the associated risks. Considering that changes in rainfall patterns and temperature are expected across the cocoa growing areas in the near and long term as a result of climate change, farmer access to insurance products that help them to better manage such risks is critical to the success of the programme.

Recent research by McKinley[47] has shown the potential value of a climate-smart cocoa insurance product for Ghana. In assessing how yields are affected by the adoption of key CSC practices and the feasibility of a crop insurance product, the authors found that across 19 districts, producers who followed the CSC recommended practices had higher estimated yields by 19-25%, were 5-25% less likely to have a yield loss large enough to receive an insurance payment, and the total expenses associated with indemnity payments in an insurance programme were 20% less for CSC farmers.

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[46]Oxford University and NCRC, unpublished data. Ghana Eco-Limits Project. Ecosystem Services for Poverty Alleviation Research Grant Programme (ESPA).

[47] McKinley, J., Lanier Nalley, L., Asare, R.A., Dixon, B.L, Popp, J.S., D'Haese, M. 2016. Managing risk in cocoa production: Assessing the potential of climate-smart crop insurance in Ghana. *Journal of International Agricultural Trade and Development*, Vol. 10:1.

Therefore, the GCFRP and its HIA stakeholders and partners will work together to develop an insurance product which can be rolled out across the various HIAs. To do this, the GCFRP will need to secure access to historical yield data and weather data so that insurance companies can assess the overall risk and parameters of a potential product. The private sector cocoa companies in Ghana have decades of yield data and farmer practice data which consortium members and other interested parties could make available for the purpose of this exercise. Ghana's Cocoa Board and the JCC will lead in engaging these stakeholders to make their data available. Historical weather data can be obtained by Ghana from multiple sources for free, including the Ghana Meteorological Association and AWhere Inc. When historical yield and weather data are available, then the GCFRP leaders and key stakeholders will identify insurance companies who are interested in assessing and developing a CSC product for the GCFRP. The GCFRP will then need to guarantee funds for insurance premium payments for short-term piloting and long term roll-out. The next step will be to pilot and test a CSC insurance product in one of the HIAs, and assuming a successful outcome, to implement the insurance product across all HIAs and eventually the entire programme area.

D3. Marketing additional ERs above FCPF

Once the ERPA period is finished, the GCFRP should package and present its potential for generating emission reductions beyond 2021 to potential funding alternatives as:

(i) Green Climate Fund: Ghana must indicate the institution that will represent the country at the GCF and will be responsible for presenting projects and local initiatives to be financed by the UNFCCC financial mechanism in the post-2020 scenario. The GCFRP must have close communication and cooperation with the indicated agency, for guarantee that additional long term funds could be channeled to REDD+ and to the HFZ.
(ii) Private investors: Looking for new business plans that are able to deliver CSC ("Ghana premium cocoa") plus emission reductions in the long-term
(iii) Impact investments: for channeling resources to innovative initiatives that intend to change the business-as-usual scenario of forest degradation and poor agriculture and production techniques in the HFZ

D4. Branding and Marketing Ghana CSC Sustainability Standard beans

In parallel to climate finance strategies, the PMU, JCC and NRS, under the guidance of Cocoa Marketing Company (CMC) (with affiliation to Cocoa Board), will foster the development and marketing of a Ghana CSC brand that could create new opportunities for trading a "premium product" on the international market. There is a growing demand worldwide for climate friendly products that are not associated with deforestation. This demand is motivated by the urgent crisis of climate change, and growing awareness amongst consumers all around the world that products should not be contributing to deforestation. Good examples of the potential for climate friendly products can be found in portals like Canopy Bridge, Landscapes.Org, Rainforest Alliance and others.

The first step for moving this initiative forward will take place in early 2017 in a meeting with GCFRP proponents and the CMC. From there, the programme will need to develop market studies about the current demand for Ghana's Climate Smart Cocoa and create a national brand for recognizing good practices and allowing access to more conscious markets and consumers. The next step will then be to stimulate demand for Ghana's CSC at the international market, selling the product as a "premium" cocoa bean.

D5. Sustainable Finance of HIAs

A key aspect of the long term success of this programme will be to ensure that each HIA target area has a sound financial foundation. In order to establish a firm foundation, each HIA will enhance revenue streams from cocoa, NTFP harvesting, other perennial tree crops, and climate finance. It will manage its operating expenses well within its income levels and it will establish a trust fund which will build up reserves to ensure long-term stability.

Each HIA will require a 5 year grant to support the costs of establishment including covering expenses for the initial 5 years and seeding the trust fund. Real revenue streams must be developed to ensure that the HIA has diversity in its financial sources estimated to achieve significant levels within 5 years. Expenses will need to be controlled to ensure a positive balance sheet at the end of each financial year. In addition long-term sustainability will be linked to the HIA having a successfully managed trust fund which can support targeted activities beyond the scope of annual finances and as a security in difficult years when revenues suffer unexpected dips.

The HIA expects to develop five types of revenue: climate-smart cocoa premiums, wild harvest NTFP premiums, other tree crop premiums, climate finance, and grant revenues. From the beginning grant revenue will be critical to kick things off but this should rapidly transition into wild harvest NTFP premiums, CSC premiums (or other tree crops) and climate finance.

It is expected that a foundation grant will be provided to allow for the formation of the HIA finances and the early implementation of the NTFP and CSC activities. Third party private sector companies will be involved in aspects of this implementation but there will be many activities which the private sector will not be prepared or willing to finance. It is anticipated that grant money will support this period of approximately 3-5 years. At the end of the grant period the HIA will not require external financial support for recurrent activities.

By year 2, NTFP related funds will begin to flow to HIA farmers/community members and into the HIA accounts in direct payments. A negotiated portion of any premiums will be paid directly to the HIA Trust Fund account in Accra as outlined below. By year 3 and 4, CSC related funds will begin to flow to HIA cocoa farmers and a negotiated portion of premiums will be paid directly to HIA accounts and trust fund. The HIA expects expenses to follow the categories of expenses including HIA staff salaries, meeting costs, transport, training programmes, utilities for offices and office rent.

The HIA will establish a financial trust fund under the management of third party professional money manager in Accra. The fund will be at arm’s length from the HIA Management Board through structural arrangements that allow for withdrawals within pre-agreed thresholds thus avoiding unauthorized withdrawals which would hamstring the future operations of the fund. Ideally the fund would be established with the full or partial grant under the formation stage.

Following the establishment of the fund, no withdrawals will be permitted until the fund surpasses a foundation valuation of the principle. Thereafter, no withdrawals will be permitted should the principle fall below the foundation valuation target. This target figure will be adjusted from time to time based on overall performance and macro-economic conditions prevailing in Ghana.

If the Trust Fund is fully seeded as outlined then the HIA Board will be able to request withdrawals not exceeding the financial managers’ recommendation for the year which will be based on overall performance of the fund and prevailing macro-economic analysis.

E. Legislative and Policy Reforms

E1. Passage of Legislation

The quick passage of the Wildlife Resources Management Bill, 2014 will be essential to the overall success of the programme as several key issues in the Bill are important for increasing communities' rights to benefit from their natural resources. The Bill was on the schedule of bills to be passed by the former Parliament in 2016, but this did not happen, likely due to the election and Parliamentarian's need to campaign. The MLNR and NRS will continue to work towards its passage under the new Parliament and are optimistic about the outcome. Therefore, under this sub-activity the programme will lobby for the passage and implementation of this Bill. This will be achieved through strategic support to the Parliamentary Sub-Committee on Natural Resources. Through the initial three years of the programme, support will be available to host the Sub-Committee for field visits and formal engagements to ensure their support and lobby within Parliament.

E2. Policy Reform and Guidance to Policy Implementation

There are three areas of necessary policy reform or guidance to support implementation of the current policy which is yet to be implemented effectively. These areas are outlined in the sections below: tree tenure reforms, benefit-sharing arrangements and cocoa farm input arrangements.

Tree tenure reforms**:** The Forest and Wildlife Policy which backs the Bill mentioned above is progressive and provides the necessary structure for implementation of the required tree tenure reform, but guidance and support is necessary for success. The programme will support the process of having all the HIAs approved by the FC to pilot new tree tenure arrangements within the target areas. A number of such tree tenure reforms have already been piloted in Ghana including the tree passport system (IUCN Ghana), and the CREMA devolution process. The implementation of such activities will be conducted under section C of the plan above but the programme will support independent studies within HIAs on such implementation of tree-tenure arrangements which will result in the preparation of official FC tree-tenure policy implementation guidelines.

Defining benefit-sharing agreements for GCFRP: The Forest and Wildlife Policy which backs the Bill mentioned above is progressive and provides an enabling framework to support the development of a benefit-sharing plan and associated agreements. The GCFRP now has a draft BSP and is set to begin consultations with the MLNR, traditional authorities, District Assemblies, CREMAs, CSOs, NGOs, farmers and other community members, and the private sector partners. The goal is to have a benefit-sharing plan and agreements with HIAs and consortiums that a balance of carbon and non-carbon benefits to the main actors and proponents who are responsible for producing emission reductions via behavior change and key implementation activities.

Reform of cocoa farm input system: Ghana's Cocoa Sector Strategy II was developed and drafted in 2014 and 2015 through a consultative process that involved a wide range of stakeholders. The draft sector strategy calls for, amongst other things, (i) increased production and distribution of free hybrid seedlings, (ii) a phased approach to fertilizer liberalization in which fertilizer is made freely available to farmers through the *hi-tech* programme up to 2017, and then a phased withdrawal to increased, direct distribution of recommended fertilizers at market prices, (iii) increased and direct distribution of chemicals for disease and pest control with a focus on accessibility and timely availability at market prices, and (iv) the development of private sector spraying gangs as business entities who provide services to farmers.

The validation and approval of the Cocoa Sector Strategy II was been delayed, but is expected to occur in 2017. The validation and passage of this sector strategy is critical to the success of the programme and its climate-smart cocoa activities because it will provide clear sector-level policy support on specific issues and activities to the programme. For CSC to deliver yield increases, improved resilience and reductions in deforestation farmers must have equal access to farm inputs at fair prices and in a timely manner. Resources from the programme will be made available to support the passage and implementation of the cocoa sector strategy.

E3. Modification to Customary Norms and Practices to Reduce Deforestation

The vast majority of landholding in Ghana is under the control of traditional governance structures and follows customary norms and practices. There are very broad systems of farming within the traditional systems but these vary from location to location. A number of these traditional systems have perverse incentives to climate-smart cocoa farm management, which ultimately drive deforestation from agricultural expansion. For example, over-aged and unproductive cocoa farms are not rehabilitated because the farmer would lose the traditional contract to the land, which is tied to the cocoa trees, by cutting them down. Consequently, such farmers prefer to start new farms, and effectively abandon old farms and leave them under limited management. New farm establishment is what drives deforestation. This is particularly so in the case of settler farms throughout the cocoa programme area.

The programme will support dialogues and negotiations in each of the HIAs to seek pathways to promote an evolution away from perverse incentives in traditional land-use practices which directly affect cocoa farming. The programme recognizes that this process will take different pathways across the set of HIAs and will thus support independent studies in HIAs to identify perverse land use norms. The programme will support negotiation with traditional leaderships at HIAs level and will encourage progressive traditional leaders to experiment with such change. The programme will support independent review on implementation of land use reforms.

4.4 Analysis of laws, statutes and other regulatory frameworks

Ghana's readiness process has focused considerable attention on the issues of land and resource tenure. As part of the R-PP, an assessment of land use, governance and forest policy was conducted[48] and the National REDD+ Strategy thoroughly describes land and resource tenure issues within the context of governance and implementation of emission reductions programmes[49]. Both the R-PP and the National REDD+ Strategy went through multiple consultations and editing processes that involved a cross-section of experts. The following description of land and resource tenure in the GCFRP accounting area is based upon this existing work and does not reflect an additional assessment.

There are two predominant land tenure systems in the accounting area of the GCFRP; customary land and statutory or public land. Land held under customary law is owned by stools, families or clans and is usually held in trust by the chief, head of family or clan for the benefit of its members. Customary land predominates, accounting for over well over 80% of the land in the programme area. Ownership of public lands, on the other hand, is vested in the President on behalf of and in trust for the people of Ghana. This land tenure regime is much less common in the programme area with national parks representing one such example. Private lands are extremely uncommon as a land tenure regime in the accounting area.

Under the customary system, there are different levels of ownership rights, the fullest level being the *allodial title*, referring to land which is vested in the whole community and is commonly referred to as stool lands or skin lands. The second type of ownership recognized under Ghanaian customary law is a *usufructuary title;* a concurrent and lesser title that individuals or families may hold on stool land, which cannot be divested without the consent of the allodial owner. The third level of

[48] GoG. 2010. R-PP.
[49] GoG. 2015. National REDD+ Strategy.

customary ownership is pledged or rented land, reflected in the common share-cropping tenancy agreements of *Abunu* and *Abusa*. According to these arrangements, land is cleared, rehabilitated and/or cultivated by the tenant farmer and then the land or the crop is shared between the tenant and the landowner. This type of customary land title is supported by Section 19 of Land Title Registration Act, 1986 (PNDCL 152 and includes the *Abunu* and *Abusa* as being vested in the stool to be granted to the local communities, farmers or inhabitants.

With respect to forest resource, Article 269 of the 1992 Constitution provides for the establishment of the Forestry Commission and its functions, and gives the State control over all natural resources of Ghana, decoupling them from the land, and stipulating that natural resources are to be vested in the President on behalf of and in trust for the people as a whole.

Forest reserves and the forest and other natural resources found with the accounting area are thereby protected by the state and are managed by the government (e.g. Forestry Commission, Minerals Commission) in trust for the stool landowners. Protection of the forest estate, however, does not affect landownership, meaning that though forest reserves and timber are managed by the FC, the land is owned by communities (the people) as represented by their chiefs and traditional authorities.

With respect to ownership and commercial exploitation of trees, Ghanaian law makes a distinction between naturally occurring and planted trees. According to the Timber Resources Management Act, 1997(Act 547) and the Timber Resource Management Act, 1998(Act 547), the economic rights to naturally occurring timber trees, whether on-reserve or off-reserve, are vested in the state and it is a statutory offence to harvest these trees without the consent of the state. However, timber trees may be felled for non-economic reasons, such as clearing forested land for agricultural purposes. In addition, section 4 of the Timber Resources Management Act as amended by Act 617 in 2002 clearly states that timber rights do not apply to land with private forest plantation or land with timber grown or owned by an individual or group.

The revenue from timber and other natural resources is shared in a constitutionally agreed benefit sharing arrangement. On Stool Lands (off-reserve) where resources are managed and extracted by the requisite commission (e.g. Forestry Commission) benefit sharing arrangements have been put in place between the state, the stool, the traditional authorities, the Office of the Administrator of Stool Lands and the District Assembly. On-reserve, the same arrangements apply, however a slightly higher percentage of the stumpage fee (revenue) is allocated to the Forestry Commission (sixty percent as compared to fifty percent).

Ghana is actively working to address critical gaps for the programme related to land and natural resource tenure. These include tree tenure reforms and an adapted benefit sharing arrangement such that the land owners and users are adequately incentivized to retain naturally regenerated trees on farm and in the farming landscape. As progress is made on these reforms, the Community Resource Management Area (CREMA) provides a clear process and mechanism by which to ensure that land owner and land users have the right to manage and derive economic benefits[50] from forest resources through the establishment of a CREMA and the issuance of a certificate of devolution by the sector Minister.

This community-based natural resource management mechanism is supported by the 2012 Forest and Wildlife Policy and is being implemented and practiced in more than 35 locations across the country, including within the GCFRP accounting area. Of critical importance is that this CREMA

[50] The right to benefit is not necessarily exclusive. For example, should a CREMA decide to establish a plantation and sell timber, the statutory taxes and fees payable to the FC and other stakeholders would apply.

mechanism is positioned to receive full legal backing through the passage of the Wildlife Resources Management Bill (2014), which is currently before Parliament and slated to be voted upon this year. Passage of this law would constitute the final step in legalizing CREMA. Passage of the law, however, would not affect the GoG's right to transact ERs, rather, the giving a CREMA full legal backing reinforces communities' rights to benefit from the ERs that they help to produce.

With respect to carbon rights / the right to transfer title to ERs, the GoG is the legitimate entity to exercise such rights, however, in recognizing the role that individuals, communities, and other entities play in helping to generate the ERs, it recognizes these contributions through sharing of due benefits. Under the CREMA, benefit sharing is defined by the members of the CREMA, with oversight by the FC, however, with the GCFRP, benefit sharing will be determined at different scales such that the proramme's BSP will be determined through a consultative and participatory process, while local level benefit sharing (e.g HIA) will happen through the HIA or CREMA bodies.

Where disputes arise, the FGRM will useful for resolving them, in partnership with the Traditional Authorities. Customary law is well-recognized by the Constitution of Ghana and is highly instrumental in the resolution of conflicts related to land rights. For this reason, customary law and the role of the Chiefs in matters of land administration is key for gaining the confidence of investors and providing clarity of land tenure, which is crucial for the smooth implementation of REDD+.

4.5 Expected lifetime of the proposed ER Programme

The activities of the GCFRP are consistent with international treaties and conventions ratified by the Republic of Ghana as well as relevant domestic legislation. Ghana is a signatory or has acceded to a wide range of ***international conventions*** in the field of human rights, environmental justice and climate change, including: the United Nations Framework Convention on Climate Change of 1992, the Kyoto Protocol of 1997, the Paris Agreement (adopted within the UNFCCC in 2015, signed by Ghana in April 2016), the Convention on Biological Diversity (CBD) of 1992, and Nagoya Protocol on Access to Genetic Resources and the Fair and Equitable Sharing of Benefits Arising from their Utilization , a 2010 supplementary agreement to the CBD, the UN Convention on the fight against desertification in countries seriously affected by drought and / or desertification, particularly in Africa (UNCCD) of 1994, the International Tropical Timber Agreement of 2006, the Convention on Wetlands of International Importance ("Ramsar Convention") of 1971, the Revised African Convention On the Conservation of Nature and Natural Resources ("Maputo Convention") of 2007, the Convention of the Elimination of All Forms of Racial Discrimination of 1966, the Indigenous and Tribal Populations Convention of 1957, and the African Charter on Human Rights and Peoples' Rights of 1989.

At a ***bilateral and regional level,*** Ghana engages in a wide range of treaties and policy initiatives, including the Forest Law Enforcement, Government and Trade ("FLEGT") Initiative with the European Union. Under the **Ghana FLEGT Programme**, the Government of Ghana signed a Voluntary Partnership Agreement in 2009 (entry into force the same year).

At the ***domestic level***, section 4.4 describes land and natural resource tenure, while the main laws of relevance for the existing land tenure regimes in the programme accounting area are summarized below in Table 7.

Table 7: Analysis of resource tenure laws and their relevance in the accounting area

Statutory Basis	Relevant Amendments and Implementing Acts	Relevance for the Tenure Regime	Relevance for the GCFRP Accounting Area
1992 Constitution of the Republic of Ghana	Relevant Laws and Regulations (see below in this table)	• Private tenure rights guarantee; • Collective customary rights guarantee for stools and skins) of allodial title to land with provisions on self-governance; • Constitutional separation of land and commercial resource; management, which is vested in the central government; • Complementary right of stools and skins to revenues from resource management; • Establishes the Forestry Commission;	• Provides basis for participation of local communities; • Provides basis for REDD+ governance; • Provides point of departure for benefit sharing arrangements;
Local Government Act 1993, (ACT 462)		• Formalizes customary governance forms (including "traditional authorities", which are defined as a House of Chiefs or a councilor body established or recognized under customary law"); • Establishes new forms of local government, including the governance through "district assemblies"	• Provides an institutional basis for the REDD+ governance framework (within local communities);
Chieftaincy Act 2008		• Implement Article 271 of the Constitution; • Set governance rules for the National and Regional Houses of Chiefs	• The Regional House of Chiefs responsible for the Accounting Area can decide whether to support the ERP or not and make, if they do, a formal commitment of support (also confirming the Benefit Sharing Plan).
Office of the Administrator of Stool Lands Act of 1994, (ACT 481)		• Establishes the central government authority acting on behalf of stools;	• May receive a share of the REDD+ benefits for administrative purposes;
Administration of Land Act of 1962, (ACT123)		• Provides details on the management of stool lands and of land proceeds; • Permits the use of land for public purposes; • Limits the maximum duration of timber and mining to 30 years; • Allows for the enforcement of land tenure title and illegal land occupation;	• Gives further guidance to the institutional set-up of the REDD+ Programme (including the involvement of forest recognized stakeholders); • Allows for the enforcement of illegal holdings within the Accounting Area;
State Lands Act of 1962 (ACT 125)	State Lands Regulations of 1962 (LI 230)	• Permits the acquisition of land by the President "in the public interest"; • Allows the President to grant a lease or license for thus acquired land;	• Serves as the legal basis for some of the public-owned areas in the Accounting Area;
Land Title Registration Act of 1986, (PNDCL 152)		• Legal basis for the registration of recognized titles to land, including allodial titles of (stools and other), freehold, and leases;	• Gives clarity on the actual land tenure holdings in the Assessment Area; • The registry is not considered complete, however; thus, not all title conflicts will be able

			to be solved on its basis;
Forest Ordinance of 1927	• Forest Protection Decree 1974 (NRCD 243)	• Establishes the Forest Reserve ("On-Reserve"); • Forest Protection Decree: Defines individual obligations for Forest Reserve Areas;	• The On-Reserve covers a 21% of the GCFRP Accounting Area;
Forestry Commission Act of 1999 (ACT 571)		• Specific legal basis giving a mandate and institutional structure to the Forestry Commission, which is responsible "for the regulation of the utilization of forest and wildlife resources, the conservation and management of those resources and the coordination of policies related to them" (§ 2); this relates to forest resources within Forest Reserves and outside („off-reserve");	• The Forestry Commission is the main operational stakeholder for the ER Programme;
Concessions Act of 1962 (ACT 124)		• Confirms that natural resource management is in the hands of the central government (represented by the minister assigned by the President); • Clarifies that all rights with respect to timber or trees on any land are vested in the President who holds them "in trust" for the stools concerned; • Lays out the general process for concession granting (including legal review); • Extends the application of the Forest Ordinance *mutatis mutandis* to timber resources outside Forest Reserves (§ 16.6);	• Gives the FC and MC rights to the forest and mineral resources in the programme area.
Trees and Timber Decree of 1974 (NRCD 273)	• Trees and Timber (Amendment) Act of 1994; (ACT 493)	• Imposes registration requirements for timber exports as well as export levies; • Allows for the creation of forest protection zones outside the Forest Reserves;	• Relevance for timber concessions;
Timber Resource Management Act 1998 (ACT 547)	• Amendment of 2002; • Timber Resources Management (Amendment) Regulations of 2003; (LI 1721) • Timber Resources Management (Legality Licensing) Regulations of 2012; (LI 2184)	• Defines the terms and the process under which a person can apply for a timber right, concession or lease; • Requires timber right holders, following an award, to conclude "Social Responsibility Agreements" with local communities to plan and finance community services from 5% of the value of the stumpage fees; • The 2012 amendment regulations implement the FLEGT process for Ghana;	• Relevant legal basis for the timber concessions given out for portions of the Accounting Area; • Social Responsibility Agreements can serve as a model for the negotiation of benefit sharing agreements; • Civil society approach of the 2012 amendments should inspire the stakeholder participation process;
Forest Plantation Development Fund Act of 2000 (ACT 583)	• Forest Plantation Development Fund Amendment Act of 2002; (ACT 623)	• Incentive mechanism for the development of forest plantations on lands suitable for timber production;	• Creates incentives for CSE within the GCFRP area.
Minerals and Mining Act of 2006 (ACT 703)		• Regulates the award of mining rights and defines the content and their limits;	• There are a number of mining locations in the Accounting Area (with mining rights given to companies);
Timber Resource Management and	LI yet to be passed	• This LI is expected to regulate import and export of timber products to and from Ghana;	• Timber Resource Management and

Legality Licensing Regulation		control the trade of illegally harvested timber products and illegal logging; improve opportunities for and regulation of small-scale timber harvesting, and support the issuance of FLEGT licenses.	Legality Licensing Regulation
Wildlife Resources Management Bill	Bill yet to be passed	• This Bill is expected to consolidate and revise the laws relating to wildlife and protected areas, provide for the implementation of international conventions on wildlife, and provide legislative support for CREMAs.	• Wildlife Resources Management Bill

A specific regulatory and land tenure related challenge within the GCFRP accounting area concerns the high number of illegal mining operations. While the regulatory context is clear – minerals are owned by the State; all mining requires a license or lease; an operative agency “to supervise the proper and effective implementation of the provisions of Section 100 of the Minerals and Mining Act, 2006 (ACT 703) is established; and certain violations are deemed criminal offenses – enforcement is weak, with the Minerals Commission not having the capacity to exercise control.

The GCFRP aims at mitigating this challenge, over time, capitalizing on soft approaches that will strengthen the social infrastructure as a whole and by increasing the level of involvement from, in particular, the stools and the traditional authorities. Though they have no direct powers to go after illegal operators, they are extremely influential in affecting how land is allocated for use. With wider support, traditional authorities can invoke the power of the ancestors to prohibit certain land uses on lands under their jurisdiction. The traditional leaders, including chiefs and queen mothers, are also able to engage other levels of governance, including Parliamentarians, Ministers, the Mining Commission, the police to demand action.

A general regulatory and tenure related challenge – relevant not just in the Accounting Area but across Ghana – concerns the strict separation between land tenure, on the one hand, and natural resource tenure, on the other hand. This leads to a lack of ‘owner protection’ from stools, in particular, and exposes forest resources to the ‘tragedy of the commons’: a resource perceived as freely available to anyone. To be sure, stools have a claim to portions of the “revenues accruing from stool land”, but as shown above, this claim is restricted in scope (net cash revenues), by share (most of the proceeds go to government bodies), and, importantly, it gives the stools little say and leverage over the resource governance process. They are at the recipient of benefits; they do not administer the forest.

This separation of land and resource has a long tradition in Ghana, and the ER Programme will not be able to do away with it. However, by involving stools and other stakeholders directly in the process of resource management and by enhancing the social infrastructure as a whole, the underlying problem stands a good chance to be effectively mitigated.

4.6 Expected lifetime of the proposed ER Programme

The expected start date and signing of the ERPA will be 2017, with a proposed programme lifetime of 20 years (2017-2037).

The GCFRP programme is truly unique and ambitious in its goal to reduce the environmental and climatic externalities of cocoa production, while also reducing emissions driven by other agricultural systems, illegal logging, and illegal mining through the implementation of a series of integrated landscape-level activities and policy reforms via consortiums of key stakeholders, investors, landowners and land users.

However, the proponents of the GCFRP also acknowledge that motivating large-scale behavior changes and reforms is not easy and will not be possible across the entire accounting area at the start. Therefore Ghana anticipates that the initial volumes to the CF will be modest (approximately 5 million tCO2e) compared to the CF's desired goal of 20 million tCO2e by 2020. However, in light of Ghana's recent deforestation *trend* and 2015 emissions, the effort required to achieve a 50% reduction in emissions, just to get down to the reference level will be substantial and make the landscape value of the ERs sold much greater.

It is expected that the long-term volumes of ERs from the programme will be significant—391 MtCO2e. The programme proponents are equally confident that there is real value in implementing this programme because it marks the beginning of REDD+ implementation in Ghana, it leverages and influences significant private sector investment in the cocoa sector, it leverages the FIP investment, it will test an innovative strategy for reducing emissions driven by agriculture and other drivers that is highly scale-able to other eco-zones (nationally) and to other countries where globally important commodities are driving deforestation, and it will add real diversity and learning value to the FCPF and the Carbon Fund's portfolio.

The overall lifetime is divided into three (3) phases, as described below:

1. *Early Implementation and Solidification (2017-2018)*: Though an ERPA is not expected to be signed with the CF until late 2017, Ghana will begin to implement elements of the programme related to CSC in the first HIAs (4) by the late of 2016 and early 2017, with ready support from the FIP, private sector cocoa companies Touton and Mondelez, and NGOs SNV, NCRC, and UNDP, amongst others. During the first 6 months, solidification of other consortium groups for selected HIAs will happen and key details on benefit sharing, tenure reforms, data management, and other aspects of implementation will be agreed and validated. This first phase will also serve as the period in which administrative bodies are resourced and staffed, coordination is planned, and consultations with communities and traditional leaders takes place, and additional grant resources are confirmed or requested. By the end of this phase the majority of the HIAs and consortiums should be operational.

2. *Full Implementation for Performance-Based Carbon Fund Payments (2019-2025):* During the second phase, full scale implementation will happen in the target HIAS within the accounting area. The first monitoring is proposed for 2020, three years after signing the ERPA, followed by a subsequent monitoring of ERs against the REL in 2023 and at the end of 2025. Assuming that the monitoring activities demonstrate strong performance, three payments would be made for emissions reductions generated during the time period from the Carbon Fund. Ghana reserves the right to sell emission reductions to other potential buyers should emission reductions exceed quantity contracted to the CF.

3. *Post Carbon Fund Implementation for Performance Based Payments* (2026-2037): Phase 3 marks the transition to the final 11 years of the programme. With the established experience in reducing deforestation and degradation and the accumulating CSE from planted trees, the magnitude of ERs is expected to increase. Post CF, the programme expects to engage with potential new investors (fund-based, bilateral, or private sector), and it reserves the right to transfer ERs towards the achievement of Ghana's NDC. If it has not happened already, scaling-out to new HIAs within the programme landscape will occur, incorporating needed adaptations based on experiences and results.

5. STAKEHOLDER CONSULTATION AND PARTICIPATION

5.1 Description of stakeholder consultation process

During the planning and design of Ghana's ER Programme, a wide range of stakeholders have been targeted and consulted to contribute and participate in the process. This information sharing has been done through cross-sector meetings, workshops, sensitization, capacity building, durbars conferences and training programmes. The purpose of these interactions has been to disseminate information and seek feedback, enhance capacity and build knowledge and expertise on REDD+. Over forty (40) institutions from government, NGO, the private sector, civil society, research and the donor communities have participated in consultations on a regular basis. Also community representatives from across the various regions within the ERP have been consulted. Besides the widely discussed financial carbon benefits, the issues in the agenda for discussion during stakeholder consultations are also focused on several non-carbon benefits that include; sustainable agriculture, ecotourism, biodiversity conservation and management of ecosystem services, social infrastructural development, provision of alternative livelihoods, sustainable utilization of non-timber forest products and food crop benefits before canopy closure.

Under the first phase of REDD+ Readiness, a number of consultations were undertaken to design a Strategic Environmental and Social Assessment (SESA) framework to identify risks and find appropriate mitigation measures. Further consultation is underway to identify the likely risks, impacts and benefits from the proposed ER programme interventions to ensure that the Cancun Safeguards are implemented with the participation and involvement of local communities.

The design process for Ghana's ERP has specifically sought to follow the Bali Action Plan which calls on REDD+ countries to engage stakeholders in designing and implementing REDD+ actions. It has also sought to ensure compliance with the COP16 decision that key safeguards should be "promoted and supported," including the full and effective participation of relevant stakeholders, in particular, indigenous peoples and local communities. Ghana's R-PP also emphasizes the importance of actions that promote "consultation and participation", which was identified as a sub-component under readiness arrangements (i.e. component 1). A REDD+ Communications Strategy was therefore developed at the very outset of the implementation of the R-PP, and REDD+ communication activities have been implemented at three levels—local/district, regional and national. The selected regions for the ERP are mainly Akan speaking people and therefore the media of engagement with the local communities was Twi to ensure ease of understanding information being shared. The channels of communication included the use of radio, posters, banners, handouts, newspapers and street announcements. Key activities have included: Community level consultations within the ERP area; REDD+ Roadshow events; REDD+ sensitization programmes for FC frontline staff in all regions of the country; national level consultation with the National House of Chiefs and the National REDD+ Forum. The NRS as much as possible includes a good representation of women on all consultative meetings to ensure gender equity, and gender considerations have been mainstreamed into all elements of the GCFRP.

The participation and feedback that this process has generated, has gone a long way to improve the ER Programme's design and ensure that it is realistic and achievable. Areas in which the programme received valuable and important feedback include issues relating to the following: engagement of all stakeholders at all levels across the landscape with particular role of traditional authorities; addressing land use planning with the integration of ERP intervention into the District Assembly development plans; sustainability of the programme; learning from existing COCOBOD safeguards system including extension services and benefit sharing mechanism; source of funding with particularly attention to domestic sources; and addressing challenges associated with the use of FPP data as well as incorporating post 2010 issues of deforestation and degradation in reference level calculation.

It is worth highlighting that private sector engagement kicked off with an informal meeting to present the broad vision for Ghana's ERP to a small group of stakeholders in early 2014 through a consultation workshop organized for a cross-section of key high-level stakeholders considered to be of significant relevance for the design and implementation of the ERP. At the end of the event, a communique was issued by the group expressing their commitment to the development and implementation of the programme so as to make the cocoa sector climate-resilient through the promotion of climate-smart interventions across the forest-cocoa mosaic landscapes within the high forest zone of Ghana.   Subsequent to this initial meeting with private sector players, a series of stakeholder consultation meetings had been arranged to secure and deepen private sector buy-in for the ERP.

As part of the preparation of the ERPD, major private sector actors (Touton, Olam, Mondelez, Ecom/Armajaro etc.) specifically signaled their willingness to participate in the ERP implementation. They have indicated locations within the GCFRP accounting area where they are interested in operating and expressed their commitment to leveraging of resources and creation of synergies for optimizing achievement of results.
The Joint Coordinating Committee (JCC) tasked with coordination of the ERP, made up of officials of the Forestry Commission and the Cocoa Board, have begun the process of engaging with these PS actors to define clear roles and terms of engagement as part of steps to firm up arrangements for the smooth take-off of implementation of the ERP.

The process builds on the issues raised during stakeholder consultations to ensure the appropriate streamlining and fine tuning of the programme. For example, it was at such a stakeholder consultation that wildfire was agreed to be added to the key drivers of deforestation after rigorous discussions on land cover maps during a Strategy Multi-Stakeholder Consultation Workshop. As a result of this process, which has taken place in an open and positive light, significant goodwill and trust has been established and reinforced, and actors and partners are showing broad based support for the GCFRP, as evidenced by their desire and commitment to participate in the HIA selection process.

Figure 6 (below) lists the main institutions, entities, and representatives that have participated in the consultation process. Consultations and engagements that have been planned for the coming months are listed in Table 8.

Government	•MLNR, MESTI, MOFA, MoF, FC (WD, FSD, TIDD,CCU), COCOBOD (CHED, RM&E), EPA, Energy Commission, NADMO, District Assembly DCEs, Parliamentarians.
Private Sector	•Touton, Ecom/Armajaro, Olam, Portal Forest Estate, Hamilton Resources and Consulting, Cocoa Processing Company Ltd, Kuman Koman Company, BD AssociatesCocoa Merchants Ghana Ltd, Barry Callebant Co. Ltd, First Sky, Unicom Co. Ghana Ltd, Cargill Ghana Ltd, Koapa Kokoo Ltd, Produce Buying Co. Ltd, Nyonkopa Cocoa Buying Ltd, Federated Commodoties, Ismeal Yamson and Associates, Mondelez Int Cocoa Life.
NGOs	•Solidaridad, Rainforest Alliance, NCRC, IUCN-Gh, A Rocha Ghana, Tropenbos, Civic Respose, Conservation Alliance, KASA, SNV, Agro Eco, Ghana Integrity Initiative, CAN Ghana, Rise Ghana, Colandef,
Traditional Leaders & Community Reps	•National House of Chiefs, Forest Forum, Cocoa Farmers from Eastern Region, Central Regoin, BA Region, Western Region, Students
Research Institutions	•FORIG, CRIG, CERSGIS, KNUST
Donors	•WB, UNDP, Norway

Figure 6: Institutions, companies and organizations represented during ERPD stakeholder consultation.

Table 8: Planned upcoming stakeholder consultation meetings

Consultation/ Training/ Meeting	**Description**	**Time of Activity**
Targeted Engagement with Traditional authorities	Consultation meetings with targeted traditional authorities in the HIAs	May
FGRM and SIS Training and capacity building for FC staf and other Stakeholders	Stakeholder consultation meetings on the draft operational modalities for the implementation of the FGRM and SIS	April to May 2017
Benefits Sharing Plan design consultation	Benefit sharing plan consultation and validation with HIA stakeholders CSOs NGOs, Private sector government	TBD
Meetings on GHG Reporting for Result-Based REDD+ Actions	Launch and Commence Project Implementation in Ghana	25-28 April 2017
Training workshop on Ghana's REDD+ Safeguards requirement Implementation	Training of FC staff will focus on Overview of REDD+, Introduction to REDD+ Safeguards Requirements and Safeguards Institutional Arrangements	28 April 2017
General Stakholder briefing on GCFRP	Stakholder briefing session on GCFRP	May 2017
Briefing for High Level Actors: Minister and Deputy, FC and COCOBOD CEOs and Dirctors.	Briefing for the high level mamagement on GCFRP	May 2017
HIA Stakehlde Consutation meeting	Consultation meetings with targeted traditional authorities in the HIAs	May 2017

NGO, Private Sector and Government Consultation	Consultation meetings with targeted traditional authorities in the HIAs	May 2017
REDD+ Roadshow 2017	Galvanize public support for actions and measures targeted at maximizing land use, reducing deforestation and forest degradation, towards improved Livelihoods in Ghana	October
2nd National REDD+ Forum	The forum will galvanise high-level and public support for actions and measures targeted at addressing the drivers of deforestation and forest degradation as part of Ghana's contribution to ongoing global efforts at abating global warming and its impacts.	November

5.2 Summary of the comments received and how these views have been taken into account in the design and implementation of the ER Programme

Since February, 2015, the NRS and its partners have held over numerous large scale meetings, workshops, trainings, plus many more additional meetings and information sessions with the aim of sharing information about the programme, gaining input and feedback to improve the concept and design and building capacity and understanding. Through these events many important comments have been received from stakeholders, which have been considered and taken into account in the process of designing the ERP. Table 9 summarizes the main REDD+ consultations that have taken place, with as many details as possible on the purpose of the event, participants, questions, answers and lessons learned. The rest of this section provides a brief summary (paraphrasing) of the main questions and issues that have been raised over the course of this process and how these comments have been responded to or reflected in the design process. Annex 5: Stakeholder Consultation provides a detailed description of the major events, participants, methods, feedback and lessons.

Table 9: Summary of questions, comments, responses and feedback from stakeholder consultation

Event	**Comments / Issues/Question**	**Responses**
ERP Information Sharing and Kick-Off for High Level Stakeholders, March 4th, 2015, Fiesta Royale Hotel, Accra.	Why so much overlap between the FIP and the ERP? How are these programmes working together and how are they different?	The FIP area is falls within the ERP area and share the same objectives. The two programme areas are characterised by the same drivers of deforestation and forest degradation. There are plans to synchronize work plans of the two programmes to avoid duplication of efforts. While the ERP is a performance based payment, the FIP is not. Rather, FIP sought to pilot readiness activities that would later be up- scaled to put Ghana in a position for implementation of performance based payment interventions like the ER Programme.
Synergy between REDD+ and FLEGT/VPA with respect to Benefit Sharing, Legality and Safeguards, March 13th, 2015, Forestry Commission Auditorium, Accra.	Is there a way of institutionalizing coordination and capturing synergies between REDD+ and VPA with respect to benefit sharing, conflict resolution, and complaint mechanisms?	The GCFP and REDD+ in general are synergistic with a number of other key initiatives like the VPA, FIP, etc. The JCC and the various sub-working groups represent efforts to ensure that there is serious institutional collaboration and coordination. For instance, on the NRWG and the Consultation and participation sub-working groups, there are representatives from FLEGT/VPA serving. In the same manner, the Head of the NRS also serves on the VPA Multi-stakeholder implementation Committee.
Consultation with stakeholders implementing REDD+ activities across the country—REDD+ Finance Tracking Initiatives (REDDX), 23rd June, 2015, FC Auditorium, Accra.	How is the programme addressing tree tenure? How is it aiming to motivate farmers to plant trees and how will farmers stand to benefit?	It is apparent that planted trees on-farms are owned by the planter. Under FIP tree seedlings are being distributed freely to farmers, and education and sensitization on the non-carbon benefits including provision of micro climate, soil conservation and fertility improvement of trees on farm are being undertaken.
	How will ERP programme engage all stakeholders, not just at high levels but also at the district and local level where the deforestation is taking place?	The programme will have specific HIAs and in each intervention area there will be HIA consortium which will have a constitution, management plan and district bye laws and the intervention area management board. The management board will be made up of the traditional authorities, village committees etc. There is already ERP stakeholder consultation plan.
	How would the sustainability of the ER programme be guaranteed	Non-carbon benefits are likely to be the most sustainable and important to farmers. The non-carbon benefit of ER such as increased yields, access to farming inputs, and rights to trees will drive the sustainability of the programme.
Training for Staff of Ghana's COCOBOD and FC on the GCFP, Sept 21-24, Aqua Safari, Ada, Ghana	How will the benefits sharing mechanism and/or bonus payment system under the COCOBOD inform the design of the Ghana's ERP benefit sharing mechanism?	This viewpoint, which was widely shared by COCOBOD participants, aligns with the logic of Ghana's ERP and has informed the design of the programme's benefit sharing mechanism.
	What existing measures are in place particularly on safeguards and for which lessons or experiences could be learnt to enhance the implementation of the ERP.	COCOBOD has extensive experience dealing with safeguard issues in its sector (e.g. child labor), as well as benefit sharing (bonuses). The Research, M&E Department of COCOBOD has the responsibility to monitor safeguard results and the staff on the ground are required to report as part of their results framework how safeguards issues are addressed. Again, CHED has developed best practices guideline for cocoa production. Lessons learnt are being incorporated into the design of ERP.
Community Consultation on Ghana's ERP, Owuram (Asamankese), Eastern Region,	How will the GCFP change the BAU on the ground with respect to contractors felling trees without farmers' consent	The ERP through stakeholder consultation at various levels including local communities has been sensitizing people particularly farmers on the legality of ownership of planted trees as well as the conditions under which contractors could fell trees on farms. The ERP learnt lessons from the free

October 9th ; and Assin Fosu, Central Region, October 13th, 2015.	and not paying compensation, and farmers' inadequate access to seedlings and fertilizer? The situation is not good for farmers.	distribution of tree seedlings and improved access to some farming inputs and will do same.
	Gender considerations in REDD+ and the programme should be stronger and clearer. How is gender being considered in REDD+ and in the design of the ERP?	Gender considerations are being given careful attention in the design of the ER Programme. Under the readiness phase of REDD+, the Forestry Commission in collaboration with IUCN engaged several stakeholders towards ensuring that gender issues are mainstreamed in the design and implementation of any REDD+ programme. The product of that collaboration in the design of a gender Road Map for REDD+ in Ghana. The roadmap guided gender considerations in the development of REDD+ Strategy.
REDD+ Strategy Multi-Stakeholder Consultation Workshop, Nov 5th, FC Auditorium, Accra	How will the programme address the lack of compliance with and enforcement of timber harvesting rules and regulations?	The programme implementation will support national efforts towards passage of legislation, reform and implementation of government policies, modification to customary norms and practices
	The strategy should clearly indicate how to address land tenure issues, tree tenure issues and carbon right as they emerge.	
	Wildfire should be part of the drivers especially considering the savannah ecological zone. The diagram showing drivers of deforestation and degradation needs to be expanded to cover other drivers aside from the five mentioned.	
	On financing, focus has been on the international market, but we should also look at the local market for financing for example Agricultural Development Bank and some internally generated system to support the implementation of the programme under the strategy.	
IUCN BMU REDD+ Benefit Sharing Project Learning Event, 9th - 11th November, 2015 at Aqua Safari Resort, Ada	Although individual landowners and land users do not have economic rights to naturally occurring trees, they do have the right to fell trees off-reserve during the land-clearing process and frequently nurture or eliminate species based upon their farming agenda and experiences. Discussions focused on how the programme should address this problem.	
	The current tree tenure system where the State owns all naturally-occurring trees and farmers have no ownership right over such economic trees in their farms, creates a disincentive for farmers to keep naturally economic trees in cocoa farms. How will the programme address this problem	The ER Programme is transformational and therefore seeks to push for significant changes and reforms in the forestry sector policies and strategies which include issues of tree tenure.
SNV Knowledge Event on Ecosystem Services in Ghana's Cocoa Landscape, 12 November, 2015 Mensvic Hotel, East Legon Accra, Ghana.	Main issues discussed included: Landscape has low carbon stocks, hence, it has the high potential for accumulating carbon with the implementation of REDD+; Non-timber species are more dominant in the landscape; more trees do not necessarily translate into greater canopy cover as it is dependent on species and tree characteristics; Shade tree canopy coupled with modest fertilizer application can have a positive impact on yields under low input smallholder cocoa cultivation.	
The National REDD+ Strategy (NRS) Validation workshop 17th December, 2015 at the FC Auditorium, Accra.	How does the programme/strategy sought to address the challenge of land use planning; what are domestic sources of funds - the document did not stress on domestic financing;	The programme will promote local level institutional coordination, stakeholder consultation and involvement in sub-national level land use planning. The development of an ER implementation plan which a consulting firm will be contracted to design will outline the various possible sources or funding or financing sources for implementing the ER

		Programme and for that matter any of the REDD+ programmes for Ghana.
	The document lacks strategic components such as setting ambitious carbon targets for the identified drivers of deforestation and forest degradation.	MRV has not been verified so setting our own targets will be difficult at this stage; Specific carbon targets cannot be provided now due to limitation in MRV - Implementation plan will provide specific details on carbon targets;
	Scope of REDD+ does not give much information on how biodiversity will be monitored. How is the issue of biodiversity conservation being addressed?	Build on earlier work carried out under the High Forest Biodiversity Conservation Project that was funded by GEF between 2000-2007, and work with FSD to effectively manage the Globally Significant Biodiversity Areas identified, among other things.
	How is cocoa strategy aligned with REDD+ strategy - there should be a close linkage.	The basic reason for the establishment and inauguration of the JCC between the FC and the COCOBOD is the general understanding that sustainability of cocoa production hinges on the sustainable management of forest. The Ghana National Cocoa Strategy II is at the draft stage of development. The strategy focuses on climate smart cocoa production and seeks to ensure combinations of cocoa trees and shade crops/trees that have both economic and environmental benefits. In fact, the cocoa strategy mentions the collaboration between FC and COCOBOD in the ER Programme and the FIP as current sustainability programmes.
Youth Event - REDD EYE CAMPAIGN	How do trees help to fight climate change? How do we benefit from not cutting trees for charcoal and export?	As trees grow, they help stop climate change by removing carbon dioxide from the air, storing carbon in the trees and soil, and releasing oxygen into the atmosphere; Trees can be cut for charcoal and export but tree cutting must be done within the law and new seedlings must be planted to replace the old ones.
Multi-Stakeholder Project Inception Workshop: Operationalizing National Safeguards Requirement for Result Based Payment From REDD+. 10th March, 2016 at the Tulip in Hotel, Accra.	How will REDD+ safeguard for Ghana maintain biodiversity and ecosystem services?	Ghana's REDD+ SESA and ESMF fully recognize the value of biodiversity and ecosystem services and the need to secure them. Compliance monitoring for the effective enforcement of the safeguards measures will ensure that biodiversity and ecosystem services are give adequate attention
Capacity Enhancement on Forest Reference Level/Measurement, Reporting and Verification System for REDD+ (MRV Training) 4th – 15th April, 2016 at the Forestry Commission Training Centre, Kumasi.	How are errors taken into consideration for projections of emissions and removals?	Activity data of specific statistics through sampling often has an error factor with it. Provisions of UNFCCC and FCPF give room for some errors based on the requirements of the organization you are submitting to. Data sampling and maps give room to report on uncertainty of emissions reduction with specific uncertainty for each deforestation strata.
	What stratification of forest is used for Ghana and how are capacities of local experts being built for MRV?	For stratification of the forest, it is important that the strata needs to be identifiable/verifiable using remote sensing/ satellite imagery. Strata could include; accessibility, openness of forest, vegetation area, terrain. There is a team of experts from Winrock and Applied Geo-Solutions to train specific institutions/individuals who will be involved in the MRV including k knowledge sharing on delineation of cocoa from forests
	Is Ghana reporting on Tier 1, 2 or 3 data	FPP is under Tier 2 because we have country specific data on above-ground biomass, below-ground

	for the reference level taking into consideration Forest Preservation Programme? Any difference between Tier 2 and Tier 3?	biomass, litter and deadwood. However, soil data is not very easy to fall under Tier 2 because it should look at change in stock rather than the available stock Ghana has. In this case Ghana can use Tier 1 for soil. Tier 3 allows negotiating at different levels using models as informative tool rather than just activity data. Indonesia and Kenya are the REDD+ countries using Tier 3 supported by Australia. Canada has Tier 3 and supporting Mexico. A country can still use national datasets to achieve Tier 3 but will use these repetitive data as well as remote sensing for modelling. However this setup is very costly and is a decision of the country to see if it's imperative to use Tier 3
Implementation Plan Consultation with Cocoa Private Sector Stakeholders at Accra City, 6th June, 2016.	The total area of land under cocoa cultivation is widely quoted as about 2million ha, but CHED is also talking about 1.7million. Which one should we reference?	In order to achieve the objectives of the ERP, it will be implemented wall to wall, thus across the entire landscape. But, of course activities will not be implemented at the same scale across the entire landscape at the same time. There is the need to start from priority areas and later scale up to cover the entire landscape.
	There is high deforestation identified particularly along the middle vertical stretch of the programme area, and this could be attributed to galamsey. Why were these areas left out in the selection of the HIAs?	The issue of mining and illegal mining has become a national security issue. The ERP resources could not be used to solve national security problem. It is therefore advisable to start with areas that do not have much gold deposit and therefore free from issues associated with mining.
	Is there significant location they are going to move to when the resources get exhausted at their current deposit site.	We will have to hear from some other state agencies on what government is doing to resolve the problems and also ensure that such activities are not moved into other areas within the landscape.
	Concerning the premium price of the commodity – who pays the difference in the price Who will be responsible for paying the differential premium	It is the consumer who will be responsible for paying the differential premium. This is because the principle is to internalize the externality. There has to be a Ghana cocoa It is not a premium but a different commodity
	If the traditional authorities and local people understand the importance of the programme, the bye laws they make at local levels are more adhered to than national laws. What will be the role of the traditional authorities and district assemblies?	At the HIA levels there will be landscape and land use planning and at that level, all these stakeholders will be brought together to discuss problems and find amicable solutions to them. An explanation ensued on the HIA body and it's Consortium in the GCFRP implementation plan which includes both the TA and DAs.
Multi Stakeholder Workshop on Ghana Cocoa Forest REDD+	We always talk about further assessment and analysis of data	The FPP data were used by the consultant in this assignment. However, there were some constrains. For instance, FPP data used only up to 2010. There is therefore the need for

Emission Reduction Programme – Draft Implementation Plan. 14th June 2016 at the Auditorium of the Forestry Commission	What happened to the FPP data – isn't it useful?	some additional analysis in order to fill some gaps in available data.
	There are lots of other things going on in the landscape apart from cocoa as well as very important stakeholders like traditional authority and farmers. How are they being consulted and involved?	HIA is the cocoa farmer – initial stakeholder analysis under this assignment focused on who has the money to invest in the programme to achieve the desired result. Going forward with implementation, there will further stakeholder mapping and analysis in each HIA. The HIAs are going to have their own consortium and will have to work on all other things including which stakeholders should be involved in the implementation of the programme. For instance, apart from political commitment at the highest level, we are also looking at political commitment at the local level where the traditional authorities are in charge.
	The cocoa sector is a 2billion dollar investment sector. The question therefore is how we leverage on the cocoa sector investment in the landscape to achieve the emission reduction.	Since HIA were partly determined based on the presence of cocoa sector stakeholders, the goal is to leverage their existing investment by making sure that they are focused on the HIAs, and then seeing how they can be tailored to address deforestation, either directly or indirectly.
	Mobilizing public finance for initiative like this has always been very challenging. What is the potential source of funding for the programme?	The potential source of funding will be the private sector and that will be cocoa money. Private cocoa companies have their sustainability programmes and these programmes are not helping our forest.
	How best will HIAs be integrated into the District Assembly system so that it will benefit from the district in term of district planning	The HIA is at the landscape level and the consortium will include all stakeholders (public private NGO CSO etc.) and it can therefore be integrated into the District assembly development plan. The programme has to be sustainable and cocoa alone cannot make it sustainable and this is why the role of other stakeholders including the district assembly will be very important in ensuring the sustainability of the programme.
Consultation with Key Policy Makers held on 7th July, 2016.		
Consultation with the Parliamentary Select Committee on Lands and Forestry on Ghana's ER Programme held on 21st July, 2016 at Villa Victoria	Was it a policy directive that Pamu Berekum Forest Reserve should be cleared? What is FC doing to address the problem? Is there sensitization in the area to educate the people on the effects of forest loss?	FC has been implementing diverse programmes including restoration activities within depleted forest reserve. Steps taken to recover forest loss at the Pamu Berekum Forest Reserve include sustainable forest plantation programme and education and sensitization of the public on the adverse effects of climate change.
	To what extent is the programme attracting private sector investment?	The GCFRP is designed in such a way to leverage on the support from the private sector in Implementing the programme.

	Who ensures that the lands are reclaimed after mining?)	Mining has been highlighted in the REDD+ Strategy document, but FC and its stakeholders cannot solve the issue of mining alone. It needs a strong political commitment and cooperation between stakeholders in the mining sector.
Consultation with Metropolitan, Municipal and District Assemblies (MMDA's) on Ghana's ER Programme held in Takoradi on 16th and in Kumasi on 18th August 2016.	Why is the ERP focusing on agriculture, specifically cocoa? Why is the Volta region not included in the GCFRP as cocoa is also grown there?	There is a special reason why cocoa is the focus. The ERP is targeting the cocoa forest mosaic landscape within the High Forest Zone of Ghana as the initial step. Agricultural expansion (conversion of forest to cocoa) is a major driver of carbon emission within that landscape. There are other ERP being designed for the Savanna, Coastal and Togo Plateau (which will cover the Volta Region).
	How can the ERP contribute to law enforcement as Ghana has a lot of laws but enforcing the laws has always been a major problem?	Law enforcement has been a problem for all institutions. There are problems with personnel especially as most forest guards are over-aged or not motivated to perform their mandate to the fullest. We need collective effort in this regard to enable Ghana realize the goal of the ERP and REDD+.
	How can the programme provide community members with alterative livelihood schemes other than forest products?	Alternative livelihood is a very important initiative; there is a need to effectively implement and monitor it. Most MMDA's present reiterated the fact that the programme must focus on providing alternative livelihood schemes for natives to concentrate on other income generating avenues rather than on forests to avoid further degradation
Consultation with Traditional Authorities on Ghana's ER Programme Held in Kumasi on 23rd August 2016.	*How will REDD+ contribute to Legislation?*	Issue of legislation is a major driver and a high priority activity. Law enforcement has been a major problem in Ghana for several years. Over the years chiefs have been able to enforce local laws in their communities and impose sanctions which have worked effectively. Capacity building programmes have been organized for frontline staff of the FC in all 10 regions. The training is a continuous process. Through REDD+ and support from traditional authorities and other stakeholders the FC is poised to effectively engage in emission reduction programmes.
	How can traditional authorities contribute to sensitization?	Chiefs could use the opportunity during festivals or durbars when engaging with communities to sensitize communities. Also the NRS is willing to attend programme or durbars upon invitation from chiefs to talk about the programme. The GCFRP is committed to supporting traditional authorities in terms of sensitization and high level advocacy on the programme.
	What has COCOBOD done in reducing emissions and contributing to the ERP?	COCOBOD has engaged with farmers in capacity building programmes by using community extension agents. Staffs of COCOBOD have also been trained on the ERP and REDD+ and staff of FC and COCOBOD work together to help reduce emissions.
Meeting of the Participants Committee of the Forest Carbon Partnership (FCPF), 26th – 30th September, 2016 @ Kempinski Hotel, Accra - Ghana		

REDDEYE Regional Campaign Launch, 1st November, 2016 at the Presbyterian Junior High School Park, Anyinam, Eastern Region.	What is the role of the public / youth in mitigating climate change?	Climate change is largely human induced - Illegal felling of trees; illegal mining (galamsey); unsustainable land use; over dependence on fuel wood and charcoal instead of renewable or clean energy; wildfires; indiscriminate dumping of refuse, among others cause climate change.
	What is the theme for this launch and why was such a theme chosen?	The youth form the bulk of the population and are mostly catalysts in activities such as illegal logging and illegal mining which destroys our forest ecosystem. Creating awareness among the youth on the impacts of these actions on future generations is essential to prevent resource depletion.
	Why it become important for the Forestry Commission to be involved in issues of climate change?	There is a relationship between forests and climate change. The most important GHG of concern is CO_2. Plants use CO_2 during photosynthesis, therefore there is a direct relationship between forest/trees. When trees are cut down there is a release of carbon but when they are planted or left standing they sequester CO_2 from the atmosphere. It is therefore, important to plant, nurture and maintain healthy forests.
	The public is being encouraged to desist from all these acts and plant more trees to absorb the greenhouse gases which are produced in the atmosphere. Youth could be attitudinal change ambassadors for REDD+ and also propagate the REDD+ message.	
Briefing Meeting on Ghana's REDD+ Process for Forestry Commission Management Staff	In other to have specific interventions to strengthen the REDD+ programme shouldn't there be the need to clearly define forest with respect to REDD+?	There is basically one definition for forest and that is what REDD used.
	How is reward going to be shared under the REDD+ programme?	In terms of benefit sharing that would be based on the actors involved in the project where their roles and responsibilities would be enumerated and then the benefit sharing proceedings would be stated. Also managers of naturally reoccurring would be also be considered.
	What is the progress of REDD+ programme with respect to synergies?	The REDD+ unit has made substantial progress with respect to synergies notwithstanding there could be more collaboration between the VPA and the REDD+ going forward.
Training workshop on	Does the country have a baseline	Ghana has developed a draft national forest reference level and submitted to the

Ghana's REDD+ Safeguards requirement Implementation	reference level for the emissions? Without pilot stage, what makes Ghana better placed to achieve successful implementation. How far have plans gone with benefit sharing.	UNFCCC. It is not only a challenge to Ghana. Funds were made only available for readiness and not for piloting. It is the onset of FIP that gives Ghana the opportunity to learn lessons. Benefit sharing, a pillar of REDD+. Under the equity, benefits accruing under REDD+ are equitably shared. FORIG were appointed to do a study on benefit sharing options and building on that, a more detailed work has been commissioned
Launch of Ghana Forestry Development Master Plan, Ghana Forest Plantation Strategy and National REDD+ Strategy at the Accra International Conference Center on November 23rd, 2016.	The three documents contain strategic interventions that seek to contribute to reducing emissions from deforestation and forest degradation, sustainable supply of timber and wood-fuels, reducing poverty and helping to conserve biodiversity Strategies and intervention outlined in the document will operate within the framework of sustainable global and national while promoting collaboration among stakeholders improve forest governance, restore degraded landscapes and tackle the adverse impacts of climate change.	
Safeguards Sub-Working Group Meeting on the 9th and 10th February, 2017 at Golden Bean Hotel, Kumasi	There is the urgent need for sector coordinated effort in ensuring synchronization and integration of on-going initiatives in order to avoid duplication of efforts.	The institutional arrangements and framework should be clear on which institution is gathering what information for the Safeguard Information System (sis). Training modules should include a framework for monitoring and evaluation. There should be identification of indicators/parameters to populate the SIS. District Assemblies (DAs) can serve as third parties in completing the complaint forms for the purposes of verification.
MRV and Reference Level Meeting with Directors and key management staff of FC at FC Conference room on 17th February, 2017	How accurate is the MRV results. Are there other ways to verify the results? Aside Rosewood exploitation, wildfire is also a serious threat to the forest therefore the need to look at interventions to pursue the REDD+ agenda at the savannah zone of Ghana Have areas known as forest in the Savannah zone mapped out?	In relation to the accuracy level, the MRV cannot be 100% however there is a lot verifications done internally and also internationally to ensure that the Maps generate are of high quality. Yes mapping has been done across all the project areas.

6. OPERATIONAL AND FINANCIAL PLANNING

6.1 Institutional and Implementation Arrangements

The institutional and implementation arrangements for the day to day operations of the GCFRP, as well as the broader support under REDD+ to the programme are shown in Figure 7. Starting from the high level institutional support and working down to the programmematic institutions and stakeholder bodies, this section describes the main roles and responsibilities of the institutions affiliated with the programme.

The NRWG is a ministerial level, multi-stakeholder body charged to provide oversight and guidance to REDD+ nationally, as fully described in Section 2.3. In line with the national REDD+ implementation architecture, the NRWG will have indirect, high level oversight of the programme. Specific to the programme, the GCFRP Steering Committee includes the Director of the REAL Sector of the MoF, the Chief Executive of the FC, the Chief Executive Officer of the Cocoa Board, and the Chief Director of the MLNR. This Ministerial level body ensures the highest level of institutional oversight, guidance, and support to the programme. Members of the NRS and the JCC communicate with and report to the Steering Committee.

As described in Section 2.3, the NRS has full administrative and management responsibility for REDD+ nationally. It receives guidance and direction from the NRWG and communicates to the programme's Steering Committee, and other future programme steering committees, while working in close collaboration with the GCFRP JCC.

At the programme level, overall management and coordination is the responsibility of Joint Coordinating Committee (JCC). The JCC is a six person committee that was established in 2015 to support the development of GCFRP, to ensure efficient communication and coordination between the NRS, Cocoa Board, the FIP, and the NRWG, and to serve as a body to coordinate and guide high level implementation. The JCC is a five-member body made up of two representatives from the NRS, one representative from the FIP and two representatives from the Ghana Cocoa Board.

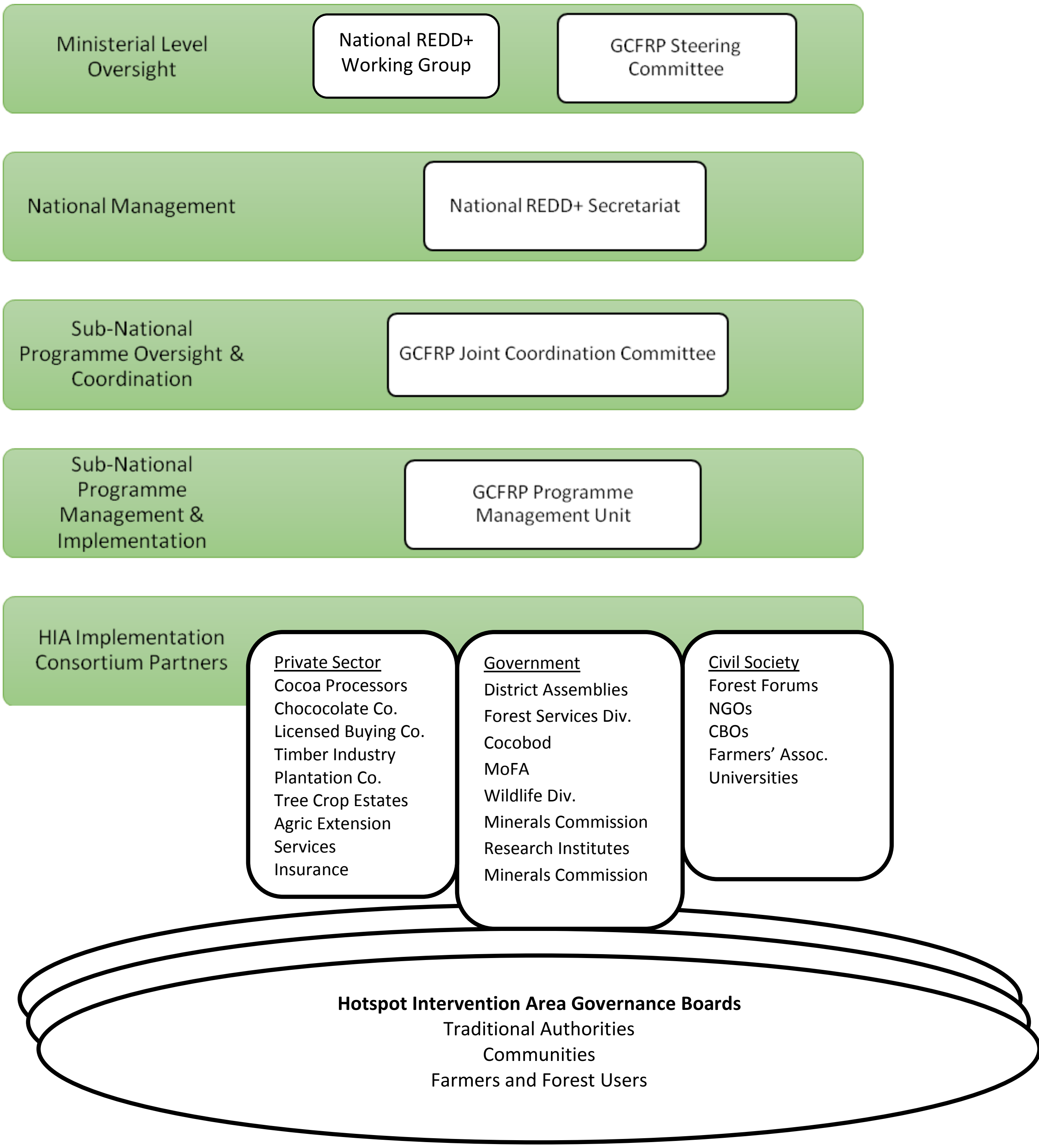
The JCC's role as a cross-sector oversight committee will primarily be to guide and direct the PMU, but will also be linked to the roles of other bodies, partners and stakeholders. To ensure transparency and effectiveness, the roles and responsibilities will be made clear to all stakeholders and partners at the onset of GCFRP implementation.It is envisioned that on an annual basis (or otherwise), the JCC will be responsible to set targets for GCFRP implementation and to approve the annual planning of GCFRP implementation as drafted by the Programme Management Unit and the HIA consortiums. The JCC will maintain financial oversight of the programme. Further, the JCC will need to secure and maintain high-level government endorsement for the GCFRP and coordinate inter-governmental collaboration and communication.

The Programme Management Unit (PMU) will be the executing agency for the GCFRP. It will be composed of representatives of the MLNR, MoF, FC, Minerals Commission (MC), COCOBOD, District Assemblies and relevant NGOs, companies and other stakeholders directly involved with the implementation of the programme's measures and activities, including stakeholder engagement and consultation. The PMU will also have technical staff responsible for key elements of the programme, including the implementation of the benefit sharing plan and safeguards, and the feedback and grievance redress mechanism. Further, the PMU will be responsible to develop an annual operational plan (AOP), annual budget, and implementation reports about the GCFRP, which will be shared with the JCC for input. The PMU will then be responsible for implementing the AOP. As part of this, The PMU should also promote partnerships among local stakeholders and other agencies and execute contracts and agreements to guarantee the implementation of the Programme, and coordinate and promote the attraction of investors and new potential sources of funds for CSC and REDD+ in the GCFRP region.

With respect to the implementation and updating of the MRV and FRL, and the operation of the data management system, this responsibility will fall under the NRS and PMU. These two bodies are responsible for these activities at both national and programme(s) level. In this regard, the PMU will be responsible for coordinating the accounting and monitoring procedures to clearly demonstrate the performance of the GCFRP against its FRL, annual monitoring and oversight of impacts and changing trends, and maintain the data management systems for housing key information related to REDD+ and CSC operation in the programme landscape. The PMU must also monitor and record the implementation status of activities in each Hotspot Intervention Area (HIA), and guarantee that the annual planning of activities is being followed and implemented.

While the PMU directs and coordinates implementation, the actual implementation of priority activities in each HIA will rely on a consortium of stakeholders (HIA Implementation Consortium Partners) who live, work, or have investments within the landscape, and have an interest in the area. As described in Section 6.1 (A5), each HIA landscape will be managed by an HIA Governance Body made up of local land-users, land owners and traditional authorities who organize themselves into a government recognized NRM structure, like that of the CREMA (i.e. modified CREMA), which accords them the right to manage their natural resources for their benefit.

The Consortium and the HIA Governance Body will establish how best to coordinate all activities related to the programme in their HIA's. The PMU and the HIA Consortium will carry on a participatory process to build the HIA governance and implementation structure at each location. Following successful negotiation of HIA initiation, the programme will support the requisite steps to establish management boards, prepare HIA constitutions, and hold regular HIA governance meetings. Key decisions of the HIA Governance Board will be to determine how best to make the transition to a climate-smart, no deforestation, sustainable cocoa production system in line with the development of a standard. Key activities will involve landscape planning, zoning land use practices, approving CSC practices to be adopted by farmers in the HIA, financial planning and management structures, and reaching agreements with the HIA CSC Consortium. Appropriate levels of communications with all stakeholders will be achieved through durbars, local FM radio announcements and other media.



Bodies in direct alignment with the REDD+ that will provide critical support but not directly under the REDD+ Structure.

REDD+ and GCFRP bodies responsible for guiding, managing and implementing REDD+ at national, sub-national, and landscape levels.

Figure 7: GCFRP Institutional Coordination Diagram

6.2 ER Programme Budget

Funding for the implementation of the GCFRP will be from a mix of sources: REDD+ funds (21.1%), private sector investment (51.3%), Government of Ghana, including Cocoa Board and FC investment (22.7%), and donor grants (4.9%). In the current budget, the mix of funding sources is summarized in Table 10. Annex 2a, 2b and 2c provide a complete financial plan and budget for the GCFRP.

Ghana estimates that the total cost of setting up and operating the GCFRP over its first 5 years is US$ 236,727,250. Of this, it is anticipated that the programme will generate approximately US$50 Million in revenue from emission reductions. This budget covers the period 2017- 2021 assuming that Ghana signs an ERPA in 2017.

Table 10: Summary of funding sources for the GCFRP

Summary of Funding Sources	Total	%
REDD+ Funding	$ 49,990,400	21.1%
Private Sector	$ 121,360,000	51.3%
Grants	$ 11,718,800	4.9%
Government	$ 53,658,050	22.7%
TOTAL	**$ $236,727,250**	**100%**

6.2.1 REDD+ Funding

It is estimated that CF finance will contribute approximately US$50 million to the programme, 21.1% of the total. Carbon Fund financing will be housed within an independently managed fund (Dedicated Fund) to enable the "sharing of benefits within the HIAs and to support key elements of the programme that are crucial to generating ERs and thus carbon-based benefits. Carbon Fund financing will be used primarily to: 1) support farmers to receive training and access to incentives and benefits through the CSC farmer engagement package, 2) to support HIA development projects; 3) to provide access to yield insurances, 4) to support law enforcement of the GCFRP area, 4) to supporting community monitoring and patrols of the HIA, 5) for MMRV, 6) for Safeguards, and 7) tocreate sustainable finance plans for each HIAs. Given that the BSP is yet to be finalized, the cost of implementing the BSP is yet to be determined and has therefore not been included.

6.2.2 Private Sector financing

The private sector investment of US$121,360,000 represents about 51% of the total value of the programme. In 2015, Ghana's entire cocoa sector was worth US$ 1.8 billion, as evidenced by the syndicated loan that the Cocoa Board signed on behalf of the private sector in Paris in September. On top of this, the private sector makes additional investments through their public-private partnership extension programmes and sustainability initiatives, which are focused at the grassroots producers. In 2017, the chocolate industry committed to reducing deforestation in the Ghana and Cote d'Ivoire with the financial support of more than 12 companies. In principle, the GCFRP does not expect the private sector to bring substantial *new* money, but rather it expects to leverage a portion of the existing investments and influence this investment into new, climate-smart and coordinated use. Specifically, the private sector will fund the major elements of the programme, namely the establishment of CSC and the development and implementation of farmer engagement packages and better farming practice guides. In addition, the fund to support access to financial credit and providing access to yield insurance will be supported through private sector funds. As of early 2017, a number of companies including WCF, IDH, Touton and Mondelez have made direct commitments to Ghana to support private sector engagement, HIAs and CSC implementation.

6.2.3 Grant Financing Sources

There are multiple potential grant sources of funding for this programme, and multiple work streams that could be packaged for such. In the current budget, grant funding will contribute US$11,718,800 to the programme, or 4.9% of the total value and will largey cover initial funding to get work started, before REDD+ finance begins or full private sector support comes on-line. Specifically, grants will cover initial law enforcement and monitoring activites, establishing and supporting of PMUs and implementation of HIA management plan in the GCFRP area. Already, NCRC/VCS/IKI will fund the entire budget for activity B4: Establish CSC landscape level validation in HIAs. In addition, a number of NGOs including Solidaridad, SNV and NCRC have made direct commitments to Ghana to support HIAs and CSC implementation (Pillars B & C), as have the FIP programme under the CIF. Palladium, with 25 million pounds sterling from DFID, is also preparing to support CSC activities in Ghana.

6.2.4 Government Financing Sources

In the current budget, government funding will contribute approximately US$53,658,050 to the programme, or 22.7% of the total. Government will fund the establishment of the Joint Coordinating Committee and the Steering Committee, help support the basic systems and operations of the programme (MRV, Safeguards, FGRM, etc) through operation and staff support to the PMU and NRS. In addition, Cocoa Board input supply is expected to represent 42% of the CSC package for beneficiary farmers. This represents the majority of government contribution, valued at approximately US$50,000,000.

6.2.5 Budget Category Summary and Discounted Cash Flow Analysis

A discounted cash flow analysis of the CSC opportunity shows that the GCFRP makes excellent financial sense in addition to climate sense. A conservative increase in yields by 50% to 600 kg/ha will realize significant benefits to farmers and to the government. The IRR for the project under this scenario is calculated at about 438.16% and the NPV at 20% will be $339.05 million.

The full discounted cash analysis is presented in Annex 2C with scenarios of no increased yield, 50% increase, 100% increase, 150% increase and 200% increase in yields. All scenarios are attractive, with the exception of no increased yield and demonstrates that focusing on increasing cocoa farm yields through the issuance of CSC packages and adoption of practices, coupled with the creation of a CSC Sustainability Standard, can produce major socio-economic benefits, in addition to carbon benefits.

The question of whether it is possible for Ghana to sustainably increase yields by 50%, to 600 kg/ha, or even double yields to 800 kg/ha is not in question. Ghana’s neighbor, Côte d’Ivoire, produced over 1,600 tonnes in 2016 and average yields are approximately 800 kg per ha. Furthermore, projects and studies in Ghana have also demonstrated the straightforward feasibility of sustainabily increasing yields as evidenced by the Climate-Smart Cocoa Pathway document, produced by Ghana's Climate Smart Cocoa working group under Forest Trends[51], as well as studies by Asare et al. (2016)[52], Ehiakpor et al. (2015)[53], and as evidenced by organizations like Cocoa Abrabopa, Sustainable Tree Crop's Program, and WCF's experiences in the field.

A brief description of each budget category is below, and Annex 2B includes a table with budget notes.

Table 11: Summary of budget categories

Budget Category	Total	%
A. Institutional Coordination and MRV	$ 14,025,850	5.9%
B. Landscape Planning within HIA areas	$ 6,946,400	3.0%
C. Increasing Yields via CSC	$ 148,080,000	62.5%
D. Risk management/finance	$ 66,930,000	28.3%
E. Legislative and Policy Reform	$ 745,000	0.3%
TOTAL	**$ 236,727,250**	**100.00%**

Institutional Coordination and MRV

At US$14,025,850, this budget category represents 5.9% of the total budget. This activity area includes funding the Joint Operating Committee (US$555,000) and establishing and supporting the operation of the Programme Management Unit (US$3,525,850). In addition, this budget category includes funding for the MRV (US$3,500,000), Law Enforcement of the GFCP area (US$5,500,000) and the creation of the CSC hotspot areas (US$945,000).

Landscape Planning within HIA area

Landscape planning represents 3.0% of the total budget, or approximately (US$6,946,400). This budget category includes funds for establishing the CSC consortium in each HIA (US$120,000). In addition, this category includes the creation of the HIA landscape management plans (US$1,608,000) and the implementation of the management plans (US$4,118,400). Finally, this category includes landscape level validation in the HIAs ($1,100,000).

Increasing Yields via CSC

Increasing yields via the CSC represents 62.5% of the total programme budget at (US$148,080,000). The majority of this category is the CSC support to farmers, estimated at $29,500,000/year over 5 years supported both through private sector funds and input support from Cocoa Board. Other activities supported in this budget category include development of the CSC packages to farmers (US$150,000),

[51] "The Case and Pathway toward a Climate-Smart Cocoa Future for Ghana" (2011), Climate-Smart Cocoa Working Group. Forest Trends, Washington D.C., and Nature Conservatoin Research Centre, Accra. www.forest-trends

[52] Asare, R., Asare, R.A., Asante, W.A., Markussen, B. and Raebild, A. 2016. *Influences of shade and fertilizer on on-farm yields of cocoa in Ghana.* Expl. Agric. (1-16). Cambridge University Press.

[53] Ehiakpor, D.S., Danso-Abbeam, G., and Mabe, F.N. 2015. *Technical efficiency in Ghana's cocoa bean industry: evidence from Western Region of Ghana.* Journal of Economics and Sustainable Development (6:7). IISTE.

development of CSC good practice guidelines (US$180,000) and support to increase transparency in the cocoa sector (US$250,000).

Risk Management/Finance

This budget category represents 28.3% of the total programme budget at (US$66,930,000). The majority of this budget category is dedicated to the creation of a credit facility to provide small scale loans to cocoa farmers (US$50,050,000). Other activities supported in this budget category include facilitating access to yield Insurance (US$15,200,000), marketing of addition emissions reductions (US$160,000), branding and marketing of ER Cocoa (US$290,000) and supporting the sustainable finance of the HIAs (US$1,230,000).

Legislative and Policy Support

This budget category represents 0.3% of the total programme budget at $745,000. Key activities supported in this budget category include support to key legislation (US$220,000), implementation guidance of government policies (US$270,000) and support for the modification of customary norms and practices (US$$255,000)

7. CARBON POOLS, SOURCES AND SINKS

7.1 Description of Sources and Sinks selected

Ghana's decision to select sources and sinks was guided by the first order emissions estimates undertaken using the FCPF REDD+ Decision Support Tool (DST)[54] as well as the 2006 IPCC Guidelines for National Greenhouse Gas Inventories, the Carbon Fund Methodological Framework and expert judgment. Ghana also ensured consistency in the selection of activities for the national FRL and the programmatic FRL.

The first order emissions estimates were based on a 10% and 20% forest cover definition (since the DST does not make provision for a 15% canopy threshold). This assessment indicated that at both the national level and High Forest Zone and irrespective of the forest cover definition, deforestation was the most significant source of emissions. Additionally, degradation was also identified as a significant source of emissions (i.e. it accounted for more than 10 per cent of total emissions).
The first order estimates was also used to determine sub-activities that were considered as key categories (defined by the 2006 IPCC guidelines as those that, when summed together, contributes to a minimum of 95 per cent of total emissions). Consequently, at the national level, all the sub-activities under degradation (i.e. logging, fuel wood and fire) were identified as key categories since each of them accounted for more than 5 per cent of total emissions. In order to ensure consistency with the national FRL, all the sub-activities under degradation were included as sources in estimating the FRL for the ER programme. **Table 12** below presents the results of the first order estimates using the DST.

Table 12: First-order emissions estimates for Ghana at the national level and High Forest Zone using the FCPF REDD+ Decision Support Tool

	Relative Percentages of Total Emissions							
	10% Forest Definition				20% Forest Definition			
	Deforestation	Timber	Fuel wood	Fire	Deforestation	Timber logging	Fuel wood	Fire
National	64%	12%	7%	17%	62%	13%	7%	18%
High Forest Zone*	80%	14%	3%	3%	80%	14%	3%	3%

* The High Forest Zone (HFZ) is based on ecological zones, but first-order estimates were calculated based on political administrative boundaries. Therefore, the estimates in this table for the HFZ include all administrative units that are >50% within the HFZ.

[54] The REDD+ DST supports decision making by using global datasets and scientifically-sound methods to produce customized first-order estimates of emissions from REDD+ activities and basic REDD+ reference levels. The REDD+ DST is available at: https://redd-dst.ags.io/.

Table 13: Description of sources and sinks

Sources/Sinks	Included?	Justification / Explanation
Emissions from deforestation	Yes	The ER Programme will account for emissions from deforestation. Deforestation was identified as the most significant source of emissions based on the first order emissions estimates using the FCPF Decision Support Tool.
Emissions from forest degradation	Yes	The ER programme will account for emission from four sources of forest degradation: -Woodfuel collection -Forest fire -Legal timber logging -Illegal timber logging Using the FCPF DST, the emissions from these sources were identified as significant (i.e. more than 10% of total emissions).
Removals from carbon stock enhancements	Yes	The ER programme will account for removals from forest plantations that have been planted both on- and off-reserve as part of the National Forest Plantation Development Programme (NFPDP). Although considered as insignificant (i.e. below the 10% threshold (in absolute terms) in terms of its contributions to net emissions), removals from carbon stocks enhancement was nonetheless included in the FRL. Ghana has developed an ambitious National Forest Plantation Strategy which is closely aligned with the programmatic objectives of the ERP. The Forest Plantation Strategy will serve as the blueprint for the NFPDP. The Strategy seeks to, amongst others, facilitate the incorporation of trees within 3.75 million hectares of agricultural landscapes in the country over a 25-year period, commencing from 2016. Inclusion of the forest plantations to be established under the NFPDP will therefore enable Ghana to access the requisite data to track/ monitor removals associated with the implementation of the NFPDP in the GCFRP area and also ensure that the GCFRP is well aligned with this important national initiative.
Sustainable Forest Management	No	Sustainable Forest Management (SFM) was not included as an activity for the ER programme based on expert advice from Ghana's REDD+ MRV sub-working group. The key reasons advanced to support this decision are outlined below: 1. Generally, carbon fluxes associated with sustainable forest management over a period tends to be at equilibrium – losses associated with harvesting and other disturbances may be offset in the long term by natural and assisted regeneration. Thus, any emissions or removals may not be significant to warrant the cost and need for development of a complex model/ approach for the activity (i.e. SFM); and 2. Emissions resulting from logging in 'managed' forests in Ghana have been incorporated in the assessment of emissions for degradation. In reality, logging in Ghana's forests leads to degradation rather than sustainable forest management since management plans are usually not fully enforced. Inclusion of SFM as an additional activity could therefore lead to 'double counting' of emissions.
Conservation	No	Conservation was also not included as an activity for the ER programme based on expert advice from Ghana's REDD+ MRV sub-working group. A fully conserved forest will have very limited emissions or removals whereas any changes in the conservation status will be captured under deforestation and degradation analyses.

7.2 Description of Carbon Pools and greenhouse gases selected

Deforestation

In 2012/3, Ghana implemented the Forest Preservation Programme (FPP). The objective of this programme was to map forest cover and estimate carbon stocks for all the ecological zones in the country. The emission factors developed for deforestation analyses under the FPP incorporated all the carbon pools including those that were identified as significant based on the IPCC recommended thresholds (i.e. the aboveground, belowground and soil carbon) and the other pools (litter, deadwood and herbaceous). The emission factors for deforestation analyses under the ER programme were sourced from the FPP and consequently included all the carbon pools.

Carbon Pools	Selected?	Justification / Explanation
Aboveground Biomass	Yes	The aboveground biomass pool is the most significant pool for forests in Ghana.
Belowground Biomass	Yes	The belowground biomass pool is a significant pool.
Litter	Yes	For completeness, litter is included
Deadwood	Yes	For completeness, deadwood is included
Herbaceous	Yes	For completeness, herbaceous is included
Soil	Yes	The soil carbon pool is a significant pool.

Greenhouse gases	Selected?	Justification / Explanation
CO_2	Yes	The ER Programme shall always account for CO_2 emissions and removals
CH_4	Yes	Forest fire results in the emissions of methane. The ER programme will therefore account for methane emissions associated with deforestation by fire.
N_2O	Yes	Forest fire results in the emissions of methane. The ER programme will therefore account for nitrous oxide emissions associated with deforestation by fire.

Degradation by Logging (legal and illegal)

Carbon Pools	Selected?	Justification / Explanation
Aboveground Biomass	Yes	The aboveground biomass pool is the most significant pool for this activity in Ghana.
Belowground Biomass	Yes	The belowground biomass pool is a significant pool.
Litter	No	The litter pool is not a significant source of emissions for this activity. Degradation occurs in forestland remaining forestland and therefore does not lead to significant carbon stock changes in litter in Ghana's context.
Deadwood	Yes	The deadwood pool is a significant pool. The approach used to estimate emission factor for legal/ illegal logging captures carbon stock losses associated with trees fatally damaged by logging operations as well as all remnants parts of the harvested tree which are left in the forest including the crown and the tree stump.
Harvested Wood Products	Yes	The harvested wood product pool is significant. A committed emissions approach is taken and so the permanently sequestered stock in harvested wood products is very small.
Soil	No	The soil carbon pool is not a significant source for this activity. Degradation occurs in forestland remaining forestland and therefore does not lead to significant carbon stock changes in soil in Ghana's context.

Greenhouse gases	Selected?	Justification / Explanation
CO_2	Yes	The ER Programme shall always account for CO_2 emissions and removals
CH_4	No	Methane emissions are not relevant for this activity
N_2O	No	Nitrous oxide emissions are not relevant for this activity

Degradation by Woodfuel Collection

Carbon Pools	Selected?	Justification / Explanation
Aboveground Biomass	Yes	The aboveground biomass pool is the most significant pool for this activity in Ghana.
Belowground Biomass	Yes	The belowground biomass pool is a significant pool for this activity in Ghana.
Litter	No	The litter pool is not a significant source of emissions for this activity
Deadwood	No	The deadwood pool is not a significant source of emissions for this activity
Soil	No	The soil carbon pool is not a significant source for this activity

Greenhouse gases	Selected?	Justification / Explanation
CO_2	Yes	The ER Programme shall always account for CO_2 emissions and removals
CH_4	No	Methane emissions are not a significant source for this activity
N_2O	No	Nitrous oxide emissions are not a significant source for this activity

Degradation by Fire

Carbon Pools	Selected?	Justification / Explanation
Aboveground Biomass	Yes	The aboveground biomass pool is the most significant pool for this activity in Ghana.
Belowground Biomass	Yes	The belowground biomass pool is always a significant pool.
Litter	Yes	Not significant, included for completeness
Deadwood	Yes	Not significant, included for completeness
Soil	No	The soil carbon pool is not a significant source for this activity

Greenhouse gases	Selected?	Justification / Explanation
CO_2	Yes	The ER Programme shall always account for CO_2 emissions and removals
CH_4	Yes	Methane emissions may be significant source for this activity
N_2O	Yes	Nitrous oxide emissions may be a significant source for this activity

12e Removals by Carbon Stock Enhancements

Carbon Pools	Selected?	Justification / Explanation
Aboveground Biomass	Yes	The aboveground biomass pool is the most significant pool for this activity in Ghana.
Belowground Biomass	Yes	The belowground biomass pool is always a significant pool.
Litter	No	The litter pool is not a significant source of emissions for this activity
Deadwood	No	The deadwood pool is not a significant source of emissions for this activity
Soil	No	The soil carbon pool is not a significant source for this activity

Greenhouse gases	Selected?	Justification / Explanation
CO_2	Yes	The ER Programme shall always account for CO_2 emissions and removals
CH_4	No	Methane removals are not relevant for this activity
N_2O	No	Nitrous oxide removals are not relevant for this activity

8. REFERENCE LEVEL

8.1 Reference Period

The reference period for the construction of the reference level is from 2005-2014, and historical emissions were estimated based on locally collected data and land cover maps.

Ghana previously requested an exemption from the Carbon Fund limitation of 2013 as the latest end date for a Reference Period (Criterion 11; Indicator 11.1 of the methodological framework). The explanation and justification for this exemption request is given in Annex 3.

However, following the Carbon Fund meeting in June 2016, Indicator 11.1 was changed and the end date is currently denoted as: "two years before the TAP starts the independent assessment of the ER Programme Document". Originally, Ghana proposed a reference period of 2000 – 2015. The end date of this reference period was out of compliance by four months since the TAP assessment of Ghana's ERPD commenced in August, 2016. Ghana therefore requested for this deviation be permitted.

Ghana had the opportunity to present their request to Carbon Fund Participants during two audio conferences on 9th January, 2017 and 16th February, 2017. The key justifications presented by Ghana for exemption on the end date limitation are outlined below:

1. To ensure that there is consistency with the national FRL which has been submitted to the UNFCCC for technical assessment. The reference period of the national FRL is 2000 – 2015;
2. To ensure that actual land cover maps and land use change analyses are used for the FRL analyses;
3. The adoption of simple historical average for projection has caused a substantial decline in Ghana's FRL which showed a marked upward trend from 2010 - 2015. Any variation that results in further reduction in the FRL will have major implications for programme viability;

The CFP however argued that these justifications did not meet the requirements of the Methodological Framework for granting of exception to criterion 11.1. A key outcome of the audio conferences was therefore an agreement for Ghana to use a 10-year reference period and an end-date of 2014. The CFP recommended that Ghana use interpolation to generate estimates for the new start and end-dates.

Ghana therefore generated historical deforestation emissions estimates from 2005 – 2014 through interpolation. No interpolation was done for the other sources of emissions and removals as a result of the availability and use of annual data with the exception of degradation by illegal logging and fuelwood extraction which adopted a single data point for the reference period.

To derive activity data for the full historical reference period for deforestation, maps representing land use in 2000, 2010, 2012, and 2015 were used. The 2000-2010 timeframe represented the first time period, 2010-2012 represented the second, and 2012-2015 the third time period. Since these time periods did not align perfectly with the historical reference period, the annual area of change for deforestation was interpolated using the following equation:

$$\mathrm{A_i} = \frac{\mathrm{A_{p1}} - A_{p1}\left(\frac{b_{p1}}{t_{p1}}\right) + A_{p2} - A_{p2}\left(\frac{b_{p2}}{t_{p2}}\right)}{t_{p1} + t_{p2} - b_{p1} - b_{p2}} \qquad \text{Eq. 1}$$

Where:

A_i = annual area of change (ha)
Ap = area of change in period p (ha)
b = interpolated time (years; e.g. if interpolation is between 2012 and 2015, b = 3)
t = time in period p (years)

8.2 Forest definition used in the construction of the Reference Level

Following Ghana's National REDD+ Strategy[55], the definition used for Ghana's ER-PD is a minimum of **15% canopy cover, minimum height of 5 meters, and minimum area of 1 hectare**, based on thresholds set by the IPCC for these structural parameters and the Marrakesh Accord. This definition is in line with the definition used in the most recent National Greenhouse Gas inventory.[56]

Tree crops, including cocoa, citrus, oil palm (in smallholder or estate plantations), and rubber are not considered to be forest trees. Timber tree plantations are considered forest under the national forest definition.

Agreement on this definition was reached following an intense consultative process in which three options were debated and discussed amongst a broad group of stakeholders. Consensus was reached on the definition stated above based on the strength of arguments adduced, however, it is important to note that not all participants in the process agreed with the outcome as they felt that the canopy cover and height parameters would exclude much of northern Ghana from participating in REDD+. It is noted that the UNFCCC will accept only a single forest definition for each country, and there is no option to provide different forest definitions for different ecological zones. However in completing the national FRL, it is clear the forest definition does not exclude the north as significant patches of forests were captured in the national land use maps that have been developed.

8.3 Average annual historical emissions over the Reference Period

8.3.1 Description of method used for calculating the average annual historical emissions over the Reference Period

The development of the RL/REL and MRV is divided into steps based on the three key activity types (Figure 8). In addition, degradation is broken down further into four separate activities: degradation from legal timber harvest, degradation from illegal timber harvest, degradation from wood fuel collection, and degradation from fire. The section below provides details on the inputs used to develop historical emissions to support the establishment of the RL/REL, and the estimation of current emissions to support the establishment of an MRV system.

The data and information for the reference level is publicly available on the Forestry Commission of Ghana's website[57]

[55] GoG, 2015. National REDD+ Strategy.
[56] Republic of Ghana, National Greenhouse Gas Inventory Report, July 2015. Table 72.
[57] Web address for reference level data and information http://fcghana.org/nrs/index.php/documents/category/5-forest-reference-level-erp-reports

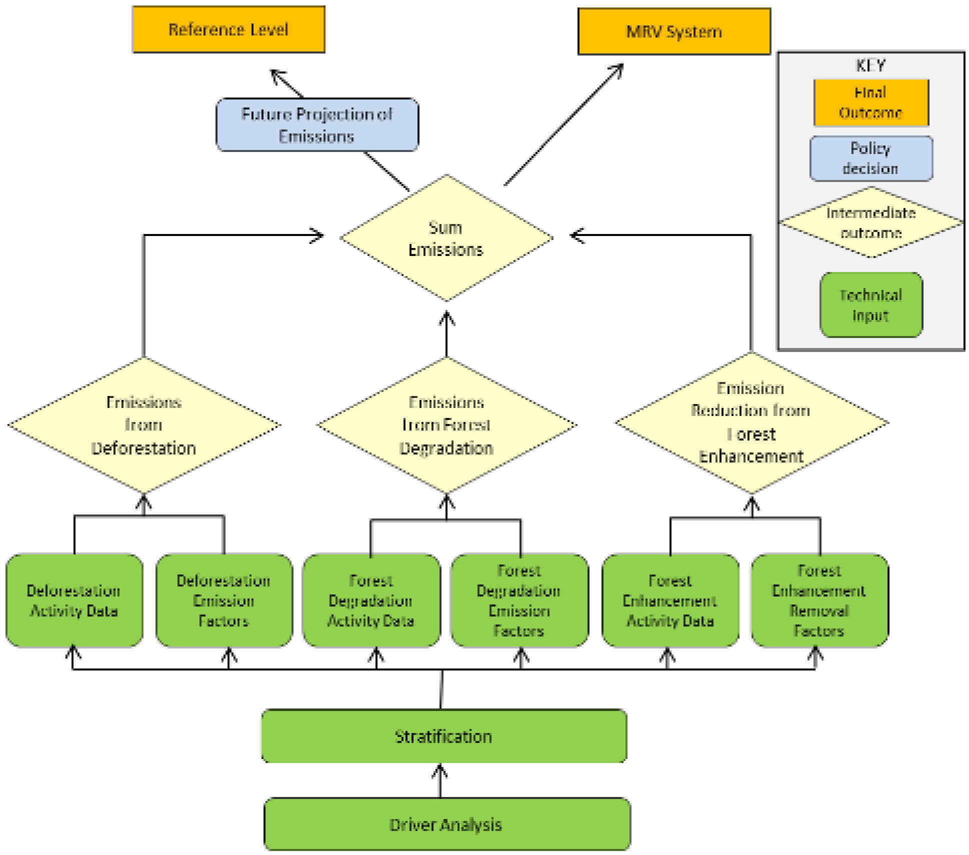


Figure 8: Framework for the NFMS to provide key input into the historical emissions for Reference Level Development and the MRV for the GCFRP.

8.3.2 Deforestation activity data and emission factors used for calculating the average annual historical emissions over the Reference Period

Activity data

Activity data for deforestation consisted of four land cover maps for the years 2000, 2010, 2012, and 2015. All maps used Landsat 7 images, with the 2010 map using ALOS images in addition to Landsat images. Originally, a map for 2013 was planned, but due to poor Landsat images for this year, a map of 2012 was used instead. For the 2010 map, efforts were made to harmonize it with the 2000 map to ensure comparability and change calculation. The 2000 and 2010 maps were produced during the FPP project, while the later maps were produced in 2016 by the RMSC of the Ghana Forestry Commission. Activity data were obtained from the 2000, 2010, 2012 and 2015 land cover maps based on 30 m resolution Landsat data. The 2000 land cover map was used to establish the time-zero forest extent for Ghana that was then used to develop a forest "mask." Losses in forestland cover, i.e. deforestation, were only counted if pixels classed as forest in the 2000 forest mask changed to non-forest in a subsequent land cover map.

Due to the similarity in the spectral signature of agricultural tree crops, especially cocoa, rubber, oil palm and citrus, the land cover maps were not able to distinguish these non-forest plantations from natural forestlands. For this reason, a high-resolution remote sensing methodology was applied (as described in Annex 8), to determine the proportion of the mapped forest that is actually agricultural tree plantations. This analysis was able to distinguish areas of forestland, cocoa, plantation (which included rubber, oil palm, and citrus), and other non-plantation and non-forest land cover types. The results showed that of the areas mapped as deforestation in the land cover maps, between 1-4% were actually transition of cocoa to non-plantation non-forest types, and between 12-39% were actually transition of plantation to non-plantation non-forest types, depending on the ecozone (Figure 9). Emissions from deforestation were subsequently reduced by the percentage of mapped deforestation that was determined to actually be movement of agricultural tree plantations to non-plantation non-forest land cover types.

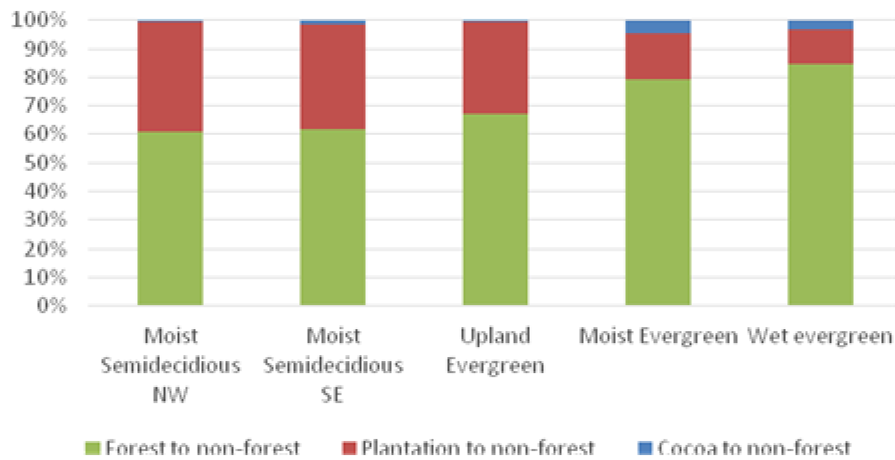


Figure 9: Results of high resolution analysis, showing percentage of areas classified as deforestation that were actually transition of agricultural tree plantations to non-plantation non-forest land cover types

The high resolution analysis was also applied to determine the percentage of area classified as forest remaining forest in the land cover maps that was actually forest transitioning to agricultural tree plantations (and thus qualifying as deforestation). Results showed that of all the classes that the land cover maps classified as forest remaining forest, forest to cocoa made up between 12-18% and forest to plantation made up between 2-5% (Figure 10).Emissions from deforestation were subsequently increased by the percentage of mapped forest remaining forest that was determined to actually be deforestation resulting from movement of forest to agricultural tree plantations.

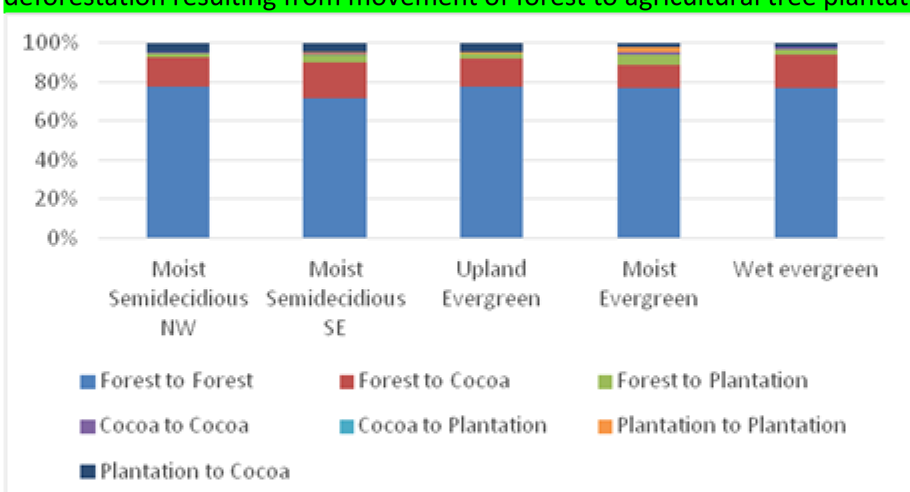


Figure 10: Results of high-resolution analysis, showing percentage of areas classified as forest remaining forest that were actually transition of forestland to agricultural tree plantations.

Total deforestation was estimated as the sum of all the pixels in the 2000 forest mask that changed to non-forest between 2000, 2010, 2012 and 2015. This process generated activity data for 2000 – 2015. Consequently, interpolation was applied to generate deforestation activity data from 2005 – 2014.

The annual historical average was derived by dividing total deforested area (2005-2014) by the number of years (10):

Annual average activity data = total deforestation / number of years

Areas of deforestation caused by fire were identified using the MODIS burned area product, as discussed below in the degradation by fire section. Areas identified as burned and also as deforested were assumed to be deforested by fire.

Activity data showing conversions of forest land (closed forest and Open Forest) to other land use types, including cropland, grassland, settlement and water are shown in Table 14. Overall, food crops are responsible for 55 percent of conversions, followed by cocoa, which accounted for 22 percent. The establishment of a cocoa farm is typically preceded by the planting of food crops as initial shade cover, so it is likely that a significant proportion of food crop land becomes cocoa land, a conversion not shown in this matrix. In closed forests, cocoa and food crops were about evenly divided and collectively responsible for 78% of conversions. In Open Forest, conversions were driven by food crops, cocoa, and conversion to grassland (which includes young fallows). Conversion of forest land to water occurred as a result of surface mining that left pools of water and inundation of the mining sites.

Table 14: Deforestation matrix based on annual interpolated data for 2005-2014

Forest Structure/ conversion	Bareland /other	Citrus	Cocoa	Cropland (herbaceous and slash and burn)	Oil Palm	Rubber	Settlement	Water	Wetlands	Grassland	Total
Closed Forest	215.7	427.31	17,191.0	17,028.9	2,563.8	1,281.9	650.9	118.3	32.3	4,644.4	**44,154.7**
Open Forest	290.2	325.37	13,917.2	5,9251.7	1,952.2	976.1	3,449.2	109.9	27.1	1,4170.5	**94469.46**
Total	**506.**	**752.67**	**31,108.2**	**76,280.6**	**4,516.0**	**2,258.0**	**4,100.1**	**228.2**	**59.5**	**1,8814.8**	**138,624.1**

Deforestation in the GCFRP area based on the four land cover maps is shown in Figure 11 below.

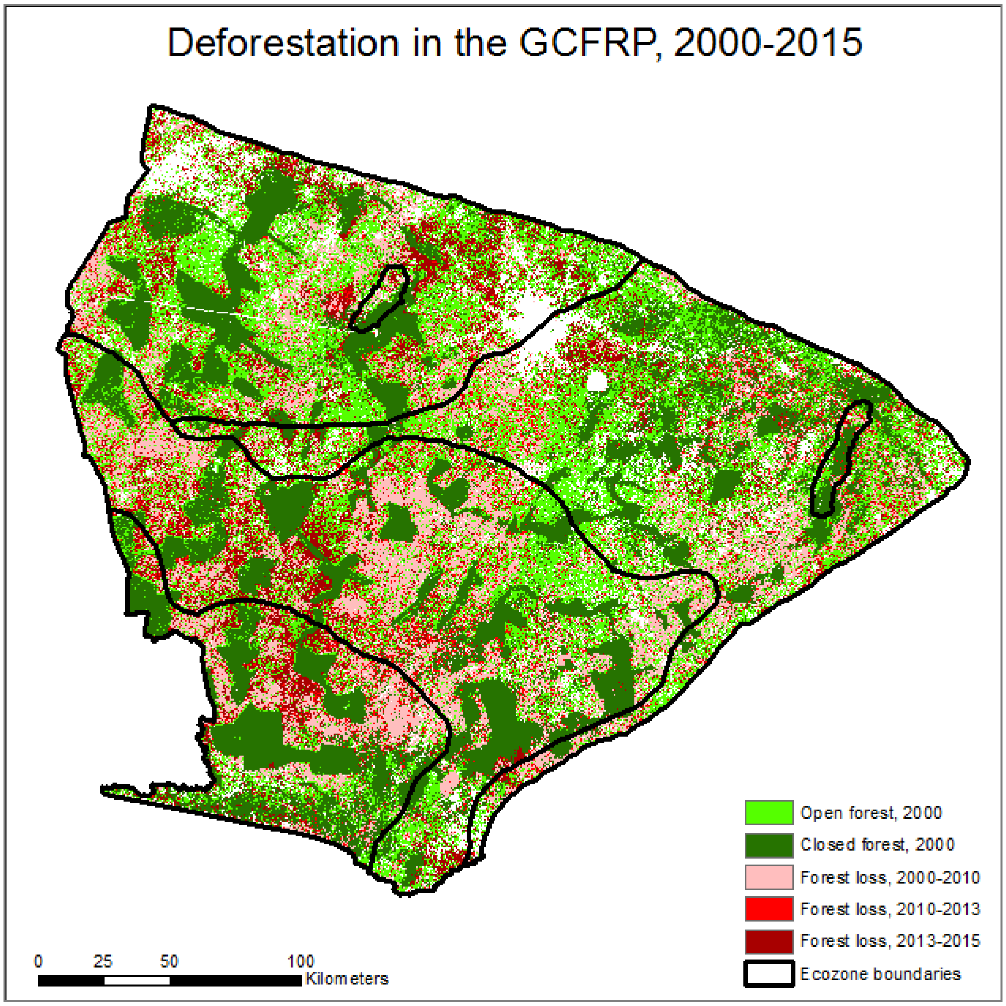


Figure 11: GCFRP Deforestation in 2000, 2010, 2013 and 2015

Table 15: Description of deforestation activity data

Description of the parameter including the time period covered (e.g. forest-cover change between 2000 – 2005 or transitions between forest categories X and Y between 2003-2006):	Landsat imagery classified using NDVI. Forest cover change between 2000-2010-2012-2015. Stratified between "open" and "closed" forest, within five ecological zones (Wet Evergreen, Moist Evergreen, moist semi-deciduous SE, moist semi-deciduous NW, upland evergreen).
Explanation for which sources or sinks the parameter is used (e.g deforestation or forest degradation):	Deforestation
Data unit (e.g. ha/yr):	Average ha/yr
Value for the parameter:	138,624.1 ha/yr

Source of data (e.g. official statistics) or description of the method for developing the data, including (pre-)processing methods for data derived from remote sensing images (including the type of sensors and the details of the images used):	Land cover maps developed by the Forest Preservation Programme (FPP) project for 2000 and 2010[58]; remote sensing analysis conducted by RMSC for 2012 and 2015, Applied Geo-Solutions (AGS) remote sensing analysis on differentiating natural forest from tree crops (see Annex 8.)
Spatial level (local, regional, national or international):	GCFRP Accounting Area ERP Accounting Area, which represents 5,926,206 ha
Discussion of key uncertainties for this parameter:	For the 2000 and 2010 images, accuracy assessment was completed on the 2010 land cover map using verification data from 2,213 field locations all across Ghana. Once the 2010 map was well established (as good an accuracy as could be produced within resource constraints) the same land cover classification methods were applied to 2000 land cover map. The 2012 and 2015 maps were produced replicating the same methodology, to the extent possible, that was used for the 2000 and 2010 maps. Key uncertainties include error in remote sensing classification due to haze, cloud cover, stripping from a Landsat 7 satellite malfunction, differences in seasonal greenness, and reflectance differences between Landsat images.
Estimation of accuracy, precision, and/or confidence level, as applicable and an explanation of assumptions/methodology in the estimation:	Accuracy Assessment has been completed for all the maps utilized for the deforestation analysis (i.e. the 2000, 2010, 2012 and 2015 maps): 1. **2000 map:** 500 data points generated from Google Earth were utilized to assess the accuracy of this map. The assessment yielded an overall accuracy of 81.7%.

ACCURACY ASSESSMENT – 2000 MAP

Class Name	Reference Total	Classified Total	Number Correct	Producers Accuracy	Users Accuracy	Kappa
Closed forest	40	43	33	81.25%	75.58%	0.7346
Open forest	163	152	136	81.87%	88.85%	0.8334
Water body	11	15	11	100.00%	70.00%	0.6936
Grassland	100	104	82	82.00%	78.85%	0.7356
Settlement / Bare ground	45	49	37	82.22%	76.29%	0.7394
Cropland	125	129	103	82.00%	79.77%	0.7302
Wetland	11	5	5	52.63%	100.00%	1
Other land	5	3	4	77.78%	100.00%	1
Total	**500**	**500**	**407**			
Overall Classification Accuracy	81.70%					
Overall Kappa Statistics	0.7644					

2. **2010 map:** 2,213 field points were utilized for accuracy assessment of the 2010 map.

[58] Forest Preservation Project. 2013. Report on Mapping of Forest Cover and Carbon Stock in Ghana. Executed by PASCO Corporation, Japan in collaboration with FC-RMSC, CSIR-FORIG and CIRT-SRI, Ghana

The overall accuracy for this map is 83.87%.

Table 2-10: Accuracy Assessment Result of LU Map of 2010

Classified data \ Reference data	Forest land	Cropland	Grassland	Settlements	Wetlands	Other land	Classified Total	Users Accuracy (%)
Forestland	520	48	39	0	0	0	**607**	85.67
Cropland	57	493	48	1	0	2	**601**	82.03
Grassland	55	44	384	0	0	9	**492**	78.05
Settlements	17	13	12	283	1	5	**331**	85.50
Wetlends	0	0	1	0	152	0	**153**	99.35
Otherland	2	0	3	0	0	24	**29**	82.76
Reference Total	**651**	**598**	**487**	**284**	**153**	**40**	**2213**	-
Producer Accuracy (%)	79.88	82.44	78.85	99.65	99.35	60.00	-	**83.87**

3. **2012 map:** Accuracy assessment was completed using historical field data and data generated from Google earth. A total of 400 points were used. The overall classification accuracy is 82.75%.

Accuracy Assessment, 2012 map

Class Name	Reference Totals	Classified Totals	Number Correct	Producers Accuracy	Users Accuracy	Kappa
Close forest	54	55	51	94.44%	92.73%	0.9159
Open Forest	146	148	129	88.36%	87.16%	0.7978
Water	20	20	20	100.00%	100.00%	1
Grass	67	73	53	79.10%	72.60%	0.6709
Settlement	15	8	8	53.33%	100.00%	1
Cropland	88	90	65	73.86%	72.22%	0.6439
Wetland	2	2	2	100.00%	100.00%	1
Otherland	8	4	3	37.50%	75.00%	0.7449
Totals	**400**	**400**	**331**			
Overall Classification Accuracy = 82.75%						
Overall Kappa Statistics = 0.7739						

4. **2015 map:** Accuracy assessment of the 2015 map was done utilizing 1,000 field data points. The overall accuracy is 80.1%.

Accuracy Assessment – 2015 map

Class Name	Reference Total	Classified Total	Number Correct	Producers Accuracy	Users Accuracy	Kappa
Closed forest	80	87	76	0.95	0.8735	0.7346
Open forest	331	263	255	0.7703	0.9696	0.8334
Water body	21	25	21	1	0.84	0.6936
Grassland	200	186	154	0.77	0.8279	0.7356
Settlement/Bare ground	90	142	84	0.933	0.5915	0.7394
Cropland	250	275	189	0.756	0.6872	0.7302
Wetland (Swampy)	19	15	15	0.7894	1	1
Other land	9	7	7	0.7778	1	1
Totals	**1000**	**1000**	**801**			
Overall Classification Accuracy = 80.1%						
Overall Kappa Statistics = 0.7644						

An assessment of the accuracy of the change between the three time periods was also conducted consisting of 6,317 verification points using 15m resolution ASTER imagery. Details of the methodology is attached, and the confusion matrices are repeated below:

2000 – 2010

		reference ("truth")		
		Change	No Change	Total
	Change	391	146	537
map ("predicted")	No Change	44	2348	2392
	Total	435	2494	2929

Area of deforestation	1,033,265	ha
Confidence interval	48541.58	

Derived uncertainty = 4.70%

2010 – 2012

		reference ("truth")		
		Change	No Change	Total
	Change	9	94	103
map ("predicted")	No Change	97	1494	1591
	Total	106	1588	1694

Area of deforestation	481,002	ha
Confidence interval	68355.29	

Derived uncertainty = 14.2%

2012– 2015

		reference ("truth")		
		Change	No Change	Total
	Change	37	155	192
map ("predicted")	No Change	184	1318	1502
	Total	221	1473	1694

Area of deforestation	930,031	ha
Confidence interval	94882.69	

Derived uncertainty = 10.2%

Thus for the activity data the applied uncertainty numbers were:

4.7% for 2000 – 2010, 14.2% for 2010 – 2012, 10.2% for 2012 - 2015

A detailed account of the methodology used for the development of the Land Use maps including the process adopted for accuracy assessment is presented in Annex 13.

Emission Factors

Deforestation emission factors were developed according to the stock-difference[59] approach provided by the IPCC Guidelines (2006), and represents the difference between the pre-deforestation carbon stocks and post-

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[59] UNFCCC, 2006. IPCC Guidelines for National Greenhouse Gas Inventories, Volume 4: Agriculture, Forestry and Other Land Use (AFOLU), Generic Methodologies Applicable to Multiple Land-Use Categories, http://www.ipcc-nggip.iges.or.jp/public/2006gl/pdf/4_Volume4/V4_02_Ch2_Generic.pdf

deforestation carbon stocks for each stratum. Annex 7 offers detailed information about the sources, data and methods used for determining pre-deforestation and post-deforestation land uses.

In some strata, where Open Forests were converted to agricultural tree crop farms, the change in carbon stocks resulted in net removals. As this is assumed to introduce perverse incentives into the REDD+ programme, an emission factor of zero was applied. Ghana recognizes that adoption of this measure is a slight deviation from the IPCC stock-difference approach. However, Ghana's ERPD seeks to encourage the protection of agroforestry system (for example through the prevention of the conversion of shaded cocaoto unshaded cocoa). In addition, a key safeguards principle which Ghana wishes to adhere to during programme implementation is the conservation of natural forests. Consequently, Ghana has introduced this measure as a means to eliminate perverse incentives that may result in the conversion of "open-forest" agroforesry system and degraded natural forests (which all fall in the open forest category) to mono agricultural tree crops.

Ghana also considered the possibility of applying ZERO carbon stocks for the tree crops. The major drawback of this approach was that to ensure consistency, a ZERO carbon stock would have to be applied to all land conversions from forests (i.e. grasslands, annual crops etc.) since in reality the other land uses have less carbon stocks than agricultural tree crops.The implication is that Ghana will then have unrealistically high historical emissions based on an approach that is fully inconsistent with the IPCC guidelines and the Carbon Fund Methodological Framework.

Finally, in Ghana, the government does not own the land and cannot direct how land is used, so assigning a zero carbon stock to such a conversion would not have an impact. The majority of farmers are smallholders and their decision process is not driven by carbon-project based calculations. Rather, a smallholder cocoa farmer decides to convert a patch of forest to a cocoa farm based on traditional land use regimes. Realistically, the programme can only hope to change these practices based on a suite of positive and tangible incentives, rather then abstract carbon allocations. With respect to prospective plantation tree crop system, the GCFRP has been clear that nesting of carbon projects will not be permitted within the accounting area, unless already validated by a recognized carbon standard; so again, there is not peverse incentive towards conversion to tree crop plantations for possible gains.

Methodologies for Estimating Emissions factors for Deforestation

In accordance with the stock-difference method, C emissions were estimated as the difference in carbon stocks before deforestation and the carbon stocks following deforestation, including carbon in living and dead biomass[60] and carbon released from the soil. The emission factor is calculated as follows:

$$EF_{def(t,x,y)} = (C_{bio.pre(x)} - C_{bio.post(t,y)} + \Delta SOC_{(t)}) * 44/12$$

Where:

$EF_{def(t,x,y)}$	= Emission factor for year t for deforestation for stratum *x* and driver *y*, $tCO_2e\ ha^{-1}$
$C_{bio.pre(x)}$	= Carbon stock in biomass in stratum *x,* prior to deforestation, $t\ C\ ha^{-1}$
$C_{bio.post(t,y)}$	= Carbon stock in biomass in year t post-deforestation, for driver *y*, $t\ C\ ha^{-1}$
$\Delta SOC_{(t)}$	= Change in soil carbon stocks in year t following deforestation, $t\ C\ ha^{-1}$
44/12	= Conversion factor from carbon to CO_2

[60]For Ghana's reference level for deforestation emissions,carbon stored in harvested wood products was not included

Pre-deforestation carbon stocks for the GCFRP Accounting Area include all carbon pools (aboveground carbon, belowground carbon, deadwood, litter, non-tree vegetation, and soil). Estimates of the magnitude of carbon stocks in these pools were mostly derived from the results of a forest biomass mapping and inventory project undertaken through the Mapping of Forest Cover and Carbon Stock in Ghana project (conducted under the Forest Preservation Programme (FPP), through support from the Government of Japan).
The only carbon pool for which FPP data were not used for pre-deforestation carbon stocks was the deadwood carbon pool, as stocks appeared to be significantly over estimated[61]. Instead, IPCC defaults were applied for this pool (aboveground carbon stocks multiplied by 0.06)

The Wet Evergreen, Open Forest statum did not have data on belowground carbon stocks, so the Mokany (2006) root-to-shoot ratio of 0.2 was applied to the aboveground carbon stocks to derive an estimate.

Pre-deforestation carbon stocks were calculated as follows:

$$C_{bio.pre(x)} = (C_{agb(x)}+C_{bgb(x)}+C_{dw(x)}+C_{lit(x)}+C_{veg(x)})$$

Where:

$C_{bio.pre(x)}$ = Carbon stock in biomass in stratum *x,* prior to deforestation, t C ha^{-1}
$C_{agb(x)}$ = Carbon stock in aboveground live tree biomass in stratum *x*, t C ha^{-1}
$C_{bgb(x)}$ = Carbon stock in belowground live tree biomass in stratum *x*, t C ha^{-1}
$C_{dw(x)}$ = Carbon stock in deadwood pools in stratum *x*, t C ha^{-1} (includes both standing and lying deadwood)
$C_{lit(x)}$ = Carbon stock in litter in stratum *x*, t C ha^{-1}
$C_{veg(x)}$ = Carbon stock in non-tree vegetation in stratum *x*, t C ha^{-1} (includes shrubs, sapling, and herbaceous understory)

Table 16: Applied Pre-Deforestation Carbon StockS confidence interval (95% of the mean +/- %) noted in parenthesis

[61]This was explained in the FPP Report on Mapping of Forest Cover and Carbon Stock in Ghana (2013) pp.128: “Deadwood in large quantities was discovered in Moist Evergreen plots, most likel due to trees felled on the cocoa farms admitted to expand into the forest reserves and palm pruning residues of palm trees in off-reserve areas.” Nevertheless, when plot deadwood carbon pool estimates were extrapolated to per-hectare values were unrealistically high (e.g, Moist Evergreen Closed Forest 2914 t CO2/ha and Moist Semi-diciduous NW Closed forest 399 t CO2/ha - over double the aboveground tree biomass).

		AGB (tC/ha)	BGB (tC/ha)	Dead Wood Carbon Stocks (tC/ha)	Litter Carbon Stocks (tC/ha)	Non-tree Carbon Stocks (tC/ha)	Total C stocks (not soil) t C/ha
Wet Evergreen	Closed Forest	124.1 (0.7)	7.9 (108.0)	7.4 (184.0)	2.7 (32.0)	0.0 (N/A)	142.2
	Open Forest	30.3 (2.3)	6.1 (N/A)	1.8 (N/A)	0.0 (N/A)	0.0 (N/A)	38.1
Moist Evergreen	Closed Forest	139.4 (0.2)	23.5 (28.0)	8.4 (69.0)	2.7 (33.0)	0.5 (40.0)	174.5
	Open Forest	39.8 (0.8)	3.0 (48.0)	2.4 (4.0)	1.1 (192.0)	1.6 (773.0)	47.9
Moist Semi-deciduous SE	Closed Forest	123.5 (0.6)	23.2 (23.2)	7.4 (93.0)	0.0 (46.0)	1.1 (63.0)	155.2
	Open Forest	35.2 (1.4)	7.6 (171.0)	2.1 (190.0)	3.5 (55.0)	0.3 (250.0)	48.7
Moist Semi-deciduous NW	Closed Forest	40.4 (0.2)	15.3 (12.0)	2.4 (74.0)	2.2 (23.0)	1.1 (23.0)	61.3
	Open Forest	17.5 (0.3)	9.0 (31.0)	1.0 (165.0)	2.2 (50.0)	0.8 (50.0)	30.5
Upland Evergreen	Closed Forest	73.1 (0.4)	23.5 (99.0)	4.4 (176.0)	1.4 (36.0)	0.3 (279.0)	102.6
	Open Forest	26.2 (0.8)	12.8 (47.0)	1.6 (113.0)	1.1 (67.0)	0.8 (173.0)	42.5

Post-deforestation carbon stocks correspond to the land uses comprised of IPCC land use classes (forest land, cropland, grassland, wetlands, settlement, bare land, other land), and their carbon stocks were derived from a combination of sources including:

1) Cropland: Given the complex set of post-deforestation land uses found in Ghana, particularly due to the wide range of agricultural land uses, the 'cropland' post-deforestation land use was subdivided into:

   a) Cropland: The FPP project collected data on cropland carbon stocks for each strata, reflecting all cropland (currently cropped or in fallow), rice fields, and agro-forestry systems. Estimates included above and belowground carbon stocks (other carbon pools in cropland are not considered significant), and post-deforestation carbon stocks were calculated as follows:

$$C_{bio.post(y,t)} = (C_{agb(y)} + C_{bgb(y,t)})$$

   Where:
   $C_{bio.post(y,t)}$ = Carbon stock in biomass in land use y at time t, post-deforestation, t C ha^{-1}
   $C_{agb(y)}$ = Carbon stock in aboveground live tree biomass in land use y, t C ha^{-1}
   $C_{bgb(y,t)}$ = Carbon stock in belowground live tree biomass in land use y at time t[62], t C ha^{-1}

   b) Plantations:Carbon stocks in plantations were treated as a time-weighted average of stocks in the cycle, and were sourced from Konsager et al. (2013)[63]'s study of carbon stock accumulation potential of tree plantations in Ghana. The values for plantation carbon stocks represent time-averaged carbon stocks for a 30-year rotation, based on the results of that study, as cited in a presentation by the same author.

[62] If roots remain following deforestation, pre-deforestation belowground carbon stocks are assumed to decompose over 10 years. Therefore post-deforestation below-ground carbon stocks are estimated as $C_{bgb(x,t-1)} - (C_{bgb(x)}/10)$, where t equals years following deforestation.

[63] Konsager et al. The carbon sequestration potential of tree crop plantations. Mitigation Adaptation Strategies for Global Change (2013) 18:1197–1213. Time-averaged results from http://orbit.dtu.dk/files/55883745/Carbon_Sequestration.pdf

The study only estimates aboveground carbon stocks, so belowground carbon stocks were derived by applying Mokany (2006) root-to-shoot ratio of 0.2 for tropical moist semi-deciduous forest with aboveground biomass stocks <125 t d.m. ha.

2) Grassland: FPP data were applied where available per strata, otherwise the IPCC default of 3.1 t C/ha was applied.
3) Wetlands: Assumed to be zero
4) Settlement: FPP data were applied where available per strata, otherwise post-deforestation carbon stocks were assumed to be zero.
5) Bareland/other: Assumed to be zero

Table 17: Applied Post-Deforestation Carbon Stocks

Stratum				Average Carbon stocks (tC/ha)	Source
Wet Evergreen	Cropland	Cropland (herbaceous and slash and burn)		30	FPP data
		Plantations	Oil Palm	36	Kongsager et al. 2013
			Citrus	55	Kongsager et al. 2013
			Rubber	90	Kongsager et al. 2013
			Cocoa	55	Kongsager et al. 2013
	Grassland			3.1	IPCC Grasslands Table 3.4.2 value for tropical moist & wet
	Wetlands			0	
	settlement			0	
	Bareland/other			0	
Moist Evergreen	Cropland	Cropland (herbaceous and slash and burn)		39	FPP data
		Plantations	Oil Palm	36	Kongsager et al. 2013
			Citrus	55	Kongsager et al. 2013
			Rubber	90	Kongsager et al. 2013
			Cocoa	55	Kongsager et al. 2013
	Grassland			3.1	IPCC Grasslands Table 3.4.2 value for tropical moist & wet
	Wetlands			0	
	settlement			0	
	Bareland/other			0	
Moist Semi-deciduous SE	Cropland	Cropland (herbaceous and slash and burn)		51	FPP data
		Plantations	Oil Palm	36	Kongsager et al. 2013
			Citrus	55	Kongsager et al. 2013
			Rubber	90	Kongsager et al. 2013
			Cocoa	55	Kongsager et al. 2013
	Grassland			3.1	IPCC Grasslands Table 3.4.2 value for tropical moist & wet
	Wetlands			0	
	settlement			0.00	
	Bareland/other			0	
Moist Semi-	Cropland	Cropland (herbaceous and slash and		31	

deciduous NW		burn)			
		Plantations	Oil Palm	36	Kongsager et al. 2013
			Citrus	55	Kongsager et al. 2013
			Rubber	90	Kongsager et al. 2013
			Cocoa	55	Kongsager et al. 2013
	Grassland			4.70	FPP data
	Wetlands			0	
	settlement			6.34	FPP data
	Bareland/other			0	
Upland evergreen	Cropland	Cropland (herbaceous and slash and burn)		34	
		Plantations	Oil Palm	36	Kongsager et al. 2013
			Citrus	55	Kongsager et al. 2013
			Rubber	90	Kongsager et al. 2013
			Cocoa	55	Kongsager et al. 2013
	Grassland			3.1	IPCC Grasslands Table 3.4.2 value for tropical moist & wet
	Wetlands			0	
	settlement			0	
	Bareland/other			0	

Changes in soil carbon stocks are related to the post deforestation land use and were estimated using the IPCC 2006 guidelines whereby changes in soil carbon stocks are based on the use of soil factors that account for how the soil is tilled, the method of management, and inputs in the post deforestation land use. This method is described through the following equation:

$$\Delta SOC = C_{soil} - (C_{soil} * F_{LU} * F_{MG} * F_I)$$

Where:

ΔSOC = Soil carbon emitted, t C ha^{-1}

C_{soil} = Carbon stock in soil organic matter pool (to 30 cm); t C ha^{-1}

F_{LU} = Stock change factor for land-use systems for a particular land-use, dimensionless (IPCC AFOLU GL)

F_{MG} = Stock change factor for management regime, dimensionless (IPCC AFOLU GL)

F_I = Stock change factor for input of organic matter, dimensionless (IPCC AFOLU GL)

The change in soil carbon stocks is assumed to occur over a 20 year time period, but for simplicity in accounting emissions are considered to be committed and to occur at the time of conversion.
The following factors and assumptions were made for each strata:

- Cropland: Applied Table 5.10 in 2006 IPCC Guidelines FLU value for shifting cultivation, shortened fallow based on FAO Country Paper on Ghana, "Shifting cultivation (also known as "slash and burn") is the main farming practice in Ghana, ... land is left to fallow for some time (3 - 5 years, depending on the availability of land for farming."[64]
  - FLU: Long-term cultivated Tropical moist =0.48
  - FMG: reduced tropical moist/wet = 1.15
  - FI: Medium, dry and moist/wet = 1.0

[64] M. O. Abebrese, 2002. ROPICAL SECONDARY FOREST MANAGEMENT IN AFRICA: Reality and perspectives, Ghana Country Paper. Available at: http://www.fao.org/docrep/006/j0628e/j0628e53.htm

- Plantations: Plantations assigned following factors:
  - FLU: Long-term perennial tree crops = 1.0
  - FMG: No till, tropical, moist/wet = 1.22
  - FI: Medium, dry and moist/wet = 1.0
- Grassland: IPCC Table 6.2, FMG: Moderately degraded grassland
- Wetlands: As seen from activity data, the areas converted to wetlands over the reference period were along the coast, so it was assumed this was due to flooding. As such, zero emissions were assumed.
- Settlement: From IPCC Chapter 8, "for the proportion of the settlement area that is paved over, assume product of FLU, FMG and FI is 0.8 times the corresponding product for the previous land use (i.e., 20% of the soil carbon relative to the previous land use will be lost as a result of disturbance, removal or relocation);"
- Bareland/Other: "Other Land" includes bare soil, rock, ice, and all unmanaged land areas that do not fall into any of the other five land-use categories. Assumed to be land devoid of vegetation and likely to be at some point in a cropping cycle. Therefore, the same values for cropland were applied.
  - FLU: Long-term cultivated Tropical moist = 0.48
  - FMG: reduced tropical moist/wet = 1.15
  - FI: Medium, dry and moist/wet = 1.0

Table 18: Description of deforestation emission factors

Description of the parameter including the forest class if applicable:	Difference in carbon stocks (pre and post deforestation land cover) in the GCFRP Accounting Area per stratum. Strata were identified through the Forest Preservation Programme (FPP) Mapping of Forest Cover and Carbon Stock in Ghana project and represent all relevant IPCC land cover classes. **Carbon pools:** Pre-deforestation land use stocks: Aboveground biomass, belowground biomass, deadwood, litter, non-tree vegetation, soil carbon stocks. Data on carbon pools were sourced from the FPP Mapping of Forest Cover and Carbon Stock in Ghana project. Post-deforestation land use carbon stocks: • Cropland: ○ Herbaceous and shifting cultivation: Aboveground biomass, belowground biomass, deadwood, litter, non-tree vegetation, soil carbon stocks. Data on carbon pools were sourced from the FPP Mapping of Forest Cover and Carbon Stock in Ghana project. ○ Plantations: Aboveground biomass and belowground biomass (other carbon stocks conservatively omitted). Aboveground biomass values sourced from Konsager et al. (2013)[65] and belowground biomass stocks were determined by applying a root-to-shoot ratio developed by Mokany et al. (2006)[66]. Grassland[67]: aboveground biomass. Values derived either from the FPP Mapping of Forest Cover and Carbon Stock in Ghana project or IPCC default values. Wetlands, settlement[68], and bareland/other: carbon stocks assumed to be zero.

[65] Konsager et al. The carbon sequestration potential of tree crop plantations. Mitigation Adaptation Strategies for Global Change (2013) 18:1197–1213. Time-averaged results from http://orbit.dtu.dk/files/55883745/Carbon_Sequestration.pdf

[66] Mokany K, Raison R.J, Prokushkin A.S 2006 Critical analysis of root : shoot ratios in terrestrial biomes. Global Change Biol. 12, 84–96. doi:10.1111/j.1365-2486.2005.001043.x.

[67] Except for Moist Evergreen and Moist Semi-deciduous NW forest strata where FPP data were available on carbon stocks for grassland and all carbon pools were included (aboveground biomass, belowground biomass, deadwood, litter, non-tree vegetation, soil carbon stocks

Data unit (e.g. t CO_2/ha):	t CO_2e/ha			
Value for the parameter:				

Forest carbon Stratum/ Forest type	Post deforestation Stratum			EF (t CO_2e/ha)
Wet Evergreen				
Closed forest	Cropland	Cropland (herbaceous and fallow land)		584
		Plantations	Oil Palm	314
			Citrus	244
			Rubber	116
			Cocoa	244
	Grassland			520
	Wetlands			521
	Settlement			590
	Bareland/other			674
Open Forest	Cropland	Cropland (herbaceous and fallow land)		203
		Plantations	Oil Palm	0.0
			Citrus	0.0
			Rubber	0.0
			Cocoa	0.0
	Grassland			139
	Wetlands			140
	Settlement			208
	Bareland/other			293
Moist Evergreen				
Closed Forest	Cropland	Cropland (herbaceous and fallow land)		652
		Plantations	Oil Palm	436
			Citrus	366
			Rubber	238
			Cocoa	366
	Grassland			649
	Wetlands			640
	Settlement			705
	Bareland/other			785
Open Forest	Cropland	Cropland (herbaceous and fallow land)		120

[68] Except for the Moist Semi-deciduous NW forest strata where FPP data were available on carbon stocks in settlement and all carbon pools were included (aboveground biomass, belowground biomass, deadwood, litter, non-tree vegetation, soil carbon stocks)

			Plantations	Oil Palm	6
				Citrus	0.0
				Rubber	0.0
				Cocoa	0.0
		Grassland			181
		Wetlands			176
		Settlement			210
		Bareland/other			253
	Moist Semi-deciduous SE				
	Closed Forest	Cropland	Cropland (herbaceous and fallow land)		479
			Plantations	Oil Palm	413
				Citrus	343
				Rubber	215
				Cocoa	343
		Grassland			571
		Wetlands			729
		Settlement			608
		Bareland/other			646
	Open Forest	Cropland	Cropland (herbaceous and fallow land)		61
			Plantations	Oil Palm	15
				Citrus	0.0
				Rubber	0.0
				Cocoa	0.0
		Grassland			166
		Wetlands			295
		Settlement			174
		Bareland/other			228
	Moist Semi-deciduous NW				
	Closed Forest	Cropland	Cropland (herbaceous and fallow land)		224
			Plantations	Oil Palm	44
				Citrus	0.0
				Rubber	0.0
				Cocoa	0.0
		Grassland			220
		Wetlands			225
		Settlement			217
		Bareland/other			325
	Open Forest	Cropland	Cropland (herbaceous and fallow land)		100
			Plantations	Oil Palm	0.0

			Citrus	0.0
			Rubber	0.0
			Cocoa	0.0
	Grassland			106
	Wetlands			312
	Settlement			144
	Bareland/other			201
Upland Evergreen				
Closed Forest	Cropland	Cropland (herbaceous and fallow land)		388
		Plantations	Oil Palm	183
			Citrus	112
			Rubber	0.0
			Cocoa	112
	Grassland			373
	Wetlands			655
	Settlement			432
	Bareland/other			501
Open Forest	Cropland	Cropland (herbaceous and fallow land)		341
		Plantations	Oil Palm	206
			Citrus	136
			Rubber	0.0
			Cocoa	136
	Grassland			370
	Wetlands			549
	Settlement			376
	Bareland/other			454

Source of data (e.g. official statistics, IPCC, scientific literature) or description of the assumptions, methods and results of any underlying studies that have been used to determine the parameter:

Pre-deforestation carbon stocks:

- Data were derived from the Forest Preservation Programme (FPP) which conducted the Mapping of Forest Cover and Carbon Stock in Ghana project. Data from this project offered estimates of all forest carbon pools, including soil.
- Deadwood carbon stocks appeared to be significantly over estimated, however, so IPCC defaults were applied for this pool (aboveground carbon stocks multiplied by 0.06)

Post-deforestation carbon stocks:

- Cropland: FPP data on cropland carbon stocks per strata, reflecting all cropland (currently cropped or in fallow), rice fields, and agro-forestry

	systems • Plantations: Kongsager et al. 2013. Only above and belowground carbon stocks included. Belowground carbon stocks derived by applying Mokany (2006)[69] root-to-shoot ratio of 0.2 • Grassland: FPP data where available or IPCC default of 3.1 t C/ha • Wetlands: assumed to be zero • Settlement: FPP data, where available assumed to be zero • Bareland/other: assumed to be zero Further details provided in Annex 7.
Spatial level (local, regional, national or international):	GCFRP Accounting Area
Discussion of key uncertainties for this parameter:	Forest carbon stock data are taken from the FPP project that estimated confidence intervals (95% of the mean) for the 6 forest carbon pools for each stratum. Generally, the FPP plot-based mean values are generated with a small number of field plots for each of the ecological zone, and this leads to relatively high uncertainty. This uncertainty will however decrease as more data are collected as the programme progresses.
Estimation of accuracy, precision, and/or confidence level, as applicable and an explanation of assumptions/methodology in the estimation:	(see table below)

Forest carbon Stratum/ Forest type	Post deforestation Stratum			Uncertainty (%)
Wet Evergreen				
Closed Forest	Cropland	Cropland (herbaceous and fallow land)		14.2
		Plantations	Oil Palm	21.9
			Citrus	27.9
			Rubber	36.6
			Cocoa	11.8
	Grassland			11.0
	Wetlands			21.5
	Settlement			6.9
	Bareland/other			18.1
Open Forest	Cropland	Cropland (herbaceous and fallow land)		28.6
		Plantations	Oil Palm	57.1
			Citrus	64.1
			Rubber	70.5
			Cocoa	36.7

[69] Mokany K, Raison R.J, Prokushkin A.S 2006 Critical analysis of root : shoot ratios in terrestrial biomes. Global Change Biol. 12, 84–96. doi:10.1111/j.1365-2486.2005.001043.x.

		Grassland			5.5
		Wetlands			36.6
		Settlement			0.5
		Bareland/other			36.3
	Moist Evergreen				
	Closed Forest	Cropland	Cropland (herbaceous and fallow land)		8.6
			Plantations	Oil Palm	16.8
				Citrus	22.7
				Rubber	31.2
				Cocoa	8.0
		Grassland			5.0
		Wetlands			6.3
		Settlement			3.3
		Bareland/other			10.0
	Open Forest	Cropland	Cropland (herbaceous and fallow land)		16.8
			Plantations	Oil Palm	43.6
				Citrus	51.3
				Rubber	59.9
				Cocoa	31.7
		Grassland			26.4
		Wetlands			41.4
		Settlement			13.7
		Bareland/other			33.7
	Moist Semi-Deciduous SE				
	Closed Forest	Cropland	Cropland (herbaceous and s fallow land)		8.4
			Plantations	Oil Palm	17.3
				Citrus	23.3
				Rubber	32.0
				Cocoa	8.0
		Grassland			5.8
		Wetlands			12.0
		Settlement			4.6
		Bareland/other			9.1
	Open Forest	Cropland	Cropland (herbaceous and fallow land)		20.1
			Plantations	Oil Palm	42.5
				Citrus	50.2
				Rubber	58.9
				Cocoa	17.9

		Grassland			27.1
		Wetlands			36.6
		Settlement			17.1
		Bareland/other			31.0
	Moist Semi-deciduous NW				
	Closed Forest	Cropland	Cropland (herbaceous and fallow land)		12.2
			Plantations	Oil Palm	36.6
				Citrus	45.3
				Rubber	55.1
				Cocoa	13.4
		Grassland			5.4
		Wetlands			10.0
		Settlement			2.5
		Bareland/other			15.9
	Open Forest	Cropland	Cropland (herbaceous and fallow land)		17.0
			Plantations	Oil Palm	56.0
				Citrus	63.2
				Rubber	69.9
				Cocoa	24.6
		Grassland			12.0
		Wetlands			19.0
		Settlement			4.4
		Bareland/other			25.3
	Upland Evergreen				
	Closed Forest	Cropland	Cropland (herbaceous and fallow land)		20.5
			Plantations	Oil Palm	29.7
				Citrus	35.8
				Rubber	44.5
				Cocoa	16.7
		Grassland			22.8
		Wetlands			26.3
		Settlement			13.7
		Bareland/other			25.1
	Open Forest	Cropland	Cropland (herbaceous and fallow land)		23.2
			Plantations	Oil Palm	45.7
				Citrus	53.9
				Rubber	62.3
				Cocoa	32.5
		Grassland			14.7

		Wetlands	43.0
		Settlement	7.2
		Bareland/other	32.6

Uncertainties represent 95% confidence intervals as a percentage of the mean

8.3.3 Degradation from legal timber harvest activity data and emission factors used for calculating the average annual historical emissions over the Reference Period

Calculations and final estimation of emissions follow the methods outlined by Pearson *et al*. (2014)[70]. This method combines data on harvest volume (activity data) with an emission factor that reflects three emission sources that occur as a result of logging:

The calculations of total emissions from logging are a result of a multiplication of total emission factor (TEF) (in t $CO2.m^{-3}$) by the activity data (m^3 extracted) for each year.

Activity Data

Ghana has timber extracted data for the entire historical period 2005-2014. These data present the total volumes of timber extracted annually by species and by administrative unit (region and locality) based on the Tree Information Forms (TIFs). This data is summed annually across administrative units to calculate total volumes by areas of interest, including the GCFRP Accounting Area (Figure 2).

Emission Factors

The three components of the logging emission factor were calculated using the methods in Pearson et al. (2014) and using field measurements taken by the Ghana Forestry Commission following the standard operating procedures in Annex 7. This method accounts separately for three emission sources that occur as a result of logging:

1. emissions from the subsequent milling, processing, use and disposal of the felled timber-tree,
2. emissions from incidental damage caused by the timber-tree fall and cutting of the log in the forest, and
3. emissions from infrastructure associated with removing the timber out of the forest (e.g. skid trails, logging decks and logging roads).

All emissions sources are associated with the volume of timber extracted (e.g. m^3) to allow for simple application of timber harvesting statistics. As such, the total emission factor from selective logging is estimated as the sum of three factors:

$$TEF = ELE + LDF + LIF$$

Where:

TEF Total emission factor ($tCO2.m^{-3}$)

ELE Emissions from extracted log ($tCO2.m^{-3}$)

LDF Logging damage factor ($tCO2.m^{-3}$)

[70] Pearson T.R.H., Brown, S. and Casarim, F. 2014. Carbon Emissions from Tropical Forest Degradation Cause by Logging. Environ. Res. Lett. 9 034017 (11pp). Winrock International. Available at: http://www.winrock.org/sites/default/files/publications/attachments/Pearson%20et%20al%202014%20Logging.pdf

LIF Logging infrastructure factor (t CO2.m^{-3})

A committed emissions approach is employed in the calculations to simplify the carbon accounting process. This means that all emissions are accounted in the year of the logging event.

To estimate ELE, an average wood density (in g cm-3) weighted by the volume extracted of each species from the activity data is calculated, so that the average wood density (and therefore ELE) would reflect the species most harvested in Ghana.The applied wood density of 0.39 t/m^3 was calculated as the weighted mean of harvested species from the database of legally harvested trees between 2005 and 2014. The chainsaw milling efficiency applied is 50% as identified by the Forestry Commission and through literature revue (Hansen et al, 2012). The ELE reflects the proportion of carbon dioxide still sequestered in harvested wood products 100 years after initial harvest (considered to be permanently sequestered). A half-life of 30 years and a decay rate of 0.023 are applied as given in Table 12.2 in IPCC 2006[71].

Estimate for LDF are based on the measurements taken from the field work conducted by Ghana FC in May 2016, using the SOPs in annex D.

For skid trails it was assumed that creation of trails would avoid trees with a diameter greater than 20cm at breast height. The proportion of forest biomass represented by trees less than 20cm was calculated from the dataset of Napier and Kongsager (2011).[72] Across ten plots these trees represented 12% of the forest biomass (95% CI = 4.8%). This proportion was applied to the carbon stock derived from the FPP inventory dataset.

From measurement of 164 skid trails by the Ghana Forestry Commission in May 2016, the mean width was 4.6m (95% CI = 0.64m). For five skid trails the associated extraction volume was determined, and through integration with trail length a skid trail emission factor was derived.

For logging roads, the mean width was calculated from 11 roads measured by the Ghana Forestry Commission in May 2016 (5.3m +/- 0.65; mean +/- 95% CI). A per length of road emission was calculated from this width and the carbon stock from the FPP inventory dataset. However, no volumes could be paired with emission per length of road. This correlation instead had to rely on the study of Medjibe et al (2013) from Gabon.[73] Medjibe et al determined road construction of 1 m per cubic meter of log extracted.

For logging decks volume correlations were similarly unavailable. The Medjibe et al study determined logging decks represent 1.6 square meters of area per cubic meter of log extracted. This paired with FPP inventory data produced a decks emission factor.

The legal timber harvest measurement approach is a direct accounting using activity data and emissions factors – as such it is NOT a proxy-based approach. The activity data is the recorded volumes of extracted timber. Emission factors are derived from field measurement in Ghana and capture the change in carbon stocks as a result of the extracted volumes. For the sake of precision, the method does not look at the difference in forest carbon stocks with and without logging, which would be challenging and imprecise to measure. Instead, the change associated directly with each extracted cubic meter is estimated. The method thus involves only measurement of trees that have been felled or accidentally killed. As the measurement takes account of the whole dead trees, dead wood stocks and arguably even

[71] IPCC (2006) Guidelines for national greenhouse gas inventories. Volume 4: Agriculture, Forestry, and Other Land Use. http://www.ipcc-nggip.iges.or.jp/public/2006gl/vol4.html

[72] Napier, J. and Kongsager R. (2011). The breakeven price of REDD-credits: a case study from Kade, Ghana. Master Thesis, Technical University of Denmark.

[73] Medjibe, V.P., Putz, F.E., Romero, C. (2013) Certified and uncertified logging concessions compared in Gabon: Changes in stand structure, tree species, and biomass. Environmental Management. DOI 10.1007/s00267-012-0006-4

litter are effectively captured. The method also tracks the biomass extracted from the forest in the timber logs and thus captures harvested wood products. However, the simplifying assumption of committed emissions is applied so the only storage in wood products is the stock estimated to still be in use 100 years after harvest.

Table 19: Description of legal timber harvest activity data

Description of the parameter including the time period covered (e.g. forest-cover change between 2000 – 2005 or transitions between forest categories X and Y between 2003-2006):	Average volume of the logs extracted annually from 2005-2014
Explanation for which sources or sinks the parameter is used (e.g deforestation or forest degradation):	Degradation from legal timber harvest
Data unit (e.g. ha/yr):	m^3/yr
Value for the parameter:	916,396 m^3/yr
Source of data (e.g. official statistics) or description of the method for developing the data, including (pre-)processing methods for data derived from remote sensing images (including the type of sensors and the details of the images used):	These data represent the total volume of logs extracted annually by species and by administrative unit (region and locality) based on the Tree Information Forms (TIFs). This is derived from diameter measurements at both ends of the bole in cm as well as the length of the bole in meters. The parameters measured are then used to estimate the volume using Smalian's formula
Spatial level (local, regional, national or international):	These data are summed annually across administrative units to calculate total volumes by areas of interest.
Discussion of key uncertainties for this parameter:	This is a forest concession census of actual timber volume extracted, so very small uncertainty is assumed—most likely as measurement error of the logs (diameters, lengths and number of logs). Standard operating procedure used for these measurements should minimize this, however.
Estimation of accuracy, precision, and/or confidence level, as applicable and an explanation of assumptions/methodology in the estimation:	This is a forest concession census of actual timber volume, so very small uncertainty is assumed—most likely as measurement error of the logs (diameters, lengths and number of logs). Standard operating procedure used for these measurements should minimize this, however.

Table 20: Calculated values of emission factors for legal timber harvest

Factor	Value (tCO_2/m^3)	Uncertainty

Emission from Extracted Log	**ELE**	0.79	0.02
Logging Damage Factor	**LDF**	2.46	0.17
Logging Infrastructure Factor	**LIF**	0.50	0.13
Total Emission Factor	**TEF**	3.75	0.21

Table 21: Description of legal timber harvest emission factors

Description of the parameter including the forest class if applicable:	The emission factor for selective logging activity in Ghana, including emissions from extracted logs, logging infrastructure, and logging damage.
Data unit (e.g. t CO_2/ha):	t CO_2/m^3
Value for the parameter:	3.75 t CO_2e/ m^3
Source of data (e.g. official statistics, IPCC, scientific literature) or description of the assumptions, methods and results of any underlying studies that have been used to determine the parameter:	Field data collection by the Forestry Commission is the main source of data. Additional assumptions and data sources are explain in more details in Annex B.
Spatial level (local, regional, national or international):	GCFRP Accounting Area
Discussion of key uncertainties for this parameter:	The standard operating procedures (Annex 9) followed minimizes the uncertainty associated with data collection. Other sources of uncertainty include: - The average milling efficiency associated with legal timber harvest is based on a literature view and reported averages from the Forestry Commission. - Estimation of the weighted average of wood density based on Ghana Forestry Commission estimates per species logged. - A half-life of and a decay rate are applied as given in Table 12.2 in IPCC 2006[74]. - carbon stock derived from the FPP inventory dataset. - no volumes could be paired with emission per length of road. This correlation instead had to rely on the study of Medjibe et al (2013) from Gabon.[75] - For logging decks volume correlations were similarly unavailable. This correlation instead had to rely on the study of Medjibe et al (2013) from Gabon.[76] This paired with FPP inventory data produced a decks emission factor.
Estimation of accuracy, precision, and/or confidence level, as applicable and an explanation of	The emissions factors are developed based on 243 logging gaps measured by the Forestry Commission. The extracted log emission (ELE) had an uncertainty equal to 2.5% of the mean at the 95% confidence level.

[74] Footnote 53

[75] Medjibe, V.P., Putz, F.E., Romero, C. (2013) Certified and uncertified logging concessions compared in Gabon: Changes in stand structure, tree species, and biomass. Environmental Management. DOI 10.1007/s00267-012-0006-4

[76] Medjibe, V.P., Putz, F.E., Romero, C. (2013) Certified and uncertified logging concessions compared in Gabon: Changes in stand structure, tree species, and biomass. Environmental Management. DOI 10.1007/s00267-012-0006-4

assumptions/methodology in the estimation:	The logging damage factor (LDF) had an uncertainty equal to 6.9% of the mean at the 95% confidence level. The logging impact factor (LIF) had an uncertainty equal to 26% of the mean at the 95% confidence level. Using a weighted propagation of errors approach the total emission factor (TEF) had an uncertainty equal to 5.7% of the mean at the 95% confidence level.

8.3.4 Degradation from illegal timber harvestactivity data and emission factors used for calculating the average annual historical emissions over the Reference Period

The approach for illegal timber harvest should be considered as a proxy method, as it relies on numbers for activity estimation from a published study for one point in time. The emission factors are Tier 2 and follow the same assumptions as for legal logging. The method involves only measurement of trees in Ghana that have been felled or accidentally killed. As the measurement takes account of the whole dead trees, dead wood stocks and arguably even litter are effectively captured. The method also tracks the biomass extracted from the forest in the timber logs and thus captures harvested wood products, however, the simplifying assumption of committed emissions is applied so the only storage in wood products is the stock estimated to still be in use 100 years after harvest. The calculations of total emissions from illegal logging will mirror those used for legal logging with the multiplication of total emission factor (TEF) (in $tCO2\ m^{-3}$) by the activity data (m^3 extracted).

Activity Data

Yearly activity data on the amount of timber harvested illegally in Ghana are not available at this time (but will become so as the MRV system is implemented). Instead, a number of studies have been conducted that provide estimates on the amount of illegal timber harvest. The study, 'Revisiting Illegal Logging and the Size of the Domestic Timber Market (Hansen *et al*. 2012) provides activity data on historical illegal timber harvest for Ghana's reference level.

Hansen *et al.* estimated illegally logged timber at 4.1 million m^3 per year in 2009 in the GCFRP Accounting Area. These numbers will be improved in a step-wise manner as Ghana develops a measurement system for illegal timber.

Emission Factor

The emission factor for illegal timber harvest follow the same methodology as for legal timber harvest. The measurements taken in the field in May 2016 by the Forestry Commission were used to estimate TEF for illegal as well as legal timber harvest. As for legal logging a committed emissions approach is taken.

The extracted log emissions (ELE) were calculated with the following assumptions:

- The species harvested reflect the same species distribution as species legally harvested in Ghana;
- The logs are chainsaw milled in the forest;
- The resulting products are solidwood products.

Based on the findings of Hansen et al. (2012) the chainsaw milling efficiency applied is 27%. The applied wood density of 0.39 t/m^3 was calculated as the weighted mean of harvested species from the database of legally harvested trees between 2005and 2014. The ELE reflects the proportion of carbon dioxide still sequestered in harvested wood products 100 years after initial harvest (considered to be permanently sequestered). A half-life of 30 years and a decay rate of 0.023 are applied as given in Table 12.2 in IPCC 2006[77].

Based on an understanding of illegal timber practices by the Forestry Commission, LDF is assumed to be identical to the factor used for legal timber harvesting. Illegal timber harvest does not differ in felling practices from legal timber harvest. Differences arise in the milling efficiency (chainsaw milling in the forest), and in extraction (milled timber carried out by hand rather than skidded out)

LIF is assumed to be nullified as illegal timber harvested either use infrastructure created by legal timber harvesting practices.

Table 22: Description of illegal timber harvest activity data

Description of the parameter including the time period covered (e.g. forest-cover change between 2000 – 2005 or transitions between forest categories X and Y between 2003-2006):	The activity data for illegal timber harvest at this stage will consist of the peer-reviewed literature estimate of Hansen et al. (2012). Hansen estimated illegal logged timber at 4.1 million m^3 per year in 2009.
Explanation for which sources or sinks the parameter is used (e.g deforestation or forest degradation):	Degradation from illegal timber harvest
Data unit (e.g. ha/yr):	m^3/yr
Value for the parameter:	4.1 million m^3/yr
Source of data (e.g. official statistics) or description of the method for developing the data, including (pre-)processing methods for data derived from remote sensing images (including the type of sensors and the details of the images used):	HANSEN, C.P., L. DAMNYAG, B.D. OBIRI and K. CARLSEN 2012. Revisiting illegal logging and the size of the domestic timber market: the case of Ghana *International Forestry Review Vol.**14**(1), 2012* 39 It can be reasonably assumed that the reported number reflects the estimated annual volume of illegally extracted timber in GCFRP accounting area because the paper states "the timber resources are located in the High Forest Zone". It can also be expected that this volume is an underestimation as illegal logging is believed to have increased in recent years. This will be conservative as actual illegal volumes are monitored under MRV
Spatial level (local, regional, national or international):	GCFRP Accounting Area
Discussion of key uncertainties for this parameter:	Uncertainty is unknown at this stage, prior to an illegal logging monitoring system in Ghana. To be highly conservative, given that the estimated volume results from a single study covering only one year, an uncertainty value is used that is equal to

[77] IPCC (2006) Guidelines for national greenhouse gas inventories. Volume 4: Agriculture, Forestry, and Other Land Use. http://www.ipcc-nggip.iges.or.jp/public/2006gl/vol4.html

	half the value of the parameter.
Estimation of accuracy, precision, and/or confidence level, as applicable and an explanation of assumptions/methodology in the estimation:	50% uncertainty is assumed. 4.1 million m^3/yr ± 2.05 million m^3/yr

Table 23: Calculated values of illegal timber harvest emission factor

Factor		Value (tCO_2/m^3)	Uncertainty
Emission from Extracted Log	**ELE**	0.81	0.03
Logging Damage Factor	**LDF**	2.46	0.17
Total Emission Factor	**TEF**	3.27	0.17

Table 24: Description of illegal timber harvest emission factor

Description of the parameter including the forest class if applicable:	The emission factor for illegal logging activity in Ghana, accounting for emissions from extracted logs and logging damage.
Data unit (e.g. t CO_2/ha):	t CO_2/m^3
Value for the parameter:	3.27 t CO_2/m^3
Source of data (e.g. official statistics, IPCC, scientific literature) or description of the assumptions, methods and results of any underlying studies that have been used to determine the parameter:	Field data collection by the Forestry Commission is the main source of data. Additional assumptions and data sources are explained in further detail in Annex 7.
Spatial level (local, regional, national or international):	GCFRP Accounting Area
Discussion of key uncertainties for this parameter:	Following the standard operating procedures (Annex 9) minimizes the uncertainty associated with data collection. Other sources of uncertainty include: - The average milling efficiency associated with illegal timber harvest is based on literature review. - Estimation of the weighted average of wood density based on Ghana Forestry Commission estimates per species logged. - A half-life of and a decay rate are applied as given in Table 12.2 in IPCC 2006[78]. - Carbon stock derived from the FPP inventory dataset.
Estimation of accuracy, precision, and/or confidence	The emissions factors are developed based on 243 logging gaps measured by the Ghana Forestry Commission.

[78] IPCC (2006) Guidelines for national greenhouse gas inventories. Volume 4: Agriculture, Forestry, and Other Land Use. http://www.ipcc-nggip.iges.or.jp/public/2006gl/vol4.html

level, as applicable and an explanation of assumptions/methodology in the estimation:	The extracted log emission (ELE) had an uncertainty equal to 3.7% of the mean at the 95% confidence level. The logging damage factor (LDF) had an uncertainty equal to 6.9% of the mean at the 95% confidence level. Using a weighted propagation of errors approach the total emission factor (TEF) had an uncertainty equal to 5.3% of the mean at the 95% confidence level.

8.3.5 Degradation from forest fire activity data and emission factors used for calculating the average annual historical emissions over the Reference Period

The measurement approach for fire uses spatial data to capture area burned annually and IPCC factors to derive emission factors. The biomass values input incorporate live biomass (above and belowground) as well as down dead wood and litter as stocks impacted by degradation caused by forest fires. These stocks are derived from the FPP (as for deforestation).

Total emissions from forest fire were estimated using Equation 2.27 from IPCC (2006)[79]:

$$L_{fire} = A * M_B * C_f * G_{ef} * 10^{-3}$$

Where:

L_{fire}= amount of greenhouse gas emissions from fire, tonnes of each GHG
A = area burnt, ha
M_B= mass of fuel available for combustion dry tonnes biomass ha^{-1}
C_f= combustion factor (proportion of pre-fire biomass that burns; from Table 2.6 IPCC 2006 GL), dimensionless; default value for tropical moist forest is 0.32 (less intense) to 0.50 (more intense), dimensionless
G_{ef}= emission factor, g kg^{-1} dry matter burnt (from Table 2.5 IPCC 2006 GL) for each GHG as follows: 1580 for CO_2, 6.8 for CH_4, and 0.20 for N_2O

Activity Data
The MODIS burned area product was used to identify areas that experienced emissions due to forest fire between 2005-2014. Only forest areas that remain forested and where forest fires occur but cause no change in land use were counted as forest degradation. Any areas that burned and were identified as deforestation were removed from degradation forest fire accounting. The analysis of agricultural tree plantations (methods discussed in Annex 7) was used to adjust the burned area totals to account for fires that occurred on agricultural tree plantations rather than forestland, yet were classified as forestland by the land cover maps. Many areas experienced fires in several of the reference period years (Figure 12).

The activity data represents the total area burnt during the reference period. The MODIS Burned Area Product was used, which gives monthly totals of burned area at the 500m scale across the globe. The following steps were taken to process this data for the reference period:

- The global dataset was clipped using the shapefile of the GCFRP accounting area.

[79] IPCC (2006) Guidelines for national greenhouse gas inventories. Volume 4: Agriculture, Forestry, and Other Land Use. http://www.ipcc-nggip.iges.or.jp/public/2006gl/vol4.html

- The monthly burned area pixels were combined to create yearly burned area maps, from 2005-2014
- The burned area was divided between areas of forest remaining forest between 2005-2014 and areas of deforestation, both according to Ghana's national land cover maps. Burned area on all other land cover types was discarded. This was done to differentiate between forest fires that result in degradation and fires that result in deforestation, since deforestation fires will be accounted for separately.

The high-resolution analysis (described in Annex 8) was used to determine the percentage of fires, mapped as deforestation fires, were actually fires occurring on agricultural tree plantations transitioning to non-plantation non-forest lands. A proportion of deforestation fires were removed from deforestation accounting corresponding to this percentage. The high-resolution analysis was also used to determine the proportion of fires, mapped as degradation fires, were actually on areas of: 1) agricultural tree plantations remaining plantations (and thus neither degradation nor deforestation fires), and 2) forest transitioning to agricultural tree plantations (and thus being deforestation fires). A proportion of deforestation fires were removed for degradation accounting corresponding to the percentages of these areas (and a proportion was added to the deforestation accounting).

Emission Factors
There are three parameters that make up the emission factor: the biomass available for combustion (M_B), the combustion factor (C_f), and the emission factor (G_{ef}).

Biomas Available for Combustion: The biomass available for combustion refers to all the biomass in the forest that is subject to burning by fire. Generally, only part of the overall biomass in the forest is subject to burning. The carbon pools that are subject to burning depend on the fire regime in the area; if surface fires are common, generally only the pools close to the forest floor are included (litter, deadwood, shrubs, grasses, small trees, and topsoil organic carbon). If canopy fires are common, a greater proportion of the larger trees may be available for combustion as well.

For this reference level, it was assumed that all forest biomass was subject to burning. This assumption was made due to the nature of the activity data from the MODIS burned area product. The burned area product generally detects only larger fires, given that it is a satellite product viewing primarily the forest canopy, has a spatial resolution of 500m. Therefore, fires must kill relatively large sections of the canopy in order to be detected by MODIS, and it is assumed that if the canopy is being burned, the understory biomass is also subject to burning.
For areas that burned in multiple years, a reduced biomass available for burning value was used, which was equal to the original biomass multiplied by the combustion factor and by the number times the area had burned. For example, if an area burned for the second time in specific year, the original biomass was multiplied by the combustion factor and by 2.

Combustion factors: Combustion factors refer to the fraction of M_B that is actually combusted during fire. C_f depends largely on climate and ecosystem, since combustion will be more complete under dry, hot conditions. Defaults from IPCC[80] were used since country-level data was not available.

[80] Factors from Table 2.6 of IPCC (2006)

Emision Factors

Emission factors in Equation 2.27 refer to the amount of each GHG that is emitted when a certain amount of dry matter is burned. The reference level accounts for the major GHGs emitted during biomass burning, which are CO_2, N_2O, and CH_4. Since these emission factors are fairly constant across forest types, IPCC (2006) defaults from Table 2.5 were used for G_{ef}.

M_B values were the same as used for deforestation, corresponding to the sum of the biomass stored in aboveground, belowground, deadwood, and litter pools in each of the ecozones within the GCFRP accounting area. One combustion factor, corresponding to primary tropical forests, was applied to all ecozones. Emission factors for tropical forests were applied for the three included gases, CO_2, CH_4, and N_2O.

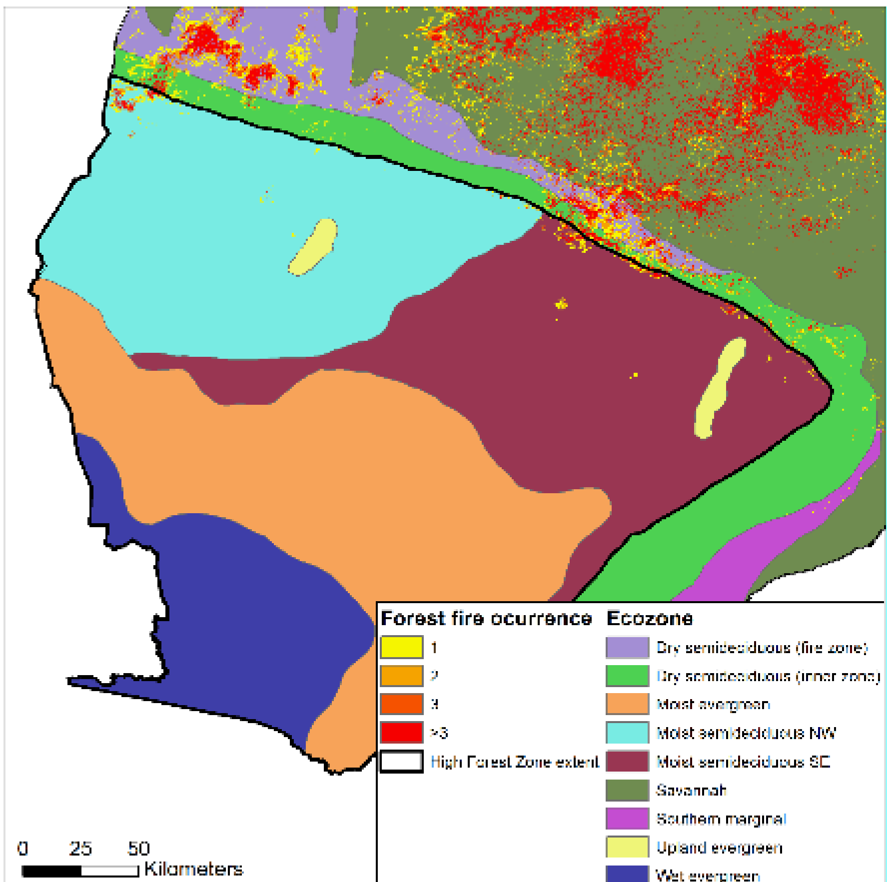

Figure 12: Fire recurrence in the GCFRP Area 2000-2015

Table 25: Description of fire activity data

Description of the parameter including the time period covered (e.g. forest-cover change between 2000 – 2005 or transitions between forest categories X and Y between 2003-2006):	Burned area for forest remaining forest between 2005-2014.

Explanation for which sources or sinks the parameter is used (e.g deforestation or forest degradation):	Forest degradation
Data unit (e.g. ha/yr):	Ha
Value for the parameter:	Annual average by ecozone: Moist Semi-deciduous (northwest subtype): Degradation fire: 346 ha Deforestation fire:760 ha Moist semi-deciduous (southeast subtype): Degradation fire: 657 ha Deforestation fire:120 ha Total GCFRP Accounting Area Degradation fire: 1,004 ha Deforestation fire: 881 ha Deforestation fire: 899 ha
Source of data (e.g. official statistics) or description of the method for developing the data, including (pre-)processing methods for data derived from remote sensing images (including the type of sensors and the details of the images used):	MODIS burned area product
Spatial level (local, regional, national or international):	MODIS product is international, but spatially explicit so detail is at the local level (500m resolution).
Discussion of key uncertainties for this parameter:	Given large pixel size ($500m^2$), the MODIS product is unlikely to capture small degradation fires. Surface fires are also unlikely to be captured as mortality of canopy vegetation is limited and cannot be detected by satellite images. Other potential remote sensing errors include: haze from smoke, cloud cover and coastal moisture effects.
Estimation of accuracy, precision, and/or confidence level, as applicable and an explanation of assumptions/methodology in the estimation:	According to Roy and Boschetti (2009)[81], average MODIS burned area agreement with Landsat-measured burned area is 96%.

Table 26: Description of fire emission factor

Description of the parameter including the forest class if applicable:	Biomass available for combustion
Data unit (e.g. t CO_2/ha):	t C/ha
Value for the parameter:	Forest carbon Stratum/ Forest | EF

[81] Roy DP and Boschetti L (2009) Southern Africa validation of the MODIS, L3RC, and GlobCarbon burned area products. *IEEE Transactions on Geoscience and Remote Sensing*: 47(4).

<table>
<tr><td></td><td>
<table>
<tr><th>type</th><th>(t CO_2e/ha)</th></tr>
<tr><td colspan="2">Wet Evergreen</td></tr>
<tr><td>Closed Forest</td><td>142</td></tr>
<tr><td>Open Forest</td><td>38</td></tr>
<tr><td colspan="2">Moist Evergreen</td></tr>
<tr><td>Closed Forest</td><td>174</td></tr>
<tr><td>Open Forest</td><td>48</td></tr>
<tr><td colspan="2">Moist Semi-deciduous SE</td></tr>
<tr><td>Closed Forest</td><td>158</td></tr>
<tr><td>Open Forest</td><td>47</td></tr>
<tr><td colspan="2">Moist Semi-deciduous NW</td></tr>
<tr><td>Closed Forest</td><td>61</td></tr>
<tr><td>Open Forest</td><td>31</td></tr>
<tr><td colspan="2">Upland Evergreen</td></tr>
<tr><td>Closed Forest</td><td>103</td></tr>
<tr><td>Open Forest</td><td>42</td></tr>
</table>
</td></tr>
<tr><td>Source of data (e.g. official statistics, IPCC, scientific literature) or description of the assumptions, methods and results of any underlying studies that have been used to determine the parameter:</td><td>Forest Preservation Programme (FPP) forest carbon stock inventory collected through Mapping of Forest Cover and Carbon Stock in Ghana project.</td></tr>
<tr><td>Spatial level (local, regional, national or international):</td><td>GCFRP Accounting Area</td></tr>
<tr><td>Discussion of key uncertainties for this parameter:</td><td>Forest carbon stock data are taken from the FPP project that estimated confidence intervals (95% of the mean) for the 6 forest carbon pools for each stratum.

Generally, the FPP plot-based mean values are generated with small number of field plots for each of the ecological zone that leads to relatively high uncertainty. This will be decreased as more data are collected as the programme progresses</td></tr>
<tr><td>Estimation of accuracy, precision, and/or confidence level, as applicable and an explanation of assumptions/methodology in the estimation:</td><td>
<table>
<tr><th>Forest carbon Stratum/ Forest type</th><th>Uncertainty %</th></tr>
<tr><td colspan="2">Wet Evergreen</td></tr>
<tr><td>Closed Forest</td><td>11.4</td></tr>
<tr><td>Open Forest</td><td>1.8</td></tr>
<tr><td colspan="2">Moist Evergreen</td></tr>
<tr><td>Closed Forest</td><td>5.0</td></tr>
<tr><td>Open Forest</td><td>27.2</td></tr>
<tr><td colspan="2">Moist Semi-deciduous SE</td></tr>
<tr><td>Closed Forest</td><td>5.8</td></tr>
</table>
</td></tr>
</table>

	Open Forest	29.0
	Moist Semi-deciduous NW	
	Closed Forest	4.3
	Open Forest	11.4
	Upland Evergreen	
	Closed Forest	23.9
	Open Forest	15.3
	Uncertainties represent 95% confidence intervals as a percentage of the mean	

Table 27: Additional description of fire emission factor

Description of the parameter including the time period covered (e.g. forest-cover change between 2000 – 2005 or transitions between forest categories X and Y between 2003-2006):	Used Combustion factor from IPCC table 2.6. The value for all primary tropical forest.
Explanation for which sources or sinks the parameter is used (e.g deforestation or forest degradation):	Forest degradation
Data unit (e.g. ha/yr):	Dimensionless
Value for the parameter:	0.36
Source of data (e.g. official statistics) or description of the method for developing the data, including (pre-)processing methods for data derived from remote sensing images (including the type of sensors and the details of the images used):	IPCC (2006) Table 2.6
Spatial level (local, regional, national or international):	Global
Discussion of key uncertainties for this parameter:	Taken from IPCC (2006)
Estimation of accuracy, precision, and/or confidence level, as applicable and an explanation of assumptions/methodology in the estimation:	Uncertainty as given by IPCC (2006) represents 36% of the value.

Description of the parameter including the time period covered (e.g. forest-cover change between 2000 – 2005 or transitions between forest categories X and Y between 2003-2006):	Emission factor
Explanation for which sources or	Forest degradation

sinks the parameter is used (e.g deforestation or forest degradation):	
Data unit (e.g. ha/yr):	G kg^{-1} dry matter burnt
Value for the parameter:	CO_2: 1,580 CH_4: 6.8 N_2O: 0.2
Source of data (e.g. official statistics) or description of the method for developing the data, including (pre-)processing methods for data derived from remote sensing images (including the type of sensors and the details of the images used):	IPCC (2006) Table 2.5
Spatial level (local, regional, national or international):	Global
Discussion of key uncertainties for this parameter:	Taken from IPCC (2006)
Estimation of accuracy, precision, and/or confidence level, as applicable and an explanation of assumptions/methodology in the estimation:	Uncertainty as given by IPCC (2006) are as follows as a percentage of the value: CO_2: 6% CH_4: 29% N_2O: 100%

8.3.6 Degradation from Woodfuel activity data and emission factors used for calculating the average annual historical emissions over the Reference Period

The measurement approach is to model supply and demand of fuelwood in the programme area. This analysis was conducted for a single point in time. It can be considered a proxy-based approach. The supply of fuelwood captures the losses that occur to both above and belowground tree biomass when trees are felled for timber. Other pools are considered insignificant with degradation through fuelwood extraction.

The Woodfuel Integrated Supply/Demand Overview Mapping (WISDOM)[82,83] approach is used to estimate carbon emissions from woodfuel use. The WISDOM approach models demand and supply dynamics and produces an estimate of non-renewable biomass (in tonnes) that is extracted for woodfuel use. Emissions can then be estimated by converting the estimate of non-renewable biomass into carbon, and then into CO_2 emissions.

An expansion factor of 1.32 was applied to the WISDOM estimates of non-renewable biomass to conservatively estimate the total biomass that is emitted as a result of woodfuel harvesting that result in

[82] http://www.wisdomprojects.net/global/ Developed by Bailis et al. (2015)
[83] Bailis et al. (2015). The carbon footprint of traditional woodfuels. Nature Climate Change 5, 266-272. http://www.nature.com/nclimate/journal/v5/n3/full/nclimate2491.html?WT.ec_id=NCLIMATE-201503

forest degradation. This factor was taken from the American Carbon Registry's *Energy efficiency measures in thermal applications of non-renewable biomass methodology*[84], based on the CDM-approved methodology AMS-II.G, Version 05.0. This factor of 1.32 was based on the assumption that for every unit of biomass extracted from the forest, an additional 10% is left in the field from uncollected aboveground biomass. A further 20% was conservatively estimated to remain from root biomass. These factors, multiplied together, produced a 1.32 expansion factor.

Estimates of CO_2 emissions from woodfuel use in Ghana are available for the year 2009 produced using the WISDOM approach[85] at the district level (a full list of district-level non-renewable biomass estimates and emissions are included in the Annex 7). These estimates serve as a Tier 2 estimate of woodfuel emissions, but are not accompanied by uncertainty estimates. Instead, to be highly conservative an uncertainty equal to 50% of the given values will be applied. The estimates are for the year 2009, and therefore do not offer multiple data points with which to develop a true historical average of woodfuel emissions. Nevertheless, annual emissions for 2009 serve to represent annual emissions for each year in the historical reference period. Future work will create annual data while increasing the precision of woodfuel use estimates.

Table 28: Description of woodfuel activity data

Description of the parameter including the time period covered (e.g. forest-cover change between 2000 – 2005 or transitions between forest categories X and Y between 2003-2006):	Woodfuel emissions 2005-2014
Explanation for which sources or sinks the parameter is used (e.g deforestation or forest degradation):	Forest degradation
Data unit (e.g. ha/yr):	t CO_2/yr
Value for the parameter:	702,133 t CO_2/yr

Source of data (e.g. official statistics) or description of the method for developing the data, including (pre-)processing methods for data derived from remote sensing images (including the type of sensors and the details of the images used):	WISDOM Model Inputs:
	Supply - Biomass + Productivity:
	• Biomass Stocks (woody AGB without twigs and stumps)
	  • Geo-referenced plot data from field surveys
	  • Forest inventories of specific locations forest/vegetation types
	  • Empirically-derived maps of biomass distribution (Saatchi et al. 2011; Baccini et al. 2012)
	• Productivity: Stock and Mean Annual Increment (IPCC)
	Demand:
	• GLOBAL Gridded Population Maps and Data
	• Global Administrative Unit Layers

[84]http://americancarbonregistry.org/carbon-accounting/standards-methodologies/energy-efficiency-measures-in-thermal-applications-of-non-renewable-biomass/acr-ams-ii-g_v-5-0_final.pdf

	• International databases of forestry/energy statistics ○ FAOSTAT ○ International Energy Agency ○ United Nations Energy ○ National-level data sources ○ World Health Organization databases on house hold fuel choice
Spatial level (local, regional, national or international):	GCFRP Accounting Area
Discussion of key uncertainties for this parameter:	The model combines a wide array of datasets and approaches and thus there is no single associated uncertainty estimate. As the numbers used result from a single year in the reference period, to be highly conservative prior to systematic collection of woodfuel data in Ghana, an uncertainty equal to 50% of the parameter value is assumed.
Estimation of accuracy, precision, and/or confidence level, as applicable and an explanation of assumptions/methodology in the estimation:	Uncertainty as a percentage of the parameter value: 50%

8.3.7 Enhancement of carbon stocks activity data and emission factors used for calculating the average annual historical emissions over the Reference Period

The measurement approach relies on national statistics on areas planted in forest reserves and off-reserves, and applies removal factors representing the growth of planted trees. Ghana-specific numbers are included for teak but IPCC defaults are applied for other species. Only accumulation in above and belowground live tree biomass is included. All other pools are insignificant and given the increase in sequestration in the implementation case versus the reference level, any exclusion of pools is conservative.

The National Forest Plantation Development Programme (NFPDP) has engaged in a range of tree planting activities including a range of species (*Tectona grandis, Terminalia superba, Triplochiton scleroxylon, Mansonia altissima, Khaya anthotheca, Terminalia ivorensis, Pycnanthus angolensis*). Teak is the dominant species planted in the GCFRP Accounting Area, so activity data and removal factors for enhancement are categorized into two sub activities:

1. Establishment of teak species
2. Establishment of other broadleaf species

Historical removals from enhancement activities in Ghana are accounted for using an approach based on IPCC (2006) equations 2.9, 2.10 and 2.15 whereby annual removals from planted areas beginning in 2005 are accounted for in a cumulative fashion over the course of the 10-year historical reference period. As plantation activities are subject to failure due to management or natural causes, a plantation failure rate derived from NFPDP data,was applied to discount activity data accordingly.

Removal Factors

Teak: The study conducted by Adu-Bredu S., et al. 2008[86] assessing tree carbon stocks in teak stands in Moist Evergreen forest in Ghana was used to develop removal factors for teak stands in the GCFRP ACCOUNTING AREA. The value of 97.69 Mg C ha^{-1} included both above and belowground tree carbon stocks. A removal factor in t CO_2/ha was calculated by applying the molecular weight ratio of carbon dioxide to carbon, of 44/12 to get 358 t CO_2/ha. To derive annual removals over the lifetime of the plantation, the removal factor was divided by a typical rotation length of 25 years in Ghana, to get a final removal factor of 14t CO_2ha^{-1} yr^{-1}.

Non-teak broadleaf species: Due to a lack of data available on carbon stocks in tree plantations in Ghana, IPCC AFOLU Vol. 4 default values from table 4.8 reflecting aboveground biomass in forest plantations were applied. Values for 'Africa broadleaf >20 years' for three ecological zones in the GCFRP Accounting Area (tropical rain forest, tropical moist deciduous forest, and tropical dry forest) were averaged to get 173.3 t d.m. ha^{-1}, which was converted to t C/ha by applying a factor of 0.47to get 81 t C/ha. The belowground biomass value was then generated by applying a root-to-shoot ratio of 0.24for tropical/subtropical moist forest/plantations >125 Mg ha^{-1} (Mokany et al.2006), to get 20 t C/ha. The total aboveground biomass in non-teak broadleaf species was thus estimated to be the sum of below and above-ground biomass stocks: 101 t C/ha.
A removal factor in t $CO2ha^{-1}$ was calculated by applying the molecular weight ratio of carbon dioxide to carbon, of 44/12 to get 370 t CO_2/ha. To derive annual removals over the lifetime of the plantation, the removal factor was divided by the typical rotation length of 40 years for indigenous species in Ghana, to get a final removal factor of 9t CO_2ha^{-1} yr^{-1}.
The values and sources used to estimate for both removal factors are summarized below:

Table 29: Summary of Removal Factors for Teak and Non-Teak Broadleaf

Species		Value	Unit	Source
Teak	AGB & BGB	98	Mg C ha^{-1}	Adu-Bredu S., et al. 2008
	Final RF	14	t CO_2 ha^{-1} yr^{-1}.	
Non-teak broadleaf	AGB	173	t d.m. ha^{-1}	IPCC AFOLU Vol. 4 table 4.8 above-ground biomass in forest plantations.
		81	Mg C ha^{-1}	
	BGB	20	Mg C ha^{-1}	Mokany et al.2006
		101		
	Final RF	9	t CO_2ha^{-1} yr^{-1}.	

Activity Data

For on-reserve plantations, the NFPDP had tabular records of planting activity for all years in the historical reference period. For MTS, CFMP, GPDP, and Model programmes, the total area planted in the GCFRP Accounting Area forest reserves up to 2009 was divided across the years the programme was in operation.

Off-reserve plantations under the NFPDP began in 2010 and continued through t0 2012.
The calculated activity data, as well as the applied failure rates and dates of NFPDP programmes are summarized below.

Table 30: GCFRP Activity Data for Enhancements

GCFRP ACTIVITY DATA FOR ENHANCEMENTS

[86]Adu-Bredu S., et al. (2008). Carbon Stock under Four Land-Use Systems in Three Varied Ecological Zones in Ghana. Proceedings of the Open Science Conference on Africa and Carbon Cycle: the CarboAfrica project, Accra, Ghana, 25-27 November 2008. Available at http://www.fao.org/3/a-I2240.pdf

Source	OFF RESERVE		ON RESERVE					
	NFPDP data		NFPDP data					
Year	Off-reserve planted area (ha)	Survival Rate	GPDP planted area (ha)	MTS planted area (ha)	CFMP planted area (ha)	Model planted area (ha)	Expanded Program	Survival Rate
2005			948.25	2428.85	303.22	0.00	0.00	55.1%
2006			948.25	2428.85	303.22	0.00	0.00	55.1%
2007			948.25	2428.85	303.22	6.67	0.00	55.1%
2008			948.25	2428.85	303.22	6.67	0.00	55.1%
2009			948.25	2428.85	303.22	6.67	0.00	55.1%
2010	1614.59	62%	0.00	0.00	0.00	0.00	1304.11	75.4%
2011	218.79	57%	0.00	0.00	0.00	0.00	2843.50	75.4%
2012	67.41	64%	0.00	0.00	0.00	0.00	2849.09	75.4%
2013			0.00	0.00	0.00	0.00	1692.49	100.0%
2014			0.00	0.00	0.00	0.00	859.50	100.0%

On-Reserve Success Rates:
2005-2009: Derived from the reported failure rate of 44.9% (Source: survey and mapping of government plantation sites established between 2004 to 2009 in some forest reserves of Ghana)
2010-2015: Derived from the average survival rate reported (Source: NFPDP dataset '2013 Final Verification Nationwide'.) As actual estimates for rates of survival per forest reserve were available in this dataset for the year 2013 and 2014, those rates were applied to activity data for 2013 and 2014. 2014:

Off-Reserve Success Rates:
2010-2012: The off-reserve survival rates are the averages of the individual small holder plantations within the GCFRP for a particular year as reported in the handing over notes of the NFPDP by Ecotech and Zoil Services limited

Table 31: Records of NFPDP for years in the historical reference period

NFPDP Programmes	Dates of Operation	Years
GPDP	2004-2009	6
MTS	2002-2009	8
CFMP	2005-2009	5
Model	2007-2009	3

Activity Data

Table 32: Description of CSE activity data

Description of the parameter including the time period covered (e.g. forest-cover change between 2000 – 2005 or	Average annual area of forests planted between 2005-2014, discounted by plantation failure rates

transitions between forest categories X and Y between 2003-2006):	
Explanation for which sources or sinks the parameter is used (e.g deforestation or forest degradation):	Carbon stock enhancements
Data unit (e.g. ha/yr):	Hectares planted/yr
Value for the parameter:	Teak: 1,340.23 ha/yr Non-teak: 574.38 ha/yr
Source of data (e.g. official statistics) or description of the method for developing the data, including (pre-)processing methods for data derived from remote sensing images (including the type of sensors and the details of the images used):	National Forest Plantation Development Programme official statistics. The NFPDP collects data on on-reserve and off-reserve tree establishment across Ghana, and include a number of programmes that took place along different time frames between 2002-2015 Government Plantation Development Programme (GPDP), Modified Taungya System (MTS), Community Forestry Management Project (CFMP), Model plantations, and other on-and off-reserve planting programmes (detailed in Annex 7). While spatial data were not available on area planted, historical tabular data are organized into hectares planted per forest reserve. For the development of historical removals within the GCFRP Accounting Area, it was necessary to isolate how many hectares were planted in forest reserves located within the ER-Programme area (GCFRP Accounting Area). Shapefiles of forest reserve boundaries were used to delineate which forest reserves were located within GCFRP Accounting Area boundaries, and only those inside the GCFRP Accounting Area were included. For plantings in forest reserves that fell both within and outside the GCFRP Accounting Area boundary, the proportion of the forest reserve inside and outside the boundary was calculated, and the only proportion of planted area within GCFRP Accounting Area boundary was applied. To account for plantation failure, the recorded annual area planted within the GCFRP Accounting Area was discounted based on official statistics from the NFPDP. These official statistics reflect the two distinct periods of activities that the NFPDP undertook, whereby the 2001-2009 period reflected plantation activities in forest reserves largely led by the public sector. Starting in 2010, activities shifted toward issuing private sector companies leases to establish plantations within forest reserves. This shift in activities and management appears to have resulted in significantly different plantation failure rates: On-Reserve: • 2005-2009: “Survey and Mapping of Government Plantation Sites Established between 2004 and 2009 in some forest reserves of Ghana” stated that 44.9% of the planted area was estimated to have failed during this time period. • 2010-2014: The NFPDP 2013 Dataset on Final Verification Nationwide included estimates of survival percentage per forest reserve. The average survival percentage for 2013 was reported as 75.43%, and thus a failure rate of 24.6% was applied. For the year 2013, actual survival rates per forest reserve were used rather than the average.

	Off-Reserve: • The NFPDP 2010-2012 handing over reports by Ecotech and Zoil services limited figures reported for off-reserve plantation within the GCFRP were used. These were smallholder plantations with different survival rates for each plantation. The average survival rate of all the plantations for each year was applied. The average survival rates are 61.84,%, 57% and 63.85 % for 2010,2011 and 2012 respectively The adjusted annual estimates for area planted were then divided according to species composition, so that appropriate removal factors could be applied. The total estimated area of successful plantations was assumed to comprise 70% teak species and 30% other broadleaf species. This assumption about species composition was made based on expert opinion as well as a review of NFPDP data.
Spatial level (local, regional, national or international):	GCFRP Accounting Area
Discussion of key uncertainties for this parameter:	The activity data used for the estimation of removals was derived from national census data, reported by the National Forest Plantation Development Programme. As such, no uncertainty is assumed.
Estimation of accuracy, precision, and/or confidence level, as applicable and an explanation of assumptions/methodology in the estimation:	Effectively zero uncertainty is assumed for this parameter.

Removal Factors

Removal factors represent the biomass accumulated annually per plantation type (teak/other broadleaf species).
To derive annual biomass accumulation from data that reflected the total carbon stocks in mature teak and other broadleaf species plantations in Ghana, the value for the mature stocks was divided by the typical rotation length for such species. This is 25 years for teak and 40 years for other broadleaf species.

Table 33: Description of CSE removal factor for teak

Description of the parameter including the forest class if applicable:	Calculated removal factor for carbon stock enhancement through plantation of teak in forest reserves (AGB and BGB)
Data unit (e.g. t CO_2/ha):	t CO_2 ha^{-1} yr^{-1}
Value for the parameter:	14t $CO_2ha^{-1}yr^{-1}$
Source of data (e.g. official statistics, IPCC, scientific literature) or description of the assumptions, methods and results of any underlying studies that have been used to determine the parameter:	Published literature (Adu-Bredu S., et al. 2008[87]) on total tree carbon stocks in teak stands in Moist Evergreen forest in Ghana (98 Mg C/ ha) (included both aboveground and belowground carbon stocks). 98 Mg C/ ha = 358 t CO_2/ha Annual removals: 358 t CO_2ha^{-1}/ 25 yr =14 t CO_2ha^{-1} yr^{-1}
Spatial level (local, regional, national or international):	Moist Evergreen forests in Ghana (GCFRP Accounting Area)
Discussion of key uncertainties for this parameter:	Adu-Bredu et al. (2008) was completed using temporary sample plots following standard operating procedures for the measurement of terrestrial carbon.
Estimation of accuracy, precision, and/or confidence level, as applicable and an explanation of assumptions/methodology in the estimation:	While only the total tree carbon stocks were used for the development of removal factors, an estimation of statistical accuracy was offered in the form of the mean, minimum, and maximum carbon values for the total carbon stocks of the teak stands studied in the Moist Evergreen Forest strata, as well as the standard deviation: Mean: 138 Minimum: 133 Maximum: 144 Based on these values a conservative value for uncertainty is 6% of the mean.

Table 34: Description of removal factor for other broadleaf species

[87] Adu-Bredu S., et al. (2008). Carbon Stock under Four Land-Use Systems in Three Varied Ecological Zones in Ghana. Proceedings of the Open Science Conference on Africa and Carbon Cycle: the CarboAfrica project, Accra, Ghana, 25-27 November 2008. Available at http://www.fao.org/3/a-I2240.pdf

Description of the parameter including the forest class if applicable:	Calculated removal factor for carbon stock enhancement through plantation of trees (non-teak) in forest reserves (AGB and BGB)
Data unit (e.g. t CO_2/ha):	t CO_2ha^{-1} yr^{-1}
Value for the parameter:	9 t CO_2ha^{-1} yr^{-1}
Source of data (e.g. official statistics, IPCC, scientific literature) or description of the assumptions, methods and results of any underlying studies that have been used to determine the parameter:	IPCC AFOLU Vol. 4 table 4.8 above-ground biomass in forest plantations. Values for 'Africa broadleaf >20 years' for three ecological zones in the GCFRP Accounting Area (tropical rain forest, tropical moist deciduous forest, and tropical dry forest) were averaged, and converted to carbon (81 t C/ha) using a carbon-to-biomass ratio of 0.47. The belowground biomass value was generated by applying a root-to-shoot ratio of 0.24 for tropical/subtropical moist forest/plantations >125 Mg ha-1 (Mokany et al.2006)[88]. This rendered a total stock of 101 t C/ha. 101 Mg C ha^{-1}= 370 t CO_2ha^{-1} Annual removals: 370 t CO_2ha^{-1} / 40 yr =9 t CO_2ha^{-1} yr^{-1}
Spatial level (local, regional, national or international):	GCFRP Accounting Area
Discussion of key uncertainties for this parameter:	For the development of this parameter, IPCC defaults for aboveground biomass in forest plantations in Africa were applied. Given they are continental averages for all broadleaf species, uncertainty can be assumed to be high. Belowground biomass stocks are produced using a root-to-shoot ratio (Mokany et al., 2006)[89], and therefore values are tied to the estimates for aboveground biomass.
Estimation of accuracy, precision, and/or confidence level, as applicable and an explanation of assumptions/methodology in the estimation:	No uncertainty values were offered in the IPCC tables (both IPCC 2003 and 2006) for this parameter. While there is uncertainty in the specific number for removal stock the scale of the variation is constrained biologically. Thus here, 33% is adopted.

8.3.8 Calculation of the average annual historical emissions over the Reference Period

The annual emissions and removals defined in the FRL are estimated according to the following equation:

[88] Mokany K, Raison R.J, Prokushkin A.S 2006 Critical analysis of root : shoot ratios in terrestrial biomes. Global Change Biol. 12, 84–96. doi:10.1111/j.1365-2486.2005.001043.x.
[89] Mokany K, Raison R.J, Prokushkin A.S 2006 Critical analysis of root : shoot ratios in terrestrial biomes. Global Change Biol. 12, 84–96. doi:10.1111/j.1365-2486.2005.001043.x.

$$FREL = (CDefor_{REL} + CDegrad_{REL\,(LTH)} + CDegrad_{REL\,(ITH)} + CDegrad_{REL\,(F)} + CDegrad_{REL\,(FW)} + CRefor_{REL})$$

Where:

Projected annual emissions and removals from the forest sector summed across all strata; t CO_2-e/yr

Predicted annual emissions from deforestation in each stratum;t CO_2-e/yr

Predicted annual emissions from forest degradation on forestland remaining forestland from legal timber harvest;t CO_2-e/yr

Predicted annual emissions from forest degradation on forestland remaining forestland from illegal timber harvest;t CO_2-e/yr

Predicted annual emissions from forest degradation on forestland remaining forestland from fire;t CO_2-e/yr

Predicted annual emissions from forest degradation on forestland remaining forestland from woodfuel harvest;t CO_2-e/yr

Predicted annual emissions from afforestation and reforestation; note net removals from the atmosphere are depicted by a negative sign;t CO_2-e/yr

Details for estimations from each activity can be found in the Annex 7.

8.4 Estimated Reference Level

The annual average emissions for the 10-year period from 2005 to 2014 from deforestation was 27.7 million tCO_2e (Table 35). Emissions were highest from the moist evergreen ecozone, which accounted for 42% of the total in the GCFRP Accounting Area (Figure 13).

Table 35: Emission from deforestation for the GCFRP Accounting Area between 2005-2014

Ecozone	Forest structure	Annual area deforested (ha)	Annual Emissions (tCO_2 yr^{-1})	Non-CO_2 gas emissions from fire (tCO_2e yr^{-1})	Total Emissions from deforestation (tCO_2e yr^{-1})
Wet evergreen	Closed forest	10,451	4,582,105	0	4,582,105
	Open forest	11,074	1,905,479	0	1,905,479
Moist evergreen	Closed forest	14,000	7,383,821	7	7,383,828
	Open forest	37,114	4,328,300	0	4,328,300
Moist semidecidious SE	Closed forest	12,218	5,138,829	1,042	5,139,871
	Open forest	23,332	1,641,408	974	1,642,383
Moist semidecidious NW	Closed forest	6,779	592,758	85	592,844
	Open forest	22,345	1,812,974	4,225	1,817,198
Upland evergreen	Closed forest	706	159,771	0	159,771
	Open forest	604	190,620	0	190,620
Total HFZ		**138,624**	**27,736,066**	**6,334**	**27,742,399**

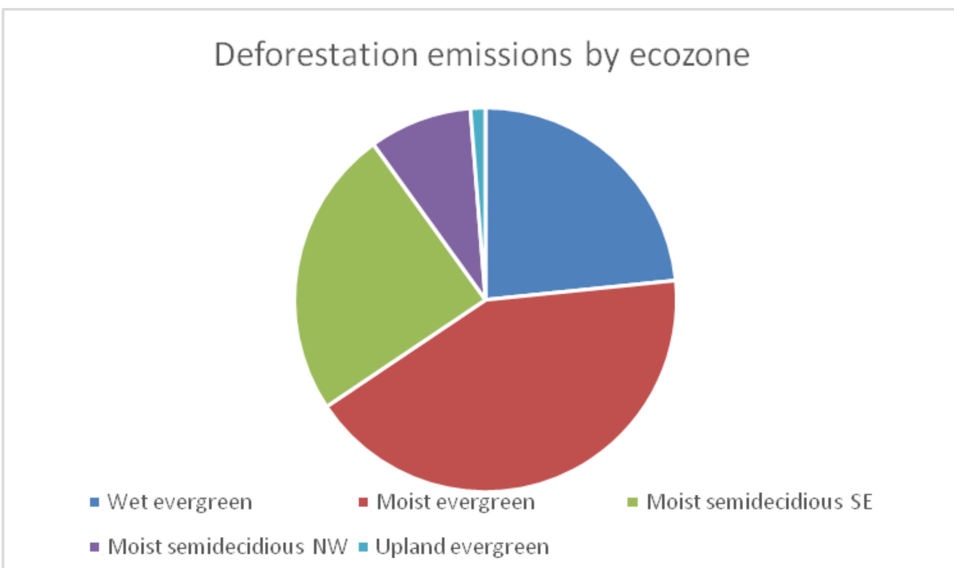

Figure 13: Deforestation emissions by ecozone

Degradation from Legal Timber Harvest

The annual average emissions over a 10-year period (2005 to 2014) from legal logging was 3,141,314 tCO_2e. In general, emissions were relatively stable, with 2013 having the highest amount of emissions (3.6 M t CO_2e). Emissions dip below average between 2008 and 2012 before the sharp increase in 2013. In 2014 emissions decreased steadily back towards the average (see Figure 14)

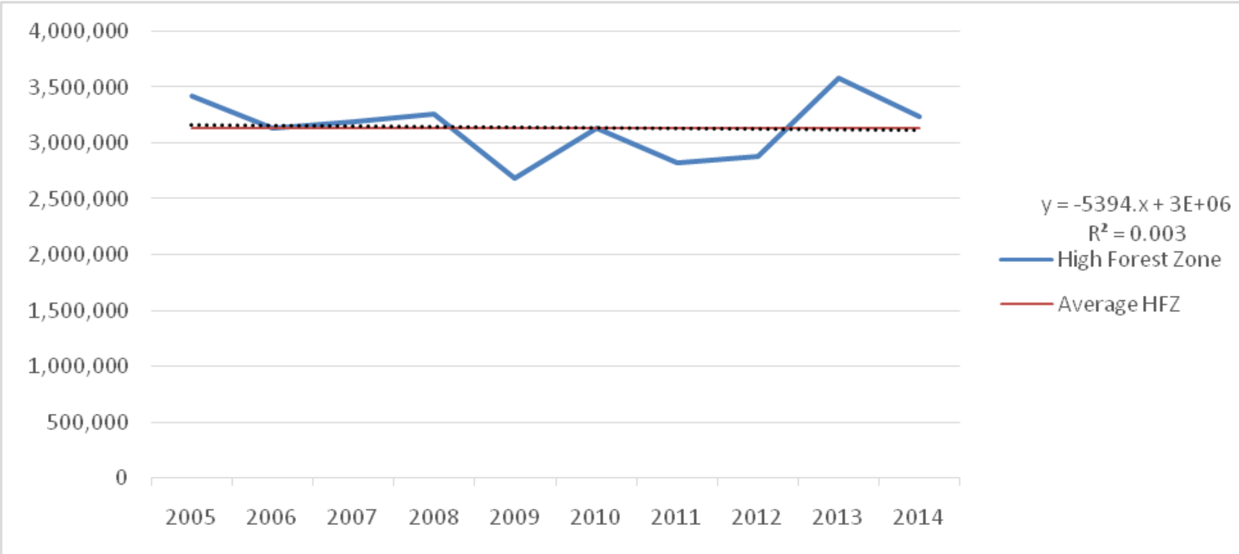

Figure 14: Emissions from legal logging between 2005-2014 (in t CO_{2e})

Illegal Logging

The annual average emissions from illegal logging over a 10-year period from 2005-2014 were 13,407,000tCO_2e

Woodfuel

Using the data for woodfuel from 2009 as a proxy for the average emissions from woodfuel, over the reference period, the average annual emission between 2005and 2014were 899,499 tCO_2e.

Degradation from Fire

The annual average emissions from forest fire from 2005 to 2014 were 58,545 tCO_2e. In general, emissions were higher in the second half of the reference period, with 2013 having the highest amount of emissions (Figure 15). Emissions were highest from the Moist Semi-deciduous ecozones (Figure 16).

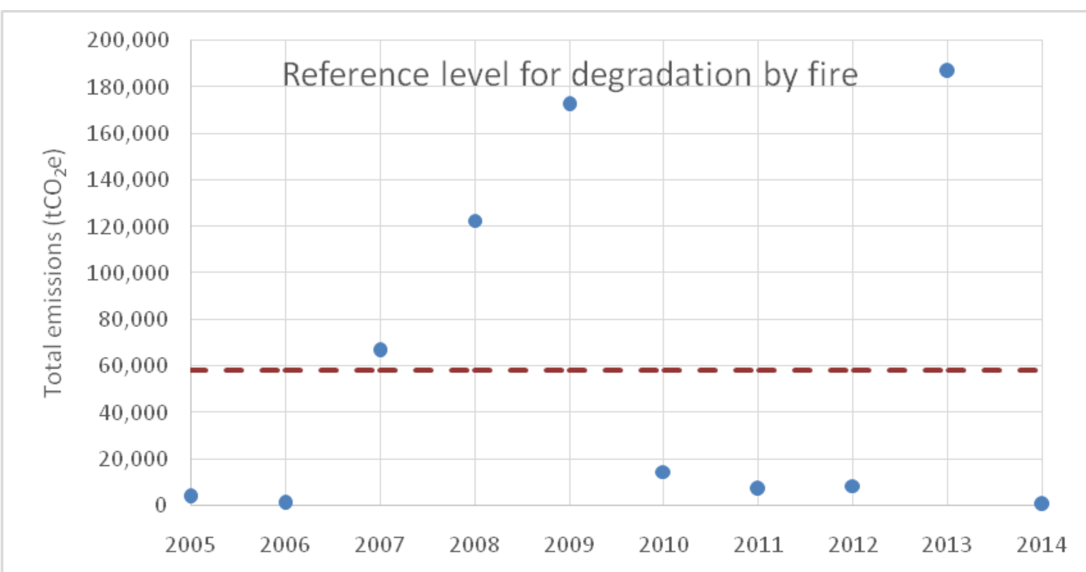

Figure 15: Emission from forest fire 2005-2014

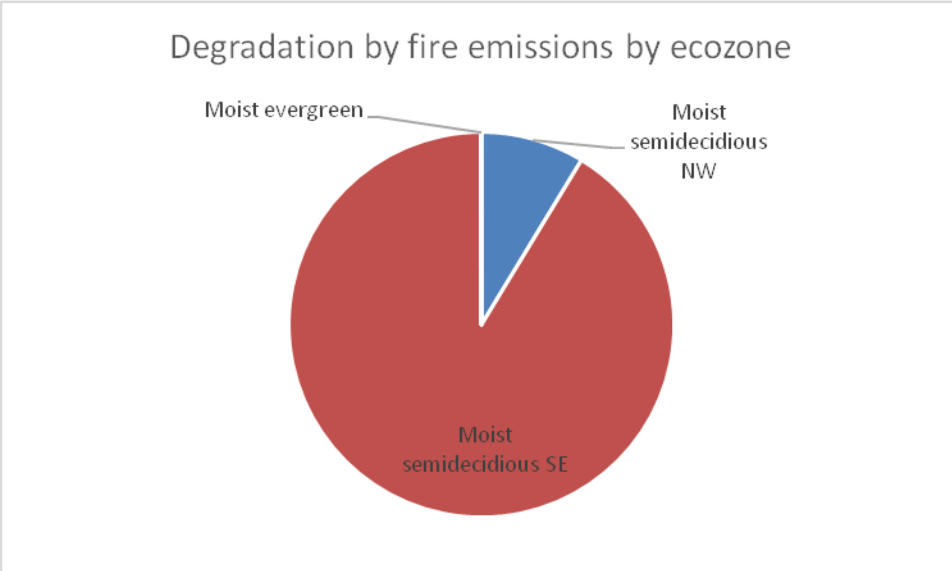

Figure 16: Emissions from fire from 2005 to 2014

Carbon Stock Enhancements

The annual average removals from 2005 to 2014 were 139,172 tCO_2e (Figure 17).

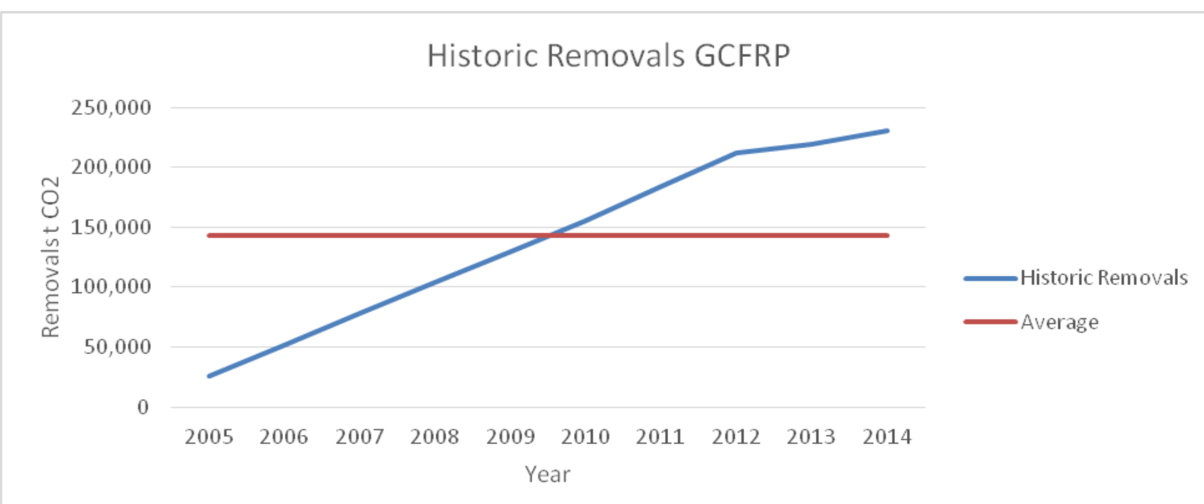

Figure 17: Removals from carbon enhancement from 2005 to 2014

Summed reference level

When summed together, the average annual emissions from 2005 -2014 were 45.1 million $tCO_2e\ yr^{-1}$ 61.12% of emissions were due to deforestation, while legal and illegal logging made up 36.68% combined. Fuelwood and forest fire accounted for a minimal percentage of total emissions, making up just 1.99% and 0.13% respectively (Figure 18).

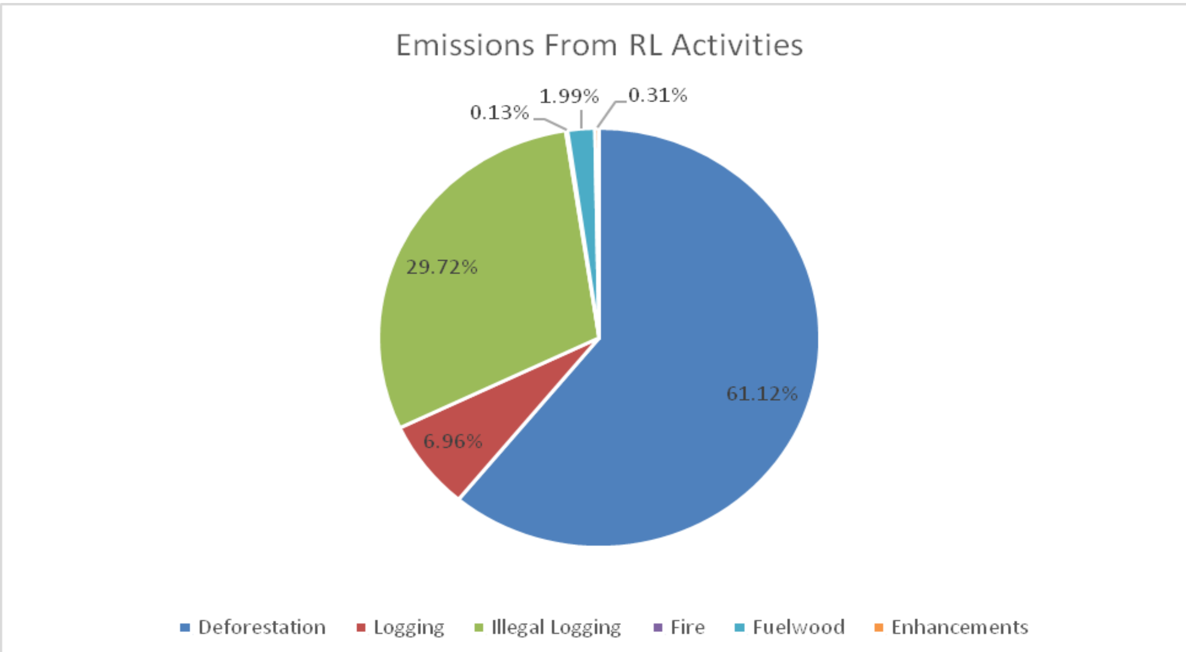

Figure 18: Relative annual emissions from each reference level activity

Table 36: GCFRP Reference Level

ERPA term year *t*	Average annual historical emissions from deforestation over the Reference Period (tCO_{2-e}/yr)	Average annual historical emissions from forest degradation over the Reference Period (tCO_{2-e}/yr)				Average annual historical removals by sinks over the Reference Period (tCO_{2-e}/yr)	Reference level (tCO_{2-e}/yr)
		woodfuel collection)	legal timber harvest	illegal timber harvest	Fire		
1	27,742,399	899,499	3,141,314	13,407,000	58,454	-139,172	45,109,495
2	27,742,399	899,499	3,141,314	13,407,000	58,454	-139,172	45,109,495
3	27,742,399	899,499	3,141,314	13,407,000	58,454	-139,172	45,109,495
4	27,742,399	899,499	3,141,314	13,407,000	58,454	-139,172	45,109,495
5	27,742,399	899,499	3,141,314	13,407,000	58,454	-139,172	45,109,495

8.5 Relation between the Reference Level, the development of the FREL/FRL for the UNFCCC and the country's existing or emerging greenhouse gas inventory

Ghana has an innovative institutional arrangement to report its national GHG emissions because it has adopted an evolving system that allows room for changes and enhancements and takes advantage of lessons and lapses of preceding efforts. The current arrangement involves a wide range of stakeholders drawn across the energy, industrial, AFOLU, agriculture and waste management sectors of the economy.

The reference level developed for the ER-Programme served as the framework for the draft national FRL submitted to the UNFCCC in January, 2017. The reference level for the ER-Programme includes data for the GCFRP Accounting Area alone. The submission to the UNFCCC included all activities covered for the ER-Programme but include data at the national scale. The FRL is currently being technically assessed by the UNFCCC and should be finalized in November, 2017. Once finalized, the national FRL will be submitted as a technical annex to the BUR and form a basis for the estimation of emissions for the 'land' subsector of AFOLU for the national GHG inventory. Currently, the major source of disparity or inconsistency between the reference level for the ERP, the national and the GHG inventory for the land subsector is the reference period. Whereas, Ghana has used a reference period of 2005 – 2014 for the ERP, the national FRL has a reference period of 2000 – 2015 whereas the GHG inventory uses a reference period of 1990 – 2015. Notwithstanding this disparity in reference periods, the data sources and methods applied are consistent amongst the three processes

9. APPROACH FOR MEASUREMENT, MONITORING AND REPORTING

9.1 Measurement, monitoring and reporting approach for estimating emissions occurring under the ER Programme within the Accounting Area

This section demonstrates Ghana's approach for measuring, monitoring and reporting against the reference level. The same methods described in Annex 7 will be used when reporting against the reference level. Assuming a 2017 start date, reporting will occur every two years although the monitoring of certain activities (e.g. legal timber harvest) will occur over different time periods as explained below.

Stepwise improvements that could be adopted to improve both the data and methodological approaches for the development of specific AD and EFs are offered in Annex 10. Where such improvements are made then the reference level will be revisited and recalculated, where appropriate, with improved emission factors or alternate activity data.

DEFORESTATION

Estimated emissions from deforestation for the monitoring period will be based on the emission factors developed for the reference level and updated change in forest cover per the identified strata. Emission factors will remain constant until carbon stocks are updated by new forest inventories (envisioned prior to reference level renewal). Activity data will be captured using analysis of Landsat imagery biennially. This analysis will be in line with the remote sensing undertaken for the national GHG inventory.

Table 37: Deforestation MMR approach for estimating emissions

Parameter:	Hectares of land deforested
Description:	Forest land converted to non-forest land for the open and closed forest in each of the ecological zones
Data unit:	Hectares
Source of data or measurement/calculation methods and procedures to be applied (e.g. field measurements, remote sensing data, national data, official statistics, IPCC Guidelines, commercial and scientific literature), including the spatial level of the data (local, regional, national, international) and if and how the data or methods will be approved during the Term of the ERPA	Activity data will be obtained from land cover maps based on 30 m resolution Landsat 8 imagery analyzing forest cover change biennially during the course of the ER-PA. Forest will be stratified between "open" and "closed" forest, and five ecological zones (Wet Evergreen, Moist Evergreen, Moist Semi-deciduous SE, Moist Semi-deciduous NW, Upland Evergreen). High resolution analysis described in Annex 8 will be applied to future monitoring events to map areas of agricultural tree plantations.
Frequency of monitoring/recording:	Every 2 years
Monitoring equipment:	Remote sensing analysis software and GIS software
Quality Assurance/Quality Control procedures to be applied:	QA/QC will be accomplished in a two-step process— i) A set of SOP for mapping using Landsat has been developed and all interpreters trained during a training in July, 2016, led by Winrock International on the use of the SOPS, and ii) Remote sensing analysis will be verified using ground truthing along with high resolution imagery such as Google Earth based on a robust verification plan for accuracy assessment.
Identification of sources of uncertainty for this parameter	Key uncertainties include error in remote sensing classification due to haze, cloud cover, stripping from a Landsat 7 satellite malfunction, differences in seasonal greenness, and reflectance differences between Landsat images
Process for managing and reducing uncertainty associated with this parameter	Remote sensing classification and accuracy assessment will be improved using new technologies that arise that allow for enhanced removal of atmospheric interference and improved classification schemes. Efforts will be made however, to maintain consistency with reference level maps, or update reference level maps using newer technology.
Any comment: **Roles and responsibilities**	RMSC will be responsible for image acquisition and processing of images for activity data. FSD and RMSC will be responsible for collection of training data sets. CERSGIS and the MRV Subworking group will be responsible for QA/QC

DEGRADATION FROM LEGAL TIMBER HARVEST

Estimated emissions from degradation for legal timber harvest for the monitoring period will be based on the emission factors developed for the reference level and yearly reporting of extracted timber volumes. Emission factors will remain constant until such a time that new field data are gathered during the programme's lifetime or it is demonstrated that logging practices in-country are significantly altered (reassessment prior to reference level renewal). Annex 9 offers specific suggested Standard Operating Procedures (SOPs) for the gathering of data to support the development of country-specific emission factors. The current emission factors were developed with Ghana country-specific data based on field work conducted in May 2016 by Ghana Forestry Commission Staff and Winrock International, but additional data would further strengthen emission factors.

Table 38: Degradation from legal timber harvest MMR approach for estimating emissions

Parameter:	Volume of logs extracted annually
Description:	These data are summed annually across administrative units to calculate total volumes for the GCFRP Accounting Area.
Data unit:	m^3
Source of data or measurement/calculation methods and procedures to be applied (e.g. field measurements, remote sensing data, national data, official statistics, IPCC Guidelines, commercial and scientific literature), including the spatial level of the data (local, regional, national, international) and if and how the data or methods will be approved during the Term of the ERPA	These data present the total volume of logs extracted annually by species and by administrative unit (region and locality) based on the Tree Information Forms (TIFs). These are derived from diameter measurements at both ends of the bole in cm as well as the length of the bole in meters. The parameters measured are then used to estimate the volume using Smalian's formula
Frequency of monitoring/recording:	Yearly
Monitoring equipment:	Field measurements
Quality Assurance/Quality Control procedures to be applied:	SOPs for field measurement and data analyses
Identification of sources of uncertainty for this parameter	This is a forest concession census of actual timber volume extracted, so very small uncertainty is assumed—most likely as measurement error of the logs (diameters, lengths and number of logs). Standard operating procedure used for these measurements should minimize this, however.
Process for managing and reducing uncertainty associated with this parameter	Further training, closer supervision, increased field staff
Any comment:	

DEGRADATION BY ILLEGAL LOGGING

Country-specific emission factors have been estimated for illegal timber harvesting for Ghana as explained in the reference level section and will remain constant throughout the monitoring period unless a significant change in illegal logging practices is observed and/or updated biomass inventories are conducted. The Emission Factors were developed with data collected in May 2016 by Ghana Forestry Commission Staff and Winrock International following the SOPs offered in Annex 9.

Concerning activity data, district rangers currently report timber harvest from intercepted illegal logging, which can serve as a framework to monitor volume extracted from illegal logging during the monitoring period. However, it is generally accepted that the data currently reported underrepresents the true scope of illegal logging practices. A more robust methodology as used by the Hansen study will be adopted for illegal timber harvest estimates

Table 39: Degradation from illegal timber harvest MMR approach for estimating emissions

Parameter:	Volume of logs extracted annually
Description:	These data are summed annually across administrative units to calculate total volumes for the GCFRP Accounting Area.
Data unit:	m^3
Source of data or measurement/calculation methods and procedures to be applied (e.g. field measurements, remote sensing data, national data, official statistics, IPCC Guidelines, commercial and scientific literature), including the spatial level of the data (local, regional, national, international) and if and how the data or methods will be approved during the Term of the ERPA	RMSC will work with FORIG, forest rangers and employees of the timber market to conduct around-the-clock market monitoring of wood-transporting vehicles over a two-week period during the dry season (peak season) and during a two-week period in the rainy season (low season). Rangers will be placed at strategic positions within the markets or at entry gates and record for each vehicle entering the markets: (i) the date; (ii) time; (iii) type of vehicle, and (iv) supply source, i.e. chainsaw processed or sawmill processed lumber, respectively. Further detail of the methodology can be found in the Hansen et al. 2012 paper.
Frequency of monitoring/recording:	Yearly
Monitoring equipment:	Field measurements
Quality Assurance/Quality Control procedures to be applied:	Following SOPs developed by the Forestry Commission
Identification of sources of uncertainty for this parameter	Assumed high levels of uncertainty because the data collected does not currently represent the full scope of illegal activity.
Process for managing and reducing uncertainty associated with this parameter	Consistent training of field crews and field data collection and recording QA/QC measures. Incentivizing district rangers to track and report all illegal activity.

DEGRADATION BY WOODFUEL COLLECTION

For the historical reference period, emissions from forest degradation as a result of woodfuel harvest were estimated using the WISDOM approach. Estimates of nonrenewable biomass for the year 2009 were produced by modeling demand and supply dynamics. The estimates were produced as part of a pantropical study (Bailis *et al.* 2015)[90] and thus stepwise improvements can be realized through country-specific data collection and re-modeling of supply and demand dynamics to better reflect unsustainable woodfuel collection practices in Ghana. Monitoring that could be done includes: surveys of household and industrial woodfuel use to determine volume of wood being burned annually, surveys of number of households/families using woodfuel, surveys of any change in woodfuel stoves by rate of adoption and type e.g., surveys of amount of woodfuel being supplied through deforested areas and

[90] Bailis et al. (2015). The carbon footprint of traditional woodfuels. Nature Climate Change 5, 266-272.

non-forest areas such as agricultural lands, plantations, and agroforestry, and/or field inventories to determine growth rates of natural forests.

It is recommended that in-country capacity is built on the application of the WISDOM model for estimating emissions from woodfuel use. Not only will this be necessary to measure the impact of interventions in the ER-Programme area for this activity, but will likely be especially important if the emissions reduction programme is to expand beyond the GCFRP Accounting Area where emissions from forest degradation as a result of woodfuel harvesting is more significant. Ghana's REDD+ strategy articulates the improvement and sustainability of woodfuel harvest and use in the 'transition' and savannah zones as a key option in reducing national emissions from deforestation and degradation, so the ability to produce reliable estimates of the impacts of this activity will be essential in monitoring and measuring the impact of measures that do so.

Table 40: Degradation from woodfuel Supply harvest MMR approach for estimating emissions

Parameter:	Woodfuel supply
Description:	Biomass available for woodfuel harvest
Data unit:	Volume (m^3) or mass (kg) of wood
Source of data or measurement/calculation methods and procedures to be applied (e.g. field measurements, remote sensing data, national data, official statistics, IPCC Guidelines, commercial and scientific literature), including the spatial level of the data (local, regional, national, international) and if and how the data or methods will be approved during the Term of the ERPA	Woodfuel supply is a measure of both the existing biomass in woodsheds as well as their productivity. Productivity is an important consideration as it accounts for the ability of biomass stocks to regenerate once harvested for woodfuel use). The following sources can contribute to the estimation of woodfuel supply: • Biomass Stocks • Forest inventories and plot data • Productivity (mean annual increment) • Published literature • Field studies
Frequency of monitoring/recording:	Depending on resources and national circumstances, every 2-5 years
Monitoring equipment:	N/A
Quality Assurance/Quality Control procedures to be applied:	Consultation with WISDOM modeling experts
Identification of sources of uncertainty for this parameter	Uncertainty in biomass stocks and stock accumulation in woodfuel sourcing forests.
Process for managing and reducing uncertainty associated with this parameter	Increased field data collection. Consistent training of field crews and field data collection and recording QA/QC measures.
Any comment:	

Table 41: Degradation from woodfuel demand harvest MMR approach for estimating emissions

Parameter:	Woodfuel demand
Description:	How much woodfuel populations use
Data unit:	Volume (m^3) or mass (kg) of wood

Source of data or measurement/calculation methods and procedures to be applied (e.g. field measurements, remote sensing data, national data, official statistics, IPCC Guidelines, commercial and scientific literature), including the spatial level of the data (local, regional, national, international) and if and how the data or methods will be approved during the Term of the ERPA	Woodfuel demand is largely a function of population and population density, infrastructure, household energy supply needs, and access to woodsheds.As such, the following sources of data can support the estimation of woodfuel demand: • Population census • Spatial data on infrastructure (e.g., roads, gas pipelines) • Topography • Surveys of household energy needs and use
Frequency of monitoring/recording:	Depending on resources and national circumstances, every 2-5 years
Monitoring equipment:	N/A
Quality Assurance/Quality Control procedures to be applied:	Consultation with WISDOM modeling experts
Identification of sources of uncertainty for this parameter	Measurement error, inconsistencies or errors in survey execution
Process for managing and reducing uncertainty associated with this parameter	Consistent training of field crews and field data collection and recording QA/QC measures.
Any comment:	

DEGRADATION BY FIRE

Measurement of fire will continue on an annual basis as the MODIS burned area product is released allowing for updated activity data. Emission factors will remain constant until carbon stocks are updated by new inventories during the programme's lifetime (expected prior to reference level renewal). For each biannual monitoring and reporting event, annual averages of burned area and emissions will be calculated from the annual monitoring data.

Table 42: Degradation from fire MMR approach for estimating emissions

Parameter:	Area burned
Description:	Area burned by forest fires
Data unit:	Ha
Source of data or measurement/calculation methods and procedures to be applied (e.g. field measurements, remote sensing data, national data, official statistics, IPCC Guidelines, commercial and scientific literature), including the spatial level of the data (local, regional, national, international) and if and how the data or methods will be approved during the Term of the ERPA	MODIS burned area product
Frequency of monitoring/recording:	Annual
Monitoring equipment:	GIS software
Quality Assurance/Quality Control	None; global dataset

procedures to be applied:	
Identification of sources of uncertainty for this parameter	Error in remote sensing Uncertainty in carbon stock estimates (as for deforestation)
Process for managing and reducing uncertainty associated with this parameter	None
Any comment:	

CARBON STOCK ENHANCEMENTS

For the historical reference period, removals from NFPDP activities were estimated by combining annual records of forest planting with removal factors derived either from published literature or from IPCC defaults reflecting the carbon content of forest plantations in Africa. Removals are accounted for on an annual basis, and accumulate over the historical reference period, and discounted to account for plantation failure by applying a success factor, derived from official records. During the MRV period,. However, it is important that failure rates are collected more systematically to more accurately reflect AD during the MRV period.

During the MRV period, removal factors will be consistent with those applied in the development of the reference level where they represent annual removals for forest plantations (reflecting carbon stocks across multiple harvest cycles, under the assumption that forest plantations in Ghana will undergo rotational harvest).

Measurement

While current data collected by the NFPDP through annual censuses will continue to serve as a key source of data for measuring and monitoring enhancement activities *under* the MRV programme, it will be necessary tointegrate additional data to allow for plantations to be spatially mapped to allow for monitoring of plantation performance throughout the MRV period.

Key data collected by the NFPDP censuses must include:

- Spatially delineated planted area to facilitate measurement and monitoring of planted areas.
- Annual data collection on species planted per forest reserve (these data appear to be available in NFPDP records for 2013, but were not available prior to or after that year).
- Annual data collection on verified area planted (ha)(these data appear to be available in NFPDP records from 2010 through 2013, but were not available prior to or after that year).
- Annual data on survival percentage of planted trees(these data appear to be available in NFPDP records for 2013, but were not available prior to or after that year).

For most years, historical data were not available on species planted per forest reserve, so for the development of the RL, it was assumed 70% of species planted were teak, and 30% non-teak. Under the MRV programme, activity data will be divided by species (teak and non-teak) to apply the appropriate removal factor to generate more accurate estimates of removals that reflect the planted species composition. This may be especially important if removals are to be accounted for nationally where the 70/30% species composition is not true for other parts of the country.

Monitoring and Reporting

Failure rates: While data on survival percentage of planted trees are collected in annual surveys of area planted under the NFPDP, reported survival rates reflect only that of the first year after planting. As such, it will be necessary to monitor the performance of plantations established under the NFPDP throughout the entire period of performance to ensure the accurate reporting of removals.

Monitoring performance will be achieved through the creation of a spatial database of area planted under NFPDP starting in 2017. For monitoring the performance of planted areas, a number of the plantations established in each year of the period of performance could be randomly selected and assessed systematically by trained spatial analysts applying high-resolution spatial imagery (e.g., Google Earth) to generate estimates of survival. This approach would represent a more cost-effective option for monitoring (as opposed to site visits) and would allow for a greater set of sites to be assessed. Based on the total number of sites planted in each forest reserve in the GCFRP Accounting Area, for every year in the reporting period, either 100 sites or 5% of the total area planted (whichever represents a lower number of sites) will be randomly selected for assessment of plantation survival. Trained spatial analysts would assess the performance of the area planted at each of those sites, according to standardized guidelines and thresholds to objectively determine the performance of the planted sites. Under this approach, it will be necessary to ensure Google Earth imagery represent the appropriate timeframe under investigation.

At reporting intervals, activity data will then be adjusted by the average percentage of plantation area that failed, taking into account both ground survey/verification data as well as the Google Earth analyses.

Table 43: CSE Plantation MMR approach for estimating emissions

Parameter:	Area planted under the NFPDP
Description:	Verified area of trees planted under the NFPDP
Data unit:	Area planted (ha)
Source of data or measurement/calculation methods and procedures to be applied (e.g. field measurements, remote sensing data, national data, official statistics, IPCC Guidelines, commercial and scientific literature), including the spatial level of the data (local, regional, national, international) and if and how the data or methods will be approved during the Term of the ERPA	The NFPDP documents annual area planted per forest reserve through national censuses. These censuses verify the area planted by the private developers who have received licenses to engage in plantation establishment in on-forest reserves. These censuses also include data on species planted per reserve and estimate the survival percentage of planted species. Under the MRV programme, it is recommended that these censuses also integrate spatial data on the areas planted within forest reserves. This will allow for the development of a spatial database that will allow for improved mapping and monitoring of planted area during the ER programme.
Frequency of monitoring/recording:	Annual
Monitoring equipment:	GPS units
Quality Assurance/Quality Control procedures to be applied:	Spot-checking. 5% of forest reserves should be re-visited during annual census taking by an independent team to ensure censuses are carried out consistently and accurately.
Identification of sources of uncertainty for this parameter	Survey error
Process for managing and reducing uncertainty associated with this parameter	Survey error

Any comment:	

Table 44: CSE Teak MMR approach for estimating emissions

Parameter:	Removal factor for teak plantations
Description:	Calculated removal factor for carbon stock enhancement through plantation of teak in forest reserves (AGB and BGB). Represents long-term stocks of teak plantations in Ghana.
Data unit:	t CO_2 ha^{-1} yr^{-1}
Source of data or measurement/calculation methods and procedures to be applied (e.g. field measurements, remote sensing data, national data, official statistics, IPCC Guidelines, commercial and scientific literature), including the spatial level of the data (local, regional, national, international) and if and how the data or methods will be approved during the Term of the ERPA	Published literature (Adu-Bredu S., et al. 2008[91]) on total tree carbon stocks in teak stands in Moist Evergreen forest in Ghana (98 Mg C/ ha) (included both aboveground and belowground carbon stocks). 98 Mg C/ ha = 358 t CO_2/ha Annual removals: 358 t CO_2ha^{-1} / 25 yr =14 t CO_2ha^{-1} yr^{-1}
Frequency of monitoring/recording:	Annual
Monitoring equipment:	N/A
Quality Assurance/Quality Control procedures to be applied:	
Identification of sources of uncertainty for this parameter	Key uncertainties in the development of removal factors include sampling error and allometric errors.
Process for managing and reducing uncertainty associated with this parameter	N/A
Any comment:	

Table 45: CSE Non-teak MMR approach for estimating emissions

Parameter:	Removal factor for other broadleaf species planted in NFPDP plantations
Description:	Calculated removal factor for carbon stock enhancement through plantation of broadleaf tree species in forest reserves (AGB and BGB). Represents long-term stocks of broadleaf tree species plantations in Ghana.
Data unit:	t CO_2ha^{-1} yr^{-1}
Source of data or measurement/calculation methods and procedures to be applied (e.g. field	IPCC AFOLU Vol. 4 table 4.8 above-ground biomass in forest plantations. Values for 'Africa broadleaf >20 years' for three ecological zones in the GCFRP Accounting Area (tropical rain forest, tropical moist deciduous forest, and tropical dry forest) were

[91]Adu-Bredu S., et al. (2008). Carbon Stock under Four Land-Use Systems in Three Varied Ecological Zones in Ghana. Proceedings of the Open Science Conference on Africa and Carbon Cycle: the CarboAfrica project, Accra, Ghana, 25-27 November 2008. Available at http://www.fao.org/3/a-I2240.pdf

measurements, remote sensing data, national data, official statistics, IPCC Guidelines, commercial and scientific literature), including the spatial level of the data (local, regional, national, international) and if and how the data or methods will be approved during the Term of the ERPA	averaged, and converted to carbon (81 t C/ha) using a carbon to biomass ratio of 0.47. The belowground biomass value was generated by applying a root-to-shoot ratio of 0.24 for tropical/subtropical moist forest/plantations >125 Mg ha-1 (Mokany et al.2006)[92]. This rendered a total stock of 101 t C/ha. 101 Mg C ha^{-1}= 370 t $CO_2 ha^{-1}$ Annual removals: 370 t $CO_2 ha^{-1}$ / 40 yr = 9 t $CO_2 ha^{-1}$ yr^{-1}
Frequency of monitoring/recording:	Annual
Monitoring equipment:	N/A
Quality Assurance/Quality Control procedures to be applied:	
Identification of sources of uncertainty for this parameter	Key uncertainties in the development of removal factors include sampling error and allometric errors.
Process for managing and reducing uncertainty associated with this parameter	N/A
Any comment:	

9.2 Organizational structure for measurement, monitoring and reporting

The country's REDD+ programme supports a multi-sector approach and is fostering collaboration from multiple institutions across sectors[93]. Ghana's REDD+ strategy[94], outlines "a governance structure that is horizontally and vertically integrated to include multiple government institutions as well as private sector, civil society, traditional authority, and community representatives; occurring at both national and sub-national levels".

For Ghana's measuring, monitoring and reporting system, the following institutions will be directly involved[95]:

- The Forestry Commission's Climate Change Unit (CCU) / NRS
- Ghana Cocoa Board
- The Forestry Commission's Resource Management Support Center (RMSC)
- The Forestry Commission's Forest Services Division (FSD)

[92] Mokany K, Raison R.J, Prokushkin A.S 2006 Critical analysis of root : shoot ratios in terrestrial biomes. Global Change Biol. 12, 84–96. doi:10.1111/j.1365-2486.2005.001043.x.
[93] Ghana's draft study document envisions "*a governance structure that is horizontally and vertically integrated to include multiple government institutions and integrated bodies comprised of government, private sector, civil society, traditionalauthority, and community representatives; occurring at both national and sub-national levels. It is also focused on the development of new structures and mechanisms, like the MMRV system and an Information Systems, to meet performance based reporting requirements on emissions and safeguards" amongst others.*
[94] Ghana National REDD+ Strategy, 2015.
[95] GoG, 2015. Development of Reference Emissions Levels and Measurement, Reporting and Verification System in Ghana, Indufor Oy. 2015. FC/FCPF/MRV/REL/RFP/01/2013 Final Report.

- ICT Department of the Forestry Commission
- The Energy Commission
- The Environmental Protection Agency (EPA)
- Private Sector, NGOs and Research Institutions
- HIA Consortium/ Governance Body
- Academia

Many of these institutions have clear mandates that will effectively allow them to undertake their specified roles during MMR of programme performance. The specialized departments and units of the Forestry Commission including RMSC, FSD, ICT and the NRS will play significant roles in the collection, analysis and storage of data during the MMR phase. These tasks form an integral component of their expected operational activities. The Forestry Commission and its parent ministry, Ministry of Lands and Natural Resources will also ensure that dedicated funds are set aside to support all the activities envisaged under the MMR and the procurement of relevant software and hardware.

Additionally, the NRS has entered into MOUs with the Environmental Protection Agency (EPA) as well as the Centre of Remote Sensing and Geographic Information System (CERSGIS) for information exchange and technical assistance on forest monitoring and national greenhouse gas inventory processes.

In order to ensure that the institutional architecture is formalized prior to the completion of Ghana's first monitoring cycle by the end of 2018; the NRS intends to conclude MOUs with all the key MMR agencies by the first quarter of 2018. The key objective is to ensure that all relevant institutions fully acknowledge their assigned roles and have adequate capacity to implement.

In formalizing the MMR institutional framework, adequate attention will also be invested towards strengthening the capacity of the identified institutions through targeted training programmes and procurement of required hardware and software. The NRS will identify experts that will serve as resource persons for the training programme.

The rest of this section describes institutional roles and responsibilities and outlines the MMR timeline.

National REDD+ Secretariat

The NRS in collaboration with the PMU is responsible for the overall coordination of the programme's MRV system. All data collected from the institutions listed above will be submitted to the NRS who will house the master MRV Tool.[96], which will be integrated into the programme's overall data management system. NRS will ensure quality assurance and quality control of the data collected and will also have responsibility for uploading data to the REDD+ Information Database.

As the focal point for REDD+ in Ghana, the NRS will have responsibility for Ghana's reporting obligations on the implementation of the MRV system to the Carbon Fund of the World Bank as well as provide requisite information to the Environmental Protection Agency to support Ghana's communication to the UNFCCC.

[96] Ghana's MRV Tool is a user friendly Excel based tool with country specific emission factors for each activity reported in the ER-PD. The tool will be updated on a yearly basis by the CCU with data reported to it by the relevant institutions as described in the 'Organizational structure for measurement, monitoring and reporting' section.

The NRS may engage the services of an academic institution e.g. KNUST for uncertainty assessment during the monitoring period.

Environmental Protection Agency

The EPA houses the National Climate Change Data Hub, as described under Section 18. The NRS will submit GHG emission estimates from the forestry sector to the EPA for national reporting to the UNFCCC. The EPA reports to the Ministry of Environment, Science, Technology and Innovation.

Resource Management Support Center

RMSC will play an overarching role in data collection and design for all forest related parameters in close collaboration with district and regional offices of the Forest Services Division (FSD). All raw data will be handled, stored and backed up by RMSC.

The specific responsibilities of RMSC during the Measurement, Monitoring and Reporting (MMR) phase of the programme include the following:

- Acquisition of Remote Sensing data and generation of spatial activity data (SOP included in Annex 9): This activity will include procurement of the requisite imagery, pre-processing, classification, change detection and accuracy assessment. These processes will facilitate the generation of activity data for assessment of deforestation trends and their associated emissions. RMSC will work closely with the Forest Services Division for the collection of field data for training and accuracy assessment of the classification. In addition, RMSC will utilize the General Automated Remote Sensing Classification Tool for generation of maps for distinguishing agricultural tree crops from forests.

- Possible refinement of emission factors for deforestation: Post and pre-deforestation carbon stocks for the different forest types and strata utilized in estimating historical emissions from deforestation during the reference period were mainly derived from results of the forest biomass mapping and inventory process completed under the Forest Preservation Programme (FPP). It is envisaged that these carbon stock estimates will be utilized during the early period in the monitoring phase (i.e. during the term of the ER-PA). However, should a strong justifiable reason emerge for revision of the carbon stocks, RMSC will play a leading role in collecting data from Sample plots for generating revised carbon stock estimates.

- Data on timber volumes extracted for degradation measurement: RMSC periodically collates timber volumes legally harvested from each forest district in Ghana. During the monitoring period, RMSC will be responsible for providing annual data on timber volumes extracted per species and per ecological zone. This data will serve as the activity data for determining emissions from degradation by legal logging.

- Possible refinement of emission factors for degradation: Nationally specific factors for ELE, LDF and LIF were developed for Ghana for the reference level estimation. If harvesting practices are significantly altered, RMSC will collaborate with the NRS for re-estimation of the EF parameters.

- QA/ QC: RMSC will undertake QA/ QC on data collected by FORIG (illegal logging data) and Energy Commission (woodfuel data)

- Estimation of degradation by Fire: RMSC will acquire and process MODIS data for generation of emissions from degradation by fire.
- Spatial data on carbon stock enhancement (CSE) in on-reserve areas: RMSC will provide spatial data on plantation establishment in forest reserves for CSE monitoring.

Forest Services Division (FSD)
FSD's Plantations Department will track the activity data needed for emission removals from enhancement activities. The department, along with RMSC's plantation department, has developed Excel-based tools to track data outlined in the enhancement section above. Again, this data will be shared with the Climate Unit for direct input into the MRV Tool.

Data on legal timber extracted is collected through the Tree Information Forms (TIFs), which record estimate of the bole volume (m^3) of timber trees extracted from both on and off-reserve areas. The records are captured and submitted by FSD's District Offices on a quarterly basis and serve as the basis for activity data for legal timber harvest. The regional offices will coordinate the raw data collection including QA/QC, data compilation and submission to RMSC. These data will be collated in excel format and submitted to the CCU on an annual basis for entry into the MRV tool.FSD will also support RMSC for the collection of data for training and accuracy assessment of the classification of land use/ cover maps.

Energy Commission
The Energy Commission collects data that provides estimates on woodfuel sources and consumption that will be collated and can be shared with the NRS to update data for the MRV.

ICT Department of the Forestry Commission
The ICT Department will provide a supporting role in storing all data, providing backups of data and advising on the procurement of any ICT software and equipment.

Research & Academia
Research organizations such as FORIG, CERSGIS and relevant departments from the universities (e.g. Maths Department of the Kwame Nkrumah University of Science and Technology) will provide support on monitoring, measurement and reporting, as needed. More specifically:

- CERSGIS will undertake QA/ QC on the development of land use/ cover maps for deforestation change detection as well as analysis of MODIS data carried out by RMSC to generate estimates of emissions from degradation by fire.
- FORIG will be responsible for collecting data on illegally harvested timber supplied to the timber market which will be utilized for the generation of activity data for degradation by illegal logging. FORIG will also support CERSGIS to undertake QA/ QC on the generation of emission estimates from degradation by fire using MODIS.
- The Maths Department will perform the uncertainty assessments of the different activities (deforestation, degradation and CSE).

Private Sector
The private sector particularly those involved in the cocoa value chain and leading HIA Consortiums will be a good source of data from their programmematic interventions. These data may include spatial/

ground data on enhancement activities being undertaken in cocoa plantations, mapping of cocoa farms, and data on illegal activities.

NGOs

NGOs will play an essential role in the MMR process by sharing any valuable data from their engagement in HIA Consortiums and implementation of programme activities with the NRS. They can also provide support in the dissemination of results from the measurement and monitoring to key local stakeholders including the Governance Bodies leading the HIA landscapes and associated communities.

The MRV sub-working group

The multi-stakeholder MRV sub-working group (one of the thematic REDD+ technical working groups) will support the NRS to undertake assessment of outputs received from the various institutions whilst supporting efforts towards information sharing with relevant agencies. Additionally, the sub-working group will support CERSGIS to undertake QA/ QC of the development of landuse/ landcover maps and associated change detection approaches.

Annex 12 provides further detail on capacity building activities undertaken and planned to ensure that the institutions referred to above receive the necessary support.

Table 46: Institutions involved in Ghana MMR and their specific roles and responsibilities

MMR Institutions	Main Roles and Responsibilities
Ministry of Lands and Natural Resources (MLNR)	The sector ministry to which the Forestry Commission reports. Responsible for Ghana's Forest Investment Programme(FIP) and will serve as the programme'sCoordination and Management Committee to ensure integration with FIP projects and related activities.The MLNR will also provide financial support for operationalizing the MRV
Forestry Commission (FC)	Allocate funding to support monitoring activities
Districts and Regions of the Forest Services Division FSD, of the FC)	Provide data on on-reserve CSE activities and legal timber harvest to RMSC; Support RMSC to collect field data for classification and accuracy assessment.
National REDD+ Secretariat	Overall coordination of the MMR processes - Reports to the Carbon Fund - Reports to the EPA
Resource Management Support Centre (RMSC, of the FC)	Technical lead for collection of field data and analysis of spatial data to generate emissions estimates
Forestry Research Institute of Ghana (FORIG)	Support with collection of data on illegally harvested timber; Develop/ refine allometric equations for carbon stocks estimation in various strata/ forest types.
Soil Research Institute (SRI)	Estimation of forest carbon
Center for Remote Sensing & Geographic Information Services (CERSGIS), University of Ghana	QA/ QC of maps
Environmental Protection Agency (EPA, under MESTI)	The National Focal Point for Climate Change and is responsible for the National Communications to the UNFCCC
Ghana Energy Commission (under MOE)	Collection of woodfuel data
Ghana Cocoa Board (COCOBOD)	Provide relevant data on CSE activities being undertaken in cocoa farms
HIA Consortium/ Governance Board	The HIA Consortium and Governance Board will constitute the

	implementing partners and governance body respectively for the GCFRP. These bodies will play a key role in facilitating the work of relevant institutions involved in the collection of data at the decentralized levels of the programme area i.e. district and community levels.

Figure 19 below, outlines the overall structure of the MRV mechanisms for Ghana, and Table 46 describes institutional roles.[97]Table 47 provides a detailed outline of the MMR timelines.

[97] Figure updated from Indufor Oy. 2015. Development of Reference Emissions Levels and Measurement, Reporting and Verification System in Ghana FC/FCPF/MRV/REL/RFP/01/2013 Final Report.

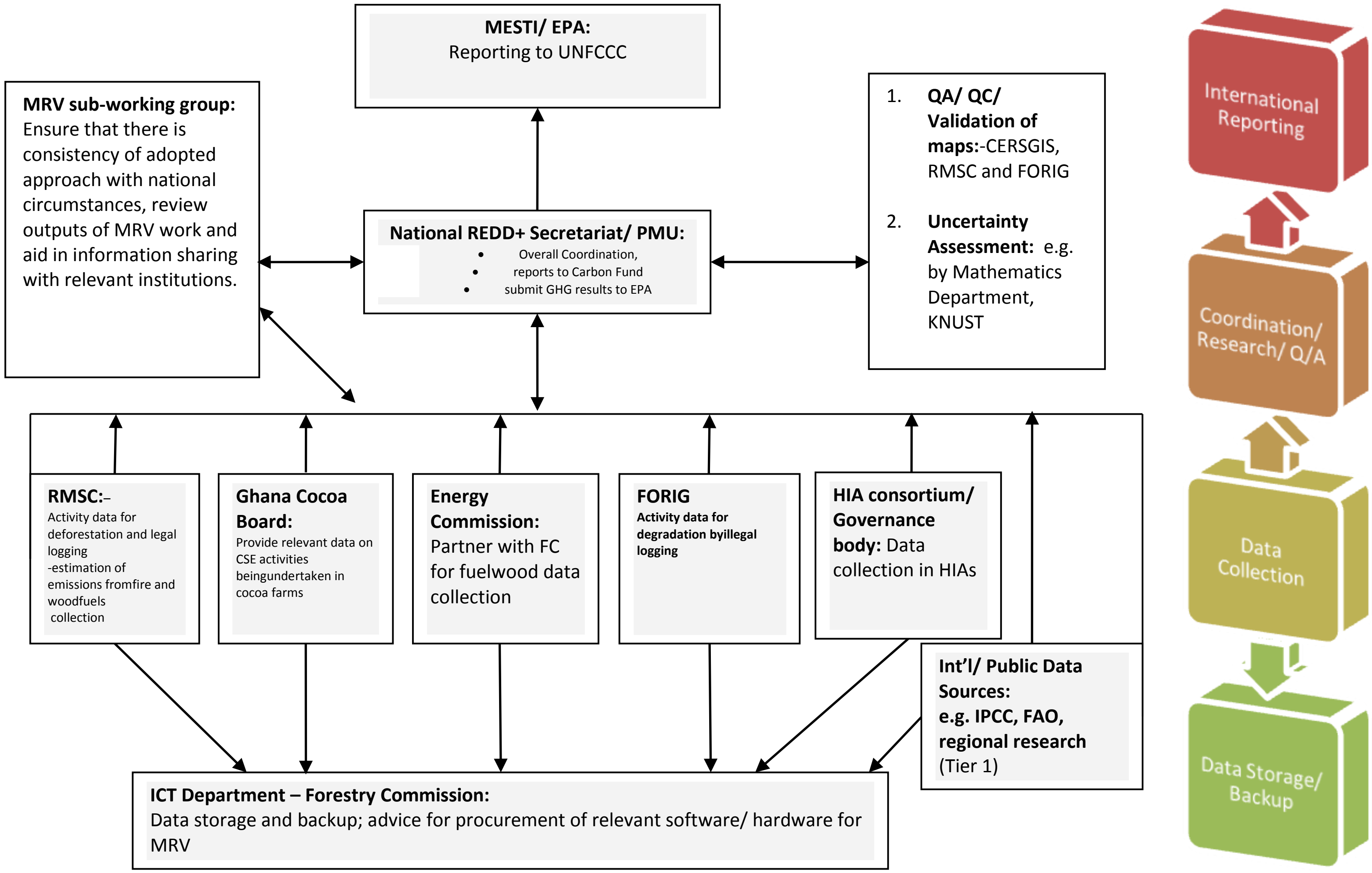

Figure 19: Overall institutional structure of Ghana's MRV mechanism.

Table 47: NRS MMR Timeline

ACTIVITIES	Monitoring period											
	First quarter			Second quarter			Third quarter			Fourth quarter		
General activities												
Finalize/ update MOUs with key institutions	■	■	■									
Procure hardware/software and renew licenses	■	■										
Capacity building				■								
Deforestation												
Satellite image acquisition			■									
Collection of training data set for classification			■	■								
Image processing and classification				■	■	■						
Estimations of activity data and emission factors								■	■			
QA/QC			■	■	■	■	■	■	■			
Degradation												
Acquisition of MODIS data for fire analysis			■	■								
Application of WISDOM Model for woodfuel			■	■								
Compiling of legal timber harvest volumes from districts		■	■									
Data collection, processing and analysis of illegal timber harvest		■	■					■	■			
QA/QC		■	■	■	■	■	■	■	■			
Carbon Stock Enhancement												
Data collection of area planted and survival rates									■	■		
Analysis of CSE											■	
QA/QC									■	■	■	
Reporting												
Review and validation of results by MRV sub-working group											■	
Submission of results to Carbon Fund												■
Submission of results to EPA												■

9.3 Relation and consistency with the National Forest Monitoring System

Under the Forestry Commission, the data necessary to estimate emission and removals from enhancements, deforestation and degradation from timber harvest (legal and illegal) as well as fire are collected at the national level and are continuously being improved on a step-wise basis.

These data serve as the basis of Ghana's National Forest Monitoring System (NFMS), which is consistent with IPCC guidelines for forest monitoring, and were used to estimate the reference level for the ER-Programme. These methods will be followed in data collection for the measurement and reporting of Ghana's emissions as well. The ER-programme is consistent with the NFMS with the exception of woodfuel.

Currently data on woodfuel are collected by the Energy Commission and these data will serve as the data used in the MRV period, which will be included in the NFMS. However, to estimate emissions for the Reference Level, the data was based on the WISDOM model as explained in the reference level section. For future monitoring of woodfuel emissions, Ghana will explore the adaptability of WISDOM into their NFMS (see Annex 10 for Stepwise Improvements to data collection for woodfuel emissions estimates).

10. DISPLACEMENT

10.1 Identification of the risk of Displacement

The programme's displacement risk is judged to be low to medium (Table 48). The logic of designing a programme that aligns with the ecological boundaries of key commodities and drivers was an intentional effort to minimize the likelihood of the displacement of activities and emission leakages.

Table 48: Displacement risks associated with different drivers of deforestation

Driver of deforestation or degradation	Risk of Displacement. (Categorize as High, Medium or Low)	Explanation / justification of risk assessment
Cocoa farming	Low	Agents are not migrating out of the activity area to plant cocoa in other localities due to ecological limitations of cocoa trees, which do not do well outside the programme's boundaries. The threat from a changing climate and its impacts on cocoa production outside the recommended growing areas further reduces the likelihood of displacement. In addition, given that cocoa farmers and farming communities will be directly engaged in the programme interventions and receiving associated benefits, there should be little incentive to move outside the programme.
Subsistence agriculture	Low	Most food crops grown in the programme area are also constrained by the same ecological limits (e.g. plantain, cassava, cocoa yam) as cocoa trees. The food crops are also inter-cropped with cocoa or grown on adjacent lands by the same cocoa farmers, reflecting a diversified farming system that is not easily displaced outside the landscape. These same farmers will also be receiving benefits from the programme. Therefore, the food crop "agents" are not likely to be migrating out of the activity area.
Illegal logging	Medium	The programme holds the majority of the timber resources being logged illegally for building and construction purposes. Sources of timber outside of the programme's ecological boundaries are less abundant. The illegal logging that has dominated in the north is particularly focused on rosewood, which is sought by Asian markets, but the north of the country is not a significant source of the illegal supply of domestic timber. A significant increase in monitoring by stakeholders at the scale of HIAs and through rapid response to other hotspots will reduce the incidence and opportunity. The FC's focus on scaling up plantation development with the private sector will be able to serve as the main source of the domestic supply, reducing the demand from illegal sources. Through the development of jobs from the plantation industry and the Cocoa Board's focus on Youth in Cocoa, the agents (chainsaw operators) will also have new livelihood opportunities.
Illegal small-scale mining	Medium	Ghana's gold belt is not equally present across the entire country. The dominant gold vein is situated within the programme area, crossing down from centre of the landscape to the southwest, though it is recognized that gold deposits are located outside the programme area

		is some places. In addition, the land owners are not migratory, only some of the agents. Increased income from climate-smart agriculture and other benefits are expected to help mitigate the opportunity cost of abandoning illegal mining for local agents. Finally, the decreasing price of gold is expected to reduce the demand more generally.

10.2 ER Programme design features to prevent and minimize potential Displacement

As stated above, the logic of designing a programme that aligns with the ecological boundaries of key commodities and drivers was an intentional effort to minimize the likelihood of displacement of the main drivers and associated emission leakages. Therefore, the programme does not expect to cause any significant displacement (leakage) outside of its boundaries, as the programme interventions are directly focused to address two of the main drivers and agents of deforestation and degradation in the region (cocoa/subsistence farming and unsustainable logging), providing them with permanent climate-smart agriculture options. Furthermore, the programme drivers and agents are not relevant outside of the programme area, with the exception of illegal mining. For example, the ecological limits of the HFZ and that of the agricultural products grown in the programme area, including cocoa, conform to the programme's ecological boundaries. Thus, expansion of cocoa, food crops, or other tree crops outside the programme area is highly unlikely, especially with the increasing threat from climate change. Therefore, the selection of the programme's boundaries along the ecological zone represents a key leakage avoidance strategy.

Despite the low risk, the potential displacement of deforestation and degradation will be monitored annually across the programme area and its surroundings. If displacements are identified and attributed to the programme, they can be deducted/compensated with reductions in future ERs, generated by the programme.

Displacement monitoring will include ongoing assessments within and outside the programme boundaries of:

- Cocoa plantation establishment
- Legal and illegal timber volumes
- Deforestation associated with mining

Displacement of cocoa leading to deforestation outside programme boundary:
Displacement through cocoa plantation establishment outside the accounting zone and within forests is a highly unlikely possibility as the programme has been designed to cover the majority of the cocoa growing area of Ghana, and thus planting cocoa outside the programme area would be to plant in a place where production is ecologically unsuitable. The Volta Region is the only possible area where this could theoretically happen, but is also unlikely given that it is the lowest production region in the country and migrations to VR for cocoa cultivation are very low due to cultural / ethnic differences and challenges in accessing land. Nonetheless, Cocoa Board and key private sector partners and Forestry Commission staff will monitor for such displacement on the ground, and the NFMS will be able to pick up deforestation driven by cocoa and other drivers outside the accounting area.

Displacement of legal and illegal logging outside GCFRP area:

Legal and illegal timber volumes will be monitored outside the accounting area through the NFMS and the FC check points that control and monitor the supply and transportation of timber across the country. Data acquired from the offices of the forest services division will provide guidance on timber felling outside the accounting areas to monitor whether legal timber felling has increased in such areas as REDD+ implementation has limited the felling within the accounting area.

Displacement of mining outside the GCFR area:
The NFMS will be able to identify deforestation driven by mining outside the programme area during the national monitoring activities, and as new ER programmes are implemented. Increased engagement with the Minerals Commission will also enable monitoring of illegal mining that may have been displaced by the programme area.

As implementation progresses, there will be other programmes within other ecological zones where monitoring will also prevent leakage of drivers from the GCFRP accounting area into such ecological zones

The risk of international displacement of emissions (leakage) is not considered to be a problem for this programme given that Ghana does not have jurisdiction over other sovereign states. More practically, however, the boundaries between Ghana and Côte d'Ivoire (the only likely border for international leakage) are monitored closely, making it difficult for people to migrate seamlessly or to transfer products like timber or cocoa beans. Moreover, the factors driving deforestation in Ghana, including agricultural expansion, could not shift onto Ivoirian soil without encountering significant barriers or consequences. Finally, Ghana is a member of the UNFCCC, and is closely watching decisions on international leakage and will conform as needed or as necessary.

11. REVERSALS

11.1 Identification of risks of Reversals

There are several risk factors that can cause reversals, as identified in the ER Buffer Programme Guidelines developed by the FCPF. Table 49 below explains in more detail these factors and the risk associated with them.

Table 49: Identified factors of Risk of Reversal

Risk Factor	Level of reversal risk [98]	Justification
Default Risk	10%	Not applicable
A. Lack of broad and sustained stakeholder support	Low 10% - 10% = 0%	There is low stakeholder risk as the programme has clearly identified its main stakeholders and a high degree of formal and informal consultation has been completed during design. Extensive further consultation in each HIA will continue during early implementation. The in-depth inclusion, as part of the design, of cocoa farmers, their rural communities, women, and the private sector and farmer associations, and the HIA-Consortium structure will ensure a high degree of buy-in. This risk would increase if there was lack of sufficient consultation and awareness creation on the basics of the programme and implementation plan. This risk will continue into early implementation phase when the hotspots areas engagement begins. In order to mitigate this, establishment of HIAs should be preceded by broad community consultation involving all stakeholders, especially traditional authorities, community elders, and other key persons to increase ownership, inclusiveness, avoid disappointment and ensure sustainability while garnering broad community support. This will be buttressed by the implementation of safeguards and grievance redress mechanisms under the programme.
B. Lack of institutional capacities and/or ineffective vertical/cross sectoral coordination	Medium: 10% - 5% = 5%	The risks associated with institutional capacity for implementation and sustainability are listed as medium. At the start of REDD+ in Ghana, institutional capacity was low, but capacity has been strengthened through numerous trainings and workshops, and Ghana's capacity to implement this programme has improved. In the past, there has been weak cross-sectoral coordination amongst the lead institutions, but this is also changing, as evidenced by the coordination required to design this programme and in the design and implementation of the FIP. Still, the complexity of the institutional and implementation arrangements for coordinating, verifying, receiving and disbursing ER payments at a programmematic scale of this size is a potential risk for the GCFRP success. Overall, the coordination across natural resource-related agencies (environment, forestry, agriculture, cocoa, water, minerals, and energy) at the local and national levels combined with: (i) the complexity of monitoring requirements for performance-based carbon finance; and (ii) the complexity of orchestrating hundreds of thousands of land-users to act toward common goals of forest conservation and climate-smart cocoa agriculture is acknowledged to be a medium risk. The mitigation of the risk will depend on the identification and effective implementation of measures

[98] The percentages represent the portion of the ERs to be set aside in a buffer reserve. The figures are based on the guidelines from the FCPF ER Programme Buffer Guidelines.

		to strengthen the capacity of participating institutions, carry out joint annual work planning and budgeting across sectors for GCFRP, enhance safeguards implementation, and ensure the timely performance and delivery of operational and coordination requirements. The programme's strategy to focus interventions in decentralized deforestation hotspots will prove an excellent opportunity to build measures to mitigate implementation risks.
C. Lack of long term effectiveness in addressing underlying drivers	Medium 10% - 5% = 5%	The programme interventions are directly focused to address two of the main drivers and agents of deforestation and degradation in the region (cocoa/subsistence farming and unsustainable logging). The risks from cocoa farming and subsistence agriculture are low because agents are not migratory and will be directly engaged in the programme interventions. The risk from illegal logging is considered medium. The programme holds the majority of the timber resources being logged illegally for building and construction purposes. Sources of timber outside of the programme's ecological boundaries are quite limited. A significant increase in monitoring by stakeholders at the scale of HIAs and through rapid response to other hotspots will reduce the incidence and opportunity. Agents will be directly engaged in the programme interventions. The risk from illegal small-scale mining is also considered medium. The land owners are not migratory, though some of the agents are. In the second phase of the programme (post-2020), lessons from the HIAs will be applied to areas with illegal mining. Increased income from climate-smart agriculture and other benefits will help to mitigate the opportunity cost.
D. Exposure and vulnerability to natural disturbances	Low 5% - 5% =0%	This risk is considered as low. The main natural risk in the GCFRP accounting area is forest fires. The use of fire for forest clearing is illegal in Ghana, but the occurrence of uncontrolled forest fires may happen as a result of illegal practices related to illegal logging, land clearing, charcoal production, and as a result of dry years (El Nino events). The programme will mitigate this risk of forest fires by further strengthening fire management and control units at Forestry Commission, district assemblies, fire volunteers etc. The programme's MRV system will help to identify forest fires almost in "real time" and the improved structure for surveillance and fire brigades will allow for immediate reaction. Better land use planning and reductions in illegal logging will also ensure healthy forests which are less susceptible to fires.
Total risk of reversals = 10% + 0% + 5% + 5% +0% = **20%**		

11.2 ER Programme design features to prevent and mitigate Reversals

Illegal Mining:

The Minerals Commission and National Security bodies will be the key institutions in mitigating risk from this issue. Illegal mining is now at the top of the government's agenda and actions and policy responses are being implemented as of early 2017. It is also assumed that landscape planning will address some of the socio-cultural issues driving illegal mining. There is already strong evidence in Western Region (Wassa Amenfi West and Wassa Amenfi Central districts) that community-based management and planning approaches can significantly reduce the incidence of mining. In the second phase of the programme (post-2020), lessons from the HIAs will be applied to areas where illegal mining is a major problem. Increased income from climate-smart agriculture and other benefits will help to mitigate the opportunity cost and threat of reversal.

Commodity Price Volatility:
Ghana's Cocoa Board regulates the price of cocoa in Ghana, which therefore moderates potential future price volatility that could affect farmers' decision making. In 2016/2017 Ghana weathered a drop in the global market price without any challenges or impacts, as compared to its neighbor, Côte d'Ivoire, which saw a major reduction in the farm gate price. However, it will be important to make sure that the appropriate resources are in place to foster long-term tree-crop farming systems on appropriate lands. To avoid and monitor this risk, the programme will register all farms included in the programme and monitor if the intensified crops are profitable enough to sustain their social needs.

Forest Fires:
The programme will mitigate this risk of forest fires by further strengthening fire management and control units at Forestry Commission. The programme's MRV system will help to identify forest fires almost in "real time" and the improved structure for surveillance and fire brigades will allow for immediate reaction. Better land use planning and reductions in illegal logging will also ensure healthy forests which are less susceptible to fires.

11.3 Reversal management mechanism

Table 50: Selection of Reversal Management Mechanism

Reversal management mechanism	Selected (Yes/No)
Option 1: The ER Programme has in place a Reversal management mechanism that is substantially equivalent to the Reversal risk mitigation assurance provided by the ER Programme CF Buffer approach	
Option 2: ERs from the ER Programme are deposited in an ER Programme -specific buffer, managed by the Carbon Fund (ER Programme CF Buffer), and based on a Reversal risk assessment.	Yes

Ghana proposes to use the Buffer ER Carbon Fund Programme to store credit risk associated with uncertainty and reversals. The manner in which the amount of credits from emission reductions will be determined in the buffer is explained in "ER Buffer Programme Guidelines" developed by the FCPF. Specifically, for rollbacks, the program will use the risk assessment tool reversion that requires a specific amount to be put in the buffer for each risk factor. Table 50 has more details about these factors and the proportion proposed as an internal risk assessment.

Ghana will also keep its own record of credits associated with emissions reductions and other ecosystem benefits. This national registry will serve to integrate all environmental services in the country and avoid double-accounting between various schemes and programmes to promote and pay for performance. Thus it will be possible to ensure that appropriations made in the buffer Carbon Fund are not committed to another programme.

11.4 Monitoring and reporting of major emissions that could lead to Reversals of ERs

Emissions that would lead to reversal will be tracked through the monitoring of activities. This will also hold true for removals from enhancements as Ghana moves towards monitoring this activity spatially. Immediate monitoring for the sake of rapid response and communication with the World Bank will be conducted through global rapid alert databases including WRI's Global Forest Watch.

12. UNCERTAINTIES OF THE CALCULATION OF EMISSION REDUCTIONS

The uncertainty analysis for Ghana takes into consideration uncertainty from every source of emissions (i.e. deforestation, degradation from fire, fuel wood collection, legal and illegal logging) as well as removals from carbon stock enhancement, for their respective activity data and emission/removal factors.

Uncertainty estimates are reported for each activity in section 8. Uncertainty is currently estimated using an error of propagation approach. A Monte Carlo analysis requires data on probability distributions within source data. Ghana has taken the approach of completeness in terms of reporting activities. However, this has only been possible through use of proxy and indicatory data and conservative assumptions. Specifically, for illegal logging and fuelwood activity data estimates are based on research done for one point in time, for a single date during the reference period. Therefore, there is no information on how emissions may vary year to year. This represents a significant uncertainty that in Ghana's ER-PD is represented by the conservative assumption of 50% uncertainty for these activities, based on the expert opinion of researches that developed those studies. Such an uncertainty would seem to lead to the requirement for a Monte Carlo simulation to determine summed uncertainty. However, this high uncertainty exists solely due to the lack of data that would be needed in order to conduct a Monte Carlo simulation. This paradoxical situation precludes a Monte Carlo analysis at this time.

Ghana is planning on improving data on illegal logging and fuelwood degradation emissions. These improvements will occur in a stepwise manner (as discussed in section 12.3), which will allow the use of a Monte Carlo analysis in the future.

12.1 Identification and assessment of sources of uncertainty

Summation of errors follows the propagation of errors approachdescribed in equations 3.1 and 3.2 of the IPCC (2006) (equations 12.1 and 12.2 respectively). Errors were weighted (Eq. 12.2) where errors were propagated for parameters with the same units of measurement.

$$U_{total} = \sqrt{U_1^2 + U_2^2 + \cdots + U_n^2}$$

Eq. 12.1 (Eq. 3.1 of the IPCC (2006))

Where:

U_{total} =   percentage uncertainty of the product of quantities (half the 95% confidence interval, divided by the total and expressed as a percentage);
U_i = percentage uncertainty associated with each of the quantities.

$$U_{total} = \frac{\sqrt{(U_1 * x_1)^2 + (U_2 * x_2)^2 + \cdots + (U_n * x_n)^2}}{|x_1 + x_2 + \cdots + x_n|}$$

Eq. 12.2 (Eq. 3.2 of the IPCC (2006))

Where:

U_{total} = percentage uncertainty of the sum of quantities (half the 95% confidence interval, divided by the total (i.e. the median) and expressed as a percentage). The term "uncertainty" is based on the 95% confidence interval x_i y U_i= absolute uncertainty and associated percentage uncertainties, respectively.

The propagation of errors approach to uncertainty assessment in the reference level has many steps which are detailed below. Source uncertainty parameters are given in the text, in the tables below, adjoining spreadsheets (as referenced below)[99] and in Chapter 8.

Deforestation

- For each of the ten forest carbon strata/forest types (wet evergreen; moist evergreen; moist semi-deciduous SE; moist semi-deciduous NW; upland evergreen BY open / closed forest) uncertainty was propagated across carbon pools representing the uncertainty for predeforesation carbon stock. Uncertainty numbers for pools were derived from the data collected under the FPP project. The exception was soil carbon where data and uncertainties were derived from the IPCC. In all cases uncertainties were weighted by the size of the pool using equation 12.2 (3.2 in IPCC 2006) (see spreashsheet "ERPD_GCFRP Emissions and Removals Calculation Tool_2017" for further detail).

$$U_{pools} = \frac{\sqrt{(Unc_{AGB} * Stock_{AGB})^2 + (Unc_{BGB} * Stock_{BGB})^2 + \cdots + (Unc_{soil} * Stock_{soil})^2}}{|Stock_{AGB} + Stock_{BGB} + \cdots + Stock_{soil}|}$$

- The uncertainty in the predeforestation stock was then propagated with post deforestation stock uncertainty (cropland; plantations – oil palm, citrus, rubber, cocoa; grassland, wetlands, settlements, bareland/other). Again, equation 12.2 was used weighting uncertainty by the size of the stock (see spreadsheet "ERPD_GCFRP Emissions and Removals Calculation Tool_2017" for further detail).

$$U_{EF} = \frac{\sqrt{(Unc_{PRE} * Stock_{PRE})^2 + (Unc_{POST} * Stock_{POST})^2}}{|Stock_{PRE} + Stock_{POST}|}$$

- Uncertainty in the activity data was calculated using the equations of Olofsson[100]. Using the confusion matrices for each of the three change periods (2000-2010; 2010-2013; 2013-2015) a standard error and confidence interval was calculated. Dividing by the total area of change gives the percent uncertainties: 2000-2010 = 4.7%; 2010-2013 = 14.7%; 2013-2015 = 10.2%. See spreadsheets.[101]
- The uncertainties in activity data and emission factors were propagated using equation 12.1

$$U_{total} = \sqrt{U_{AD}^2 + U_{EF}^2}$$

- Uncertainty in non-CO2 gas emissions was the final addition. Equation 12.1 was used to combine uncertainties in the forest stocks, combustion factors and emission factors for N2O and CH4 (see spreadsheet "ERPD_GCFRP Fire Emissions" for further detail).

$$U_{CH4/N2O} = \sqrt{U_{stocks}^2 + U_{combustion}^2 + U_{CH4/N2OEF}^2}$$

$$U_{nonCO2} = \frac{\sqrt{\left(\left((FireEmission_{S1} * 0.721) * U_{CH4}\right)^2 + \left((FireEmission_{S1} * 0.278) * U_{N2O}\right)^2 \ldots + \ldots\right)}}{(FireEmission_{S1} + FireEmission_{S2} + \ldots)}$$

Where 0.721 and 0.278 are the proportions of fire emissions derived from methane and nitrous oxide respectively, and S1, S2…Sn represents strata (e.g. wet evergreen, moist semideciduous SE etc).

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[100] Olofsson, Foody, Stehman and Woodcock. 2013. Making better use of accuracy data in land change studies: Estimating accuracy and area and quantifying uncertainty using stratified estimation. Remote Sensing of Environment 129: 122-131.
[101]See spreadsheet named: "ERPD_GCFRPOlofsson 2000-2010"; "ERPD_GCFRPOlofsson 2010-2013" and "ERPD_GCFRPOlofsson 2013-2015"

$$U_{defor,t1} = \frac{\sqrt{(U_{total,t1} * EmissionCO2_{t1})^2 + (U_{nonCO2} * Emission_{nonCO2})^2}}{|Emission_{CO2,t1} + Emission_{nonCO2t1}|}$$

- Annual uncertainties for the years 2005 to 2014 were then combined weighted by annual emission using equation 12.2 (see spreadsheet "ERPD_GCFRP Emissions and Removals Calculation Tool_2017" for further detail)

$$U_{defor} = \frac{\sqrt{(U_{defor,t1} * Emission_{defor,t1})^2 + (U_{defor,t2} * Emission_{defor,t2})^2 + \cdots + (U_{defor,t10} * Emission_{defor,t10})^2}}{|Emission_{t1} + Emission_{t2} + \cdots + Emission_{t10}|}$$

Timber Harvest

Uncertainties of the three components of the emission factor (ELE; LDF; LIF) were combined using equation 12.2 weighted by the size of the component factors (see spreadsheet "ERPD_GCFRP Logging Data EF" for further detail).

$$U_{EF,logging} = \frac{\sqrt{(Unc_{ELE} * EF_{ELE})^2 + (Unc_{LDF} * EF_{LDF})^2 + (Unc_{LIF} * EF_{LIF})^2}}{|EF_{ELE} + EF_{LDF} + EF_{LIF}|}$$

For legal logging the volume statistics are assumed to be complete. For illegal logging where data are from a single point in time the emission factor uncertainty is propagated with the conservative assumption of uncertainty using Equation 12.1.

$$U_{IllegalLogging} = \sqrt{U_{AD,IL}^2 + U_{EF,IL}^2}$$

Expert judgement was elicited to support this estimate of uncertainty through one of the scientists, Lawrence Damnyag who worked on the illegal logging study (Revisiting Illegal Logging and the Size of the Domestic Timber Market: The Case of Ghana) He deemed the estimation of an uncertainty value of 50% is appropriately conservative.

Fire

As described under deforestation uncertainties were combined across carbon stocks, fire emission factors and uncertainties in the fire area estimations.

Woodfuel

As data are from a single point in time a conservative assumption of 50% uncertainty was applied. This assumption was confirmed by the developer of the WISDOM model. The model combines a wide array of datasets and approaches and thus there is no single associated uncertainty estimate. As the numbers used result from a single year in the reference period, to be highly conservative prior to systematic collection of woodfuel data in Ghana, an uncertainty equal to 50% of the parameter value is assumed. Expert judgement was elicited to support this estimate of uncertainty through consultation with Rudi Drigo, an expert on wood energy use and mapping and co-developer of the WISDOM Model. He deemed the estimation of an uncertainty value of 50% is appropriately conservative.

Combining Uncertainties

The uncertainties from each of the component sources were combined using Equation 12.2 weighted by the size of the source (see spreadsheet ERPD_GCFRP Emissions and Removals Calculation Tool_2017for further detail).

$$U_{RL} = \frac{\sqrt{(U_{defor} * E_{defor})^2 + (U_{LL} * E_{LL})^2 + (U_{IL} * E_{IL})^2 + (U_{Fire} * E_{Fire})^2 + (U_{Fuel} * E_{Fuel})^2 + (U_{En} * E_{En})^2}}{|E_{defor} + E_{LL} + E_{IL} + E_{Fire} + E_{Fuel} + E_{En}|}$$

Where: defor = deforestation, LL = legal logging, IL = illegal logging, Fire = Fire emissions, Fuel = Woodfuel emissions, En = enhancement
U = uncertainty, E = emission

Table 51: Assessment of uncertainty associated with the emissions

Activity	Sources of Uncertainty	Summed Uncertainty						
		Forest carbon Stratum/ Forest type	Post deforestation Stratum			Uncertainty 2000-2010	Uncertainty 2010-2013	Uncertainty 2013-2015
Deforestation	Uncertainty in remote sensing of land cover maps as identified in the confusion matrices Sampling uncertainty for the measurement data for emission factors[102]	**Wet evergreen**						
		Closed forest	Cropland	Cropland (herbaceous and slash and burn)		14.9	20.0	17.4
				Plantations	Oil Palm	22.4	26.1	24.1
					Citrus	28.3	31.3	29.7
					Rubber	36.9	39.3	38.0
					Cocoa	12.7	18.5	15.6
			Grassland			12.0	18.0	15.0
			Wetlands			22.0	25.8	23.8
			settlement			8.3	15.8	12.3
			Bareland/other			18.7	23.0	20.7
		Open Forest	Cropland	Cropland (herbaceous and slash and burn)		29.0	31.9	30.4
				Plantations	Oil Palm	57.3	58.8	58.0
					Citrus	64.2	65.6	64.9
					Rubber	70.6	71.9	71.2
					Cocoa	37.0	39.3	38.1
			Grassland			7.2	15.2	11.6
			Wetlands			36.9	39.3	38.0
			settlement			4.7	14.2	10.2
			Bareland/other			36.6	39.0	37.7
		Moist Evergreen						
		Closed forest	Cropland	Cropland (herbaceous and slash and burn)		9.8	16.6	13.4
				Plantations	Oil Palm	17.5	22.0	19.7

[102] Spreadsheets show calculation of uncertainty across pools for the emission factors. Combination with activity data relies of the 84% accuracy of classification (thus 16% uncertainty)

					Citrus	23.2	26.8	24.9
					Rubber	31.6	34.3	32.9
					Cocoa	9.3	16.3	13.0
			Grassland			6.8	15.0	11.3
			Wetlands			7.9	15.5	12.0
			settlement			5.8	14.6	10.7
			Bareland/other			11.1	17.4	14.3
		Open Forest	Cropland	Cropland (herbaceous and slash and burn)		17.4	22.0	19.6
				Plantations	Oil Palm	43.8	45.8	44.7
					Citrus	51.5	53.3	52.3
					Rubber	60.1	61.6	60.8
					Cocoa	32.1	34.8	33.3
			Grassland			26.8	30.0	28.3
			Wetlands			41.6	43.7	42.6
			settlement			14.5	19.8	17.1
			Bareland/other			34.1	36.6	35.2
		Moist Semi-deciduous SE						
		Closed forest	Cropland	Cropland (herbaceous and slash and burn)		9.7	16.5	13.2
				Plantations	Oil Palm	17.9	22.4	20.1
					Citrus	23.8	27.3	25.5
					Rubber	32.4	35.0	33.6
					Cocoa	9.3	16.3	13.0
			Grassland			7.5	15.3	11.7
			Wetlands			12.9	18.6	15.7
			settlement			6.6	14.9	11.2
			Bareland/other			10.2	16.8	13.6
		Open Forest	Cropland	Cropland (herbaceous and slash and burn)		20.6	24.6	22.5
				Plantations	Oil Palm	42.7	44.8	43.7
					Citrus	50.4	52.1	51.2
					Rubber	59.1	60.6	59.7
					Cocoa	18.6	22.9	20.6
			Grassland			27.5	30.6	28.9
			Wetlands			36.9	39.2	38.0
			settlement			17.7	22.2	19.9
			Bareland/other			31.4	34.1	32.7
		Moist Semi-deciduous NW						
		Closed forest	Cropland	Cropland (herbaceous and slash and burn)		13.1	18.7	15.9
				Plantations	Oil Palm	36.9	39.3	38.0
					Citrus	45.6	47.5	46.5
					Rubber	55.3	56.9	56.0

					Cocoa	14.2	19.5	16.8
			Grassland			7.2	15.2	11.5
			Wetlands			11.1	17.4	14.3
			settlement			5.3	14.4	10.5
			Bareland/other			16.6	21.3	18.9
		Open Forest	Cropland	Cropland (herbaceous and slash and burn)		17.7	22.2	19.8
				Plantations	Oil Palm	56.2	57.7	56.9
					Citrus	63.4	64.8	64.0
					Rubber	70.1	71.3	70.6
					Cocoa	25.1	28.4	26.7
			Grassland			12.9	18.6	15.8
			Wetlands			19.6	23.7	21.6
			settlement			6.4	14.9	11.1
			Bareland/other			25.8	29.0	27.3
		Upland Evergreen						
		Closed forest	Cropland	Cropland (herbaceous and slash and burn)		21.0	24.9	22.9
				Plantations	Oil Palm	30.0	32.9	31.4
					Citrus	36.1	38.5	37.2
					Rubber	44.8	46.7	45.7
					Cocoa	17.3	21.9	19.6
			Grassland			23.3	26.8	25.0
			Wetlands			26.7	29.8	28.2
			settlement			14.5	19.7	17.1
			Bareland/other			25.5	28.8	27.1
		Open Forest	Cropland	Cropland (herbaceous and slash and burn)		23.7	27.2	25.3
				Plantations	Oil Palm	46.0	47.9	46.9
					Citrus	54.1	55.7	54.8
					Rubber	62.5	63.9	63.2
					Cocoa	32.9	35.5	34.1
			Grassland			15.4	20.4	17.9
			Wetlands			43.2	45.3	44.2
			settlement			8.6	15.9	12.5
			Bareland/other			32.9	35.5	34.1
Legal Timber Harvest	Sampling uncertainty for emission factors	5.7%						
Illegal Timber Harvest	Sampling uncertainty for estimates of	53%						

<table>
<tr><td></td><td>illegal logging volumes. Sampling uncertainty for emission factors</td><td></td></tr>
<tr><td>Woodfuel</td><td>Sampling uncertainty for woodfuel supply volumes. Model uncertainty for woodfuel demand volumes</td><td>50%</td></tr>
<tr><td>Fire</td><td>Uncertainty resulting from the coarseness of MODIS data Uncertainty from the IPCC default factors Sampling uncertainty for emission factors</td><td>
<table>
<tr><th>Forest carbon Stratum/ Forest type</th><th>Uncertainty
%</th></tr>
<tr><td colspan="2">Wet evergreen</td></tr>
<tr><td>Closed Forest</td><td></td></tr>
<tr><td>CO_2</td><td>38.2</td></tr>
<tr><td>CH_4</td><td>47.9</td></tr>
<tr><td>N_2O</td><td>106.9</td></tr>
<tr><td>Open Forest</td><td></td></tr>
<tr><td>CO_2</td><td>36.5</td></tr>
<tr><td>CH_4</td><td>46.5</td></tr>
<tr><td>N_2O</td><td>106.3</td></tr>
<tr><td colspan="2">Moist Evergreen</td></tr>
<tr><td>Closed Forest</td><td></td></tr>
<tr><td>CO_2</td><td>36.8</td></tr>
<tr><td>CH_4</td><td>46.8</td></tr>
<tr><td>N_2O</td><td>106.4</td></tr>
<tr><td>Open Forest</td><td></td></tr>
<tr><td>CO_2</td><td>45.5</td></tr>
<tr><td>CH_4</td><td>53.8</td></tr>
<tr><td>N_2O</td><td>109.7</td></tr>
<tr><td colspan="2">Moist Semi-deciduous SE</td></tr>
<tr><td>Closed Forest</td><td></td></tr>
</table>
</td></tr>
</table>

		CO_2 36.9 CH_4 46.8 N_2O 106.4 Open Forest CO_2 46.6 CH_4 54.8 N_2O 110.2 **Moist Semi-deciduous NW** Closed Forest CO_2 36.7 CH_4 46.7 N_2O 106.4 Open Forest CO_2 38.2 CH_4 47.9 N_2O 106.9 **Upland Evergreen** Closed Forest CO_2 43.6 CH_4 52.3 N_2O 108.9 Open Forest CO_2 39.5 CH_4 48.9 N_2O 107.4
Enhancement	Sampling uncertainty for removal factors	Teak: 6% Other: 33%

12.2 Quantification of uncertainty in Reference Level setting

Details of uncertainty quantification methods are given under the relevant section for each activity in Section 12.3. Summation of uncertainties was a propagation of error approach with weighting.

Table 52: Quantification of Reference Level Uncertainty

Activity	Uncertainty
Deforestation	1.5%
Legal Timber Harvest	5.7%
Illegal Timber Harvest	53.0%
Woodfuel	50.0%
Fire	23.0%
Enhancement	20.3%

Total	15.7%

Total uncertainty for the reference level is 15.7% (uncertainty as a percentage of the mean). This is dominated by the dominance of emissions from deforestation (60%).

12.3 How uncertainties will be reduced

Uncertainty in deforestation emissions are low and further meaningful reduction through MRV changes may be minimal. However, the ER programme implementation will include assessment of activity data with confusion matrices and updating of emission factors with continuous field data collection.

Uncertainty in legal timber harvest is equally low through excellent field data collection by the Forestry Commission and activity data through national statistics. The Forestry Commission intends to keep up the effective collection of field data on legal harvesting with the implementation of Wood Tracking System as an improvement over the paper based tracking of wood from forest to market.

In contrast, the uncertainty in illegal logging emissions is high due to the use of proxy data. This uncertainty will be reduced through a specific monitoring programme capturing annual activity data. A systematic approach of collecting data on illegal timber harvest is being strengthened by the Forestry Commission to collate annual timber harvested illegally. This is with the objective of moving away from the use of proxy to a national data source approach. This will be tested and rolled out in the programme area. In addition, HIA consortiums and HIA governance boards can support Forestry Commission in monitoring within their boundaries and develop indicators for the data management system.

Fuelwood emissions, while a very small proportion of total emissions (2%) are also highly uncertain, predominantly because they result from an analysis at a single point in time. Uncertainty will be reduced through implementation of the MRV plans. This plan includes the tracking of volumes of fuelwood collected from on and off reserves by Forestry Commission through issuing permits to prospective fuelwood extractors.

Fire emissions for the programme region are even less significant than those from fuelwood (just 0.13 % of total emissions). As such the 23% uncertainty is considered reasonable. However, efforts at discouraging slash and burn farming practices and the retention of trees on farms within the cocoa landscape in particular during ER programme implementation are major steps towards reduction of emissions from fire.

Uncertainty in sequestration will be reduced through implementation of the MRV system and in particular the development of new removal factors for non-teak tree plantations.

13. CALCULATION OF EMISSION REDUCTIONS

13.1 Ex-ante estimation of the Emission Reductions

The GCFRP will focus on reducing emissions from deforestation and degradation from agricultural expansion, primarily cocoa farming, and illegal logging to achieve the greatest impact, as the two activities represents the largest source of emissions across the accounting area. Annually, an estimated 1,644,030 tCO_{2-e} will be reduced from deforestation, 1,041,390 tCO_{2-e} from forest degradation and an increase of 8,370 tCO_{2-e} in carbon stock enhancement.

As detailed in the Reversals chapter, 20% of emission reductions are retained in a reversals buffer account, while 15% of emission reductions from both degradation and CSE are retained in a buffer against uncertainty. Taken together, the programme is putting 25.8% of emission reductions into buffer accounts.

The GCFRP expects to generate 2,700,000 tCO_{2-e} per year (Table 53) over the 5 year ERPA term of the programme, totaling 13,500,000 tCO_{2-e} over the 5 year ERPA, of which 3,487,320 tCO_{2-e} will be set-aside in uncertainty and reversal buffers and 10,012,680 tCO_{2-e} will be available for sale.

Table 53: Ex-ante estimation of ERs from the ER Programme

ERPA term year *t*	Reference level (tCO_{2-e}/yr)	Estimation of expected emissions under the ER Programme (tCO_{2-e}/yr)	Estimation of expected set-aside to reflect the level of uncertainty associated with the estimation of ERs during the Term of the ERPA (tCO_{2-e}/yr)	Estimation of expected ERs set-aside to cover risk of reversals during the Term of the ERPA (tCO_{2-e}/yr)	Estimated ERs (tCO_{2-e}/yr) without removal of buffers
1	45,109,495	42,409,495	157,464	540,000	2,700,000
2	45,109,495	42,409,495	157,464	540,000	2,700,000
3	45,109,495	42,409,495	157,464	540,000	2,700,000
4	45,109,495	42,409,495	157,464	540,000	2,700,000
5	45,109,495	42,409,495	157,464	540,000	2,700,000

†Given the 5.4% uncertainty for deforestation the conservativeness factor, according to the Methodological Framework, is 0% for deforestation so there is no uncertainty buffer set-aside. For degradation the uncertainty set-aside is 15% as detailed under Criterion 22.2. For enhancement a 15% uncertainty set-aside is also added.

14. SAFEGUARDS

14.1 Description of how the ER Programme meets the World Bank social and environmental safeguards and promotes and supports the safeguards included in the UNFCCC guidance to REDD+

14.1.1 Ghana's Approach to World Bank Safeguards Compliance

At the national level, under the first phase of readiness, Ghana carried out a Strategic Environmental and Social Assessment (SESA)[103] using a consultative process, which was completed in 2014. The SESA took into account national and institutional sustainability policies, plans and strategies and also addressed World Bank Safeguards Operational Policies. By conducting the SESA, the relationship between national policies, laws, and regulations, and their effects on the proposed REDD+ interventions were identified. The SESA process also determined which World Bank Safeguards Operational Policies (OPs) would be triggered by planned REDD+ interventions, and this subsequently produced an Environmental and Social Management Framework (ESMF) with the necessary mitigation options for identified risks. The national SESA process for readiness produced three reports; the SESA report, the ESMF and the Resettlement Policy Framework (RPF). Two additional documents were produced under Ghana's Forest Investment program (FIP), based on the SESA conducted for readiness, these are the Pest Management Plan and the Process Framework for stakeholder engagement.

The SESA process was carried out in a highly participatory and inclusive manner (see SESA Report) with relevant stakeholder representatives consulted at community, district, regional, and national levels. The process of this engagement is fully detailed in the SESA report attached to this submission. As a demonstration of best practice, the SESA was also implemented in alignment with the development of Ghana's National REDD+ Strategy, which took the thirteen original strategy options articulated in Ghana's R-PP and grouped them into programmatic approaches to REDD+ based on eco-zones, common drivers, and commodities. The SESA process itself consisted of five steps that are based on Ghana's Strategic Environmental Assessment (SEA) practice and made up the structure of the SESA report. The steps include: 1) Preparation; 2) Scoping & Situation Assessment/Baseline Study; 3) Assessment of Strategy Options; 4) Monitoring and Evaluation Proposal; 5) Reporting, Communication and Learning.

It is worth noting that in relation to the fifth step (above), a **REDD+ Communication Strategy** had been developed previously in October 2013 and formed an integral part of the SESA communication process. The goal of the communication strategy was to enhance communication with different stakeholders and raise awareness and knowledge on climate change and REDD+ issues in the country. As part of the SESA process, it was seen to be important in increasing the visibility of REDD+, improving people's understanding about the role forests play in sustaining livelihoods, and improving people's knowledge of REDD+ within local communities. The existence of the communication strategy was therefore acknowledged to secure greater participation in and collective ownership of the process to develop strategies on REDD+ and safeguard measures.

[103] Refer to Table 2 for the link to the document

The communication strategy articulated different messages tailored to specific stakeholders' groups including the media, local communities, NGOs, and private sector actors. While there were some common points for everyone, messages specific to each group were tailored and various communication tools were also identified employed such as the use of newsletters, radio, television, mobile megaphone announcements, public events (conferences, forums, roadshows, durbars and round table discussions). In particular, the NRS adopted an annual REDD+ Roadshow that started in 2014, which travels the country raising awareness about REDD+ and the GCFRP. A National REDD+ Forum was also organized to happen biennially, with the maiden forum organized in November 2015. The second REDD+ Forum in scheduled for November, 2017.

Updated SESA for the GCFRP

In 2016, following the completion of Ghana's National REDD+ Strategy, Ghana produced an updated SESA report specific to the GCFRP, which aims to address the seven strategy options that are relevant to the GCFRP through its implementation plan. These include:

I. Improving the quality of multi-stakeholder dialogue and decision-making
II. Clarifying rights regime
III. Addressing unsustainable timber harvesting
IV. Mitigating effects of agricultural expansion (particularly cocoa in the HFZ)
V. Strengthening local decentralised management of natural resources
VI. Expansion of high biomass agroforestry /tree crops systems
VII. Improving regulation of mining activities to reduce forest degradation

The updated SESA report was developed in 2016 to better understand the environmental and social concerns of the programme, and to better define the necessary mitigation mechanisms and safeguards compliance issues associated with the seven strategy options that are to be applied through implementation of the GCFRP. Specifically, it details the risks and opportunities, and signals the World Bank Ops that would be triggered by the seven REDD+ strategy options. These have been captured in detail in Section 6 of the updated SESA report and the table below presents a summary. The report also contains a review of relevant policies, laws and regulations (PLRs) in relation to the World Bank OPs and makes suggestions for regulatory reforms where appropriate. Appropriate mitigation measures and recommendations are provided in the ESMF to guide the implementation of all REDD+ interventions in the country including the proposed ER programme. The National REDD+ Secretariat (NRS) of the Forestry Commission is responsible for ensuring that mitigation measures and recommendations provided in the ESMF applicable to the ER Programme area are implemented.

Table 54: World Bank Operational Procedures triggered by the REDD+ Strategy Options

World Bank Safeguard Policy	Potential to be Triggered under REDD+ in Ghana
OP 4.01: Environmental Assessment	Triggered
OP 4.04: Natural Habitats	Triggered
OP 4.36: Forest	Triggered
OP 4.09: Pest Management	Triggered
O.P. 4.11: Physical Cultural Resources	Triggered
OP 4.12: Involuntary Resettlement	Triggered
OP 4.10: Indigenous peoples	Not triggered
OP 4.37: Safety of Dams	Not triggered
OP 7.50 Projects on International Waterways	Not triggered
OP 7.60: Projects in Disputed Areas	Not triggered

To effectively address the triggered safeguards operational policies (Table 54), the following documents (link to site) were prepared to outline and address the needed mitigation approaches.

Environmental and Social Management Framework (ESMF)

As detailed in the ESMF report (Table 2), Ghana's ESMF establishes clear procedures and responsibilities for the environmental and social screening of all likely interventions under the ER Programme, and identifies the environmental/social issues/concerns and likely impacts from the proposed ER Programme intervention and recommends appropriate mitigation measures to address the likely adverse impacts or risks. The document has identified relevant institutions to be involved with the implementation of the environmental/social mitigation measures and provides an environment/social due diligence capacity and training programme to ensure that appropriate training is provided to the institutions with limited capacity in environmental/social safeguards. It specifies appropriate roles and responsibilities and outlines the necessary reporting procedures for managing and monitoring environmental and social concerns. The ESMF will be executed by the Forestry Commission (at both the national, regional and district levels) in collaboration with other partners such as MLNR, COCOBOD, MOFA, EPA, Water Resources Commission, Lands Commission, District Assemblies, local communities and other institutions to be identified as relevant. Detailed roles and responsibilities of these institutions are captured in the ESMF document.

The NRS together with the Safeguards sub-working group has outlined a detailed plan to implement Ghana's ESMF with various training modules for various stakeholder groups to equip them with better understanding of what safeguards are and the need to implement it as a country. Training has begun with frontline staff of the FC who will be focal persons at the project level to implement and report on safeguards in collaboration with the relevant stakeholders. Building the capacity of stakeholders on the details and implications of the ESMF is a good preparatory start towards implementation of the GCFRP.

The Opportunity/Benefit and Risk Matrix, which is summarized below (Table 55 with full detailed in link provided in Table 2), helps to assess the potential opportunities and risks associated with the proposed strategy options, so that remedial/ mitigation measures for the risks can be proposed and factored in the design of sub-components and implementation of the strategy options/interventions. The opportunities associated with or available during implementation of the strategy options can also be enhanced. The analysis was based on the following:

- Proposed strategy options/interventions;
- Potential opportunities (i.e. ongoing or recent past polices/plans/programmes in the forestry sector or other relevant sectors) that can be taken advantage of to improve or enhance the implementation of the proposed strategy options;
- Anticipated risks or challenges (external or internal) that could adversely impact on the strategy options during implementation. The outcome of the compatibility and compound matrixes were also considered for issues of potential negative/risk implications so that adequate mitigation measures are provided;
- Proposed enhancement measures/proposals for opportunities identified;
- Proposed mitigation measures/proposals for risks/ challenges identified; and
- Identified institutions to be responsible for implementing the proposals. The following tables detail the opportunities identified with the implementation of the GCFRP and how the program elements will address risks.

Table 55: Summary of Opportunity/Benefit, Risks Matrix and proposed mitigation measures

Opportunities/Benefits and Risks	Proposed Enhancement/Mitigation Measures to guide implementation	Responsible Institution(s)
Strategy Option: Improve the quality of multi-stakeholder dialogue and decision making		
Opportunities	**Enhancement Measure**	
Diverse capacities available among stakeholders	-Document capacities of stakeholder groups and strengthen capacity of stakeholders where necessary to deliver.	MLNR/FC
Opportunity to engage high level political leaders /TAs across the divide (all political parties)	-Create separate platform or forum for high level decision makers (e.g. political leaders across the divide and paramount chiefs)	
VPA/R-PP/SESA stakeholder engagement experiences	-Contact stakeholders (e.g. via emails, phone etc) involved for their opinions in ways of improving dialogue/decision making.	FC
Benefits		
• Increased knowledge and capacity for forest management • Increased understanding and use of local & traditional knowledge & practices in forest management • Increased participation / ownership by local communities and other stakeholders • Environmental & social awareness among various stakeholder groups		
Risks	**Mitigation Measures/Guidelines**	
Dominance of male decision makers that would prevent female participation and equity in dialogue and decision-making.	-Diversify and include all genders (men, women, youth) in decision-making and outputs for equitable outcomes	MLNR/FC
Inequity in knowledge management and information sharing	-Equitable distribution of information for the benefit of all by sharing equally among men and women and youth.	
Politicization of issues and decisions	-Adopt non-partisan and all inclusive approach. -Identify and use non-political experts/NGOs/CSOs to lead discussions on politically sensitive issues.	FC/NGOs
Strategy Option: Clarify Rights Regime		
Opportunities	**Enhancement Measures**	
National Expert Consultation review on allocation of carbon rights	-Factor equality and equity issues to benefit all (including people with disability, minorities and settler farmers)	MLNR/FC/Review Experts
Availability of carbon markets	-Sustain accessibility to carbon market Ensure transparency in carbon market transactions	
Monetary benefits (e.g. income) for stakeholders	-Benefit sharing mechanism to ensure realistic income /benefits to stakeholders	

Benefits		
• Improved law/legal framework for tree tenure • Improvement in equity to benefit-sharing • Improved rights & access to land / forests • Better access to Non Timber Forest Products (NTFP) by local communities • Increased understanding of the importance and benefits of ecosystem service function of forestry resources by local communities		
Risks	**Mitigation Measures/Guidelines**	
Lack of a law on carbon rights and national institution in charge of carbon rights/markets	-Enact a law on carbon rights and designate an institution to be responsible for carbon right issues in the country	MLNR/FC/MoFA
Women's challenges with land ownership and tree tenure rights	-Address this through tree tenure policy review Sensitize TAs/landowners on relevant constitutional provisions and laws	FC/OASL/TAs
Traditional inheritance laws may prevent equitable benefit sharing of carbon credits and benefits	-Address cultural and traditional gender discrimination through education and sensitization -Rules of engagement under REDD+ should clearly indicate gender concerns at all levels	FC/TAs
Lack of economic empowerment and sustainable alternate livelihood actions for women	-Promote livelihood and economic empowerment in policy regulation and benefit sharing rights	FC/DAs
Strategy Option: ***Address unsustainable timber harvesting***		
Opportunities	**Enhancement Measures**	
Existence of forest management plans and operational manuals.	-Strictly adhere to forest management plans and operational manuals	MLNR/ FC
Ongoing tree tenure reforms	-Benefit sharing should include farmers	
Ecosystem friendly/climate smart cocoa interventions by NGOs/CSO	-Tap on NGO/CSO experiences in improving or ensuring maintenance of shade trees in cocoa farms. -As much as possible use such NGOs/CSOs to carry out REDD+ activities on the ground	FC/NGOs
Implementation of ongoing VPA/FLEGT arrangement	-Maintain links to VPA process and integrate actions as appropriate	MLNR/FC
Benefits		
• Reduced illegal logging • Reduction in the creation of illegal access routes into forest reserves • Reduced deforestation and forest degradation • Reduction in loss of biodiversity • Improvement in the sustainable management of forest resources • Improved use of timber resources • Improved benefit sharing		
Risks	**Mitigation Measures/Guidelines**	
Underestimation of women involvement in timber supply industry	-Inclusion and diversity in the process to forestall deforestation and unsustainable timber supply -Carry out a study to unravel gender roles in the timber supply industry to provide	FC/MMDAs

	relevant information for mitigation	
Access to land for tree plantation is a challenge, especially for women	-Assistance to disadvantaged persons (mostly migrant farmers, women) to access land for tree plantations. -Sensitize TAs to release land for women groups for tree plantation projects	FC/TAs
Weak law enforcement	-Improve law enforcement through effective collaboration with security agencies -Strengthen capacity of FC field staff and provide adequate resources (staff, equipment, funds, etc.) for effective enforcement and monitoring. -Sensitize Judiciary on importance of forests, climate change and other environmental issues -Review law on forest offences and review fines upwards	MLNR, FC, Security agencies, Judiciary
Low awareness of existence of improved cookstoves and alternative fuels (bamboo briquettes, bamboo charcoal, biofuel/biogas)	-Education and provision of improved cook-stoves and fuels for the benefit of all.	FC/ Energy commission
Strategy Option: Mitigate effects of agricultural expansion (particularly cocoa in the HFZ)		
Opportunities	**Enhancement Measures**	
Ongoing promotion of shade cocoa, CODAPEC/ cocoa high-tech (spraying and fertilizer application), rehabilitation of moribund cocoa farms by COCOBOD	-Improve security of land tenure for cocoa farmers -Remove all forms of politicization and other constraints (availability of agro-chemicals -e.g. agro-chemicals labelled not for sale are being sold)	FC, MoF, COCOBOD
Existing MoFA programmes (e.g. FASDEP) on productivity of farmlands and food security	-Improve collaboration with MoFA extension service -Training in best agronomic practices -Timely provision of inputs to farmers	FC, MoFA
Ongoing ecosystem friendly/climate smart cocoa/agriculture interventions by NGOs/CSOs (e.g. Rainforest Alliance, Solidaridad etc)	-Tap on the experiences of NGOs/CSOs and learn lessons from their activities to improve REDD+ activities. -Use experienced NGOs/CSOs already undertaking similar activities to implement ground activities under REDD+.	NGOs/CSOs
Benefits		
• Improved tree cover in cocoa farms • Improved cocoa yield and income of cocoa farmers • Reduced expansion of cocoa farms in forests reserves • Reduced conversion of natural forest into cocoa farms (i.e. reduced deforestation and forest degradation) • Legal framework on tree tenure established • Better understanding of cocoa farmers on ecosystem /environmental service function of shade trees • Improved benefit sharing to land owners and cocoa farmers • Desire of landowners/traditional authorities to give out forested lands for cocoa farming reduced due to improved benefit sharing		
Risks	**Mitigation Measures/Guidelines**	
Persistent presence of admitted and illegal farms/ settlements in Forest Reserves	-Review policy on admitted farms/settlements to allow for gradual and planned relocation of farms/ settlements out of FRs over an agreed period with stakeholders. -Enforce forest laws with regard to illegal farms in FRs	MLNR, FC, MoFEP, MoFA, MMDAs

	-Collaborate with MoFA, COCOBOD and MMDAs. -Sensitize political leaders at the district/regions on impact of illegal farms/settlements on FRs and climate change in general.	
Land documentation and lease acquisition challenges for lands/farmlands acquired by settler/migrant farmers through customary means	-Collaborate and support the LAP/OASL initiative to address this challenge -Engage and sensitize TAs/ landowners /farmers on relevant constitutional provisions and laws. -Provide assistance to settler/migrant farmers to be able to acquire proper land documents (e.g. site plans, indenture/ land agreements etc)	MLNR, OASL, TAs, FC
Land tenure, conflicts and disputes	-MLNR/LAP should expedite work on the customary land demarcation project. -Provide assistance to settler/migrant farmers to be able to acquire proper land documents (e.g. site plans, indenture/ land agreements etc). -MLNR through stakeholder engagement should develop a policy to ban or discourage verbal arrangements for leasing or giving out land to settler/migrant farmers especially for perennial plant/tree crop farming purposes.	
Inadequate land for farms, economic trees and tree plantations	-Promote intensive use of land (soil enrichment, agroforestry) Identify and rehabilitate degraded lands for useful purposes	MLNR, MoFA, FC
Strategy Option: Strengthen local decentralized management of natural resources		
Opportunities	**Enhancement Measures**	
Existing links to Natural Resource and Environmental Governance (NREG) strategy and GPRSII/Ghana's development agenda	-Strengthen links in an all-inclusive manner	MLNR, FC
Existing relationship between decentralised departments and agencies (OASL, MOFA, DAs, NGOs, etc.) and FC	-Intensify engagement and clarification of efforts to avoid duplication -Information sharing and creation of platform for joint monitoring of resources	OASL, MOFA, DAs, NGOs, and FC
Existence of informal arrangement or agreement (between FC and TAs/community) for accessing and harvesting of NTFPs	-Increase community awareness/education on conservation of natural resources -Clarify and formalize rules/guidelines for accessing and harvesting of NTFPs	MLNR, FC, TAs, MMDAs
Benefits		
• Strengthened local organisations in forest management • Increased understanding and use of local & traditional knowledge & practices in forest management • Increased participation / ownership by local communities and traditional authorities • Better understanding of ecosystem service function of forests by local communities • Reduced deforestation and forest degradation • Improved benefit sharing • Improved rights and access to forest resources/NTFP		
Risks	**Mitigation Measures/Guidelines**	
Inadequate capacity at the decentralized level	-Improve training in natural resource management at decentralised level	MLNR, FC,

		FORIG
Limited inclusion of women in management of natural resources	-Create and strengthen gender desks at decentralised levels (to enhance full participation in decision making/contribute to the process of legislation review)	MLNR, FC
Traditional norms dictating roles and responsibilities of males and females in favour of males	-Training in forest and resource management should emphasize on inclusion of both males and females. -Education of TAs on gender issues	
Strategy Option: ***Expansion of high biomass agroforestry /tree crops systems***		
Opportunities	**Enhancement Measures**	
Existence of inter-sectoral collaboration on Charcoal and Fuel Wood production and use (FC, EPA, EC) under the law	-Improve collaboration through formation of inter-sectoral body to implement law/exercise mandate in an equitable manner	FC, EC, EPA
Presence of alternative fuels on the market (Improved cook-stoves, bamboo and crop briquettes, LPG, etc)	-Increase awareness on existence of alternative fuels for people to buy-in -Promote production and use of alternative fuels for carbon benefits	FC, EC
Existence of Renewable Energy Act that promotes the use of alternative sources of fuelwood and biomass other than natural forest	-Strengthen education on the Act (for benefit of all)	
Existing regulation/license manual in the production of charcoal (Energy Commission, FC)	-Strengthen implementation of the regulations on charcoal and other biomass fuel production	
Benefits		
• Increased awareness on existence of alternative fuels • Investment in alternative fuels • Increased awareness on the existence of a renewable energy legal framework at the community level		
Risks	**Mitigation Measures/Guidelines**	
Tree species less likely to have double usage (Commercial and domestic purposes)	-Establish woodlots for dual purposes of acquiring carbon credits and fuelwood for women	MLNR, FC
Low acceptability and behavioural change towards reform and adoption of alternate fuels	-Education on harmful effects of unsustainable fuel wood use (for adoption of alternative fuels)	
Tree tenure and benefit sharing challenges create barrier to cultivation of tree plantations	-Address barriers in tree tenure and benefit sharing for all, especially for women	
Lack of participation of women in decision making and selection of alternative fuels	-Provide entrepreneurial skills in production and distribution of alternate fuels	
Limited establishment of woodlots for fuelwood	-Create woodlots purposely for fuelwood and promote alternative energy uses	
Continuous illegal exploitation of forests for charcoal and other woodfuels and flouting of regulations	-Enforce the guidelines on biomass use, especially the production of charcoal for commercial purposes and export. -Provide credit facilities for locals (especially women) to take advantage of commercial opportunities in renewable fuels.	

Strategy Option: ***Improve regulation of mining activities to reduce forest degradation***		
Opportunities	**Enhancement Measures**	
Existence of the EPA Act 490 and EIA requirements	-Strengthen monitoring and supervision by relevant institutions for effective implementation of activities under EIA	EPA, MC, FC
Recent political will to curb illegal mining activities	-Regularize and sustain efforts of national task force on illegal mining	Office of the President, MLNR,
New regulations on Mineral and Mining	-Create awareness on new regulations at the community level especially on small scale mining activities	Minerals Commission (MC)
Existing collaboration between FC and MC, EPA on mining in production forest reserves	-Strengthen collaboration to include joint monitoring programmes	FC, MC, EPA
Benefits		
• Improved collaboration among FC, Minerals Commission, National Security, Traditional authorities and local communities • Reduced mining activities in forests • Increased awareness on impact of mining on the environment and forest resources in particular • Clear policy and legal framework for mining in forests		
Risks	**Mitigation Measures/Guidelines**	
Lack of clarity on institutional mandate to safeguard mineral resources	Need to clarify institutional mandates on safeguarding mineral resources	National security, EPA, MC
Widespread illegal small scale mining/galamsey activities	-Regularize and sustain efforts of national task force to curb illegal mining -All relevant institutions/agencies should enforce their regulations -Adopt and apply punitive sanctions to offenders/ illegal miners -Create awareness on new mining regulations especially concerning small scale mining at the community level -Investigate and identify financiers of illegal small scale mining and extend punishment to cover financiers -Educate TAs not to release land for illegal mining and extend punishment to landowners who knowingly release land for illegal mining	FC, EPA, MC, National Security, TAs, MMDAs
Cost burden and prolonged EIA processes and acquisition of permits for small scale mining could be discouraging	-Simplification of procedures/processes and decentralization of permit acquisition for small scale mining	EPA, MC
Vested interest in illegal small scale mining/galamsey activities	-High level multi-stakeholder dialogue (e.g. politicians, chiefs, influential people etc) required to address issue	House of chiefs, political parties, parliament, MLNR
Land owners /cocoa farmers willing to release land for illegal mining activities for monetary compensation	-Create awareness and educate land owners/farmers of such illegal practices and long term benefits -Apply punitive measures or sanctions to offenders	TAs/ landowners
Limited awareness on mining policies, regulations and laws especially at the community levels	-Sensitize local communities on mining, environmental and forest laws/policies	MC, EPA, FC

Resettlement Policy Framework (RPF)

The 2014 SESA also triggered a Resettlement and Policy Framework in response to the World Bank OP 4.12 on involuntary resettlement. The RPF was updated to contribute to the smooth implementation of the GCFRP with regards to social impacts such as:

a. Involuntary Resettlement,
b. acquisition of land,
c. impacts on socio-cultural resources
d. impacts on livelihoods or
e. Restricted access to Natural Resources.

Instances of legal Admitted farms encroachment into forest areas and illegal farms would present a challenge to successful program implementation therefore based on the RPF, such farms would be incorporated with trees over time until the trees shade out the crops and farmers would be allocated other land outside the forest area. Thereby ensuring local participation for social cohesion and sustainability of the interventions. The RPF identifies national policies, laws and regulations that need to be complied with, and also gaps between these national policies, laws and regulations and the World Bank safeguard policy on involuntary resettlement. It is clearly stated in the RPF that "Where there are gaps or inconsistencies between Ghanaian laws and the World Bank policy on involuntary resettlement, OP 4.12, the RPF which is consistent with the World Bank policy OP 4.12 will apply".

Process Framework (PR)

Ghana's Forest Investment Program process produced two other significant and important documents which were not produced under readiness but are very beneficial to the implementation of the GCFRP. Considering the GCFRP will lessons from projects being piloted under FIP, this presents a good opportunity for integration and alignment. There is significant overlap and synergy between the FIP and the ER Programme in terms of articulated activities and the target landscapes. The FIP focal area targets the Western Region, located in the ER Programme area (cocoa forest mosaic landscape), and the Brong-Ahafo Region, which encompasses part of the cocoa forest mosaic landscape. The proponents of the FIP and the ERP see this activity-based and geographic overlap as being strategic and essential for the successful implementation of the ER Programme and it has been agreed that the FIP will lead implementation of the GCFRP in one or two of the HIA landscapes. Further, the MLNR which is responsible for the FIP has a representation on the GCFRP's Joint Coordinating Committee to ensure full integration with FIP projects and related activities.

The Process Framework (PF) prepared for the FIP has been prepared because the project may cause restrictions in access to natural resources in legally designated parks and protected areas. The Process Framework establishes a process by which members of potentially affected communities are engaged and participate in the design of project components, determination of measures necessary to achieve resettlement policy objectives and implementation and monitoring of relevant project activities (link to PF). Currently, an institutional training to ensure the smooth implementation and monitoring of the environmental and social issues and impacts identified in the FIP ESMF/PF is being implemented by the Forestry Commission.

Pest Management Framework (PMP)

The specific objective of the Pest Management Plan produced for the FIP is to promote the use of biological and environmental control methods for pest management and reduce the use of synthetic chemical pesticides to ensure that health and environmental hazards associated with pesticides are minimized (Link to PMP). Other objectives of the PMP which will be adopted and used by the GCFRP, are to:

a. Ensure integration of appropriate pest management techniques into agro-forestry technologies, and cocoa landscapes in the project area.
b. Monitor pesticide use and pest issues among participating farmers, admitted farmers within forest reserves, and local communities.
c. Promote implementation of an Integrated Crop and Pest Management (IPM) in cocoa production.

To achieve its objectives, the PMP provides relevant information on;

i. Promoting the IPM approach for the cocoa sector including the promotion and adoption of climate smart cocoa,
ii. Summarizing the national pesticide use and management in Ghanaian agriculture and in the cocoa sector in particular and
iii. Providing insight and recommendations on the capacity building opportunities for the promotion of IPM and rational use of pesticides in cocoa production,
iv. Implementation strategies and budget for the PMP.

14.1.2 Analysis of Ghana's legal Framework to Promote and Support the Cancun Safeguards

Ghana understands that identifying, assessing, and strengthening existing governance arrangements provides a useful framework through which we can address and respect the seven (7) Cancun Safeguards listed below for REDD+:

- That actions complement or are consistent with the objectives of national forest programs and relevant international conventions and agreements;
- Transparent and effective national forest governance structures, taking into account national legislation and sovereignty;
- Respect for the knowledge and rights of indigenous peoples and members of local communities;
- The full and effective participation of relevant stakeholders, in particular indigenous peoples and local communities;
- That actions are consistent with the conservation of natural forests and biological diversity, ensuring that actions are not used for the conversion of natural forests, but are instead used to incentivize the protection and conservation of natural forests and their ecosystem services, and to enhance other social and environmental benefits;
- Actions to address the risks of reversals;
- Actions to reduce displacement of emissions.

Ghana's process for ensuring compliance with the Cancun Safeguards is being conducted in partnership with SNV Netherlands Development Organization, KASA Ghana (a civil society organization), and with technical support from the British Organization Climate Law and Policy (CLP). This work was supported by the International Climate Initiative of BMUB[104] as part of a bigger project of Operationalizing National Safeguards Requirements for Results Based Payments where Ghana is defining its Country Approach to Safeguards (CAS). The end result of the CAS would be a functional SIS to report on how safeguards are

[104] This project, named Operationalising National Safeguard Requirements for Results-based Payments from REDD+**,** aimed to assist the government of Ghana (as well as Vietnam and Peru) to meet multiple safeguard requirements and be eligible for results-based payments.

being addressed and respected for REDD+ Implementation. Table 56 below outlines the process of developing Ghana's CAS which is very iterative and not linear. Therefore for each step Ghana has carried out parts of the proposed activities as is evident in all the attached and referenced documents as this is very much a learning by doing process. (Table 2 for link to draft CAS)

Table 56: Process of developing Ghana's CAS

Step 1: Engaging stakeholders in Country Approaches to Safeguards
• Continued Awareness creation and Capacity building • Continued Consultation and Participation • Defining Institutional arrangements
Step 2: Setting Safeguards Goal and Scope
• Ghana has set its safeguards goal as 'integrating environmental and social considerations of Policy Laws and Regulations (PLR) at national and international levels into REDD+ Policies Actions and Measures (PAMs); to promote environmental integrity without adverse impacts on the socio-cultural rights and livelihoods of stakeholders'' • The scope is defined to apply to 'REDD+ Policies Actions and Measures (PAMs) and other related activities'
Step 3: Identifying, Assessing and Strengthening Existing Governance Arrangements
• Adopting robust and participatory methodological approaches to carry out Assessments. • Addressing gaps and weaknesses identified
Step 4: Clarifying the Cancun and World Bank Safeguards in the Context of Ghana
• Adopting participatory approaches to clarify the Cancun and World Bank safeguards. • Analyzing Ghana's legal framework (Policies, Laws and Regulations) and their relation to the seven Cancun safeguards and the World Bank Operational Policies
Step 5: Articulating how the Ghana's safeguards goals would be achieved
• Linking the proposed governance arrangements to the country specific safeguards requirements • Outlining how proposed governance arrangements and any additional measures will be used to address/mitigate/minimize identified risks and maximize identified benefits •
Step 6: Designing the Safeguards Information System (SIS)
• Define the objective of the SIS • Determine safeguard information needs • Determining the sources of information • Establishing the necessary functions of the SIS • Exploring the institutional arrangements for the SIS

The assessment found that the legal frameworks in Ghana already protects and regulates many of the rights and objectives enshrined in the Cancun Safeguards; therefore, the legal analysis that was conducted for Ghana to meet the Cancun Safeguard requirements was considered to be a crucial step to interpret or explain how the broad rights and duties embodied in the Cancun Safeguards text are reflected in the country. Overall, the assessment of the PLRs indicates that Ghana's legal framework is largely supportive of REDD+ actions, however, the results of the legal analysis and of the SESA clearly identify legislative and policy gaps which will require reforms.

Three of the most significant weaknesses that were identified are:

- Tree tenure arrangements for naturally occurring forest trees outside forest reserves where the farmers or landowners are not entitled to economically benefit from the trees. This is a great disincentive to encouraging shaded cocoa farming systems and in broader agro-forestry systems.
- The absence of a land-use plan for the country. the Land Use and Spatial Planning Act 2016 provides a general framework for the development of land use plans, the Act does not specifically address forested areas or agricultural lands as the focus is skewed towards urban and peri-urban plannin.
- The absence of a legislative instrument to propel the National Gender Act, 2012 is also a major gap, though the Constitution of Ghana does not permit discrimination on the grounds of gender.

Recommended reforms, which are essential to the overall success of the programme identified through the assessment of PLRs and their relation to safeguards requirements include:

- Passage of the Wildlife Resources Management Bill which will support effective implementation of the new Forest and Wildlife Policy (2012).
- Policy reform on tree tenure
- Policy reform on cocoa farm inputs
- Policies to address carbon transaction rights and benefit-sharing arrangements.

The full set of findings of the legal analysis are summarized in Table 57 (below), with an extensive and full description of the legal analysis available in link provided in Table 2. The full legal analysis outlines how the legal framework addresses each safeguard component on paper and in practice, the gaps with respect to PLRs on paper and in practice, and recommendations on how to address the gaps on paper and through implementation.

Table 57: Summary of the Analysis of Ghana's Policies, Laws and Regulations

Existing safeguards related Policies, Laws and Regulation	Gaps Identified	Recommendations on how safeguard relevant and related legal framework should be addressed
UNFCCC REDD+ safeguard (A): ***"That action complements or is consistent with the objectives of national forest programmes and relevant international conventions and agreements;"***		
In Ghana's Legal Framework[105], there is an implied duty for all stakeholders to ensure consistency of activities and interventions with the national forest programmes.	n/a	The drafting of a consolidated Forest and Wildlife Legislation, a provision be inserted that requires consistency as far as possible, of all forest plans, policies and programmes. The provision should also address procedures for addressing inconsistencies.
UNFCCC REDD+ safeguard (B): ***"Transparent and effective national forest governance structures, taking into account national legislation and sovereignty;"***		
The Administration of Lands Act and Environmental Assessment Regulations, provide for the dissemination of information on forestry events, issues and trends, but is also silent as to the mode of dissemination.	Ghana's Legal Framework contains limited provisions that define information.	It is also recommended that a public agency be mandated to ensure that public information is readily made available upon request.
Although there are no dedicated institutions for the dissemination of information, there are Constitutional bodies like the National Commission for Civic Education that is charged with educating the citizenry in all matters.	The Legal Framework in Ghana currently does not create a dedicated institution for the dissemination of information.	A requirement in law mandating an agency of state to disseminate and make public information particularly relating to the environment and natural resources.
Institutions or agencies for promoting public transparency are adequately provided for within the Legal framework of Ghana.	There is no clear legal definition of what amounts to corruption in Ghana.	Public agencies that are charged with the responsibility of ensuring accountability should be placed on an additional duty to make their findings from corruption investigations public, in order to deter others form abusing their offices.
The Legal framework in Ghana caters for a regime of a right to fair distribution of benefits arising from the use of forest resources. In some instances, the amount to be paid and who the beneficiaries of such payments are, have been clearly stipulated.	The categories of beneficiaries spelt out in the relevant legislation are broad (see constitution) and therefore subject to elite capture.	Future legislations may contemplate a situation where monies due to communities whose lands have been compulsorily acquired, are paid directly to the heads of these communities instead of the present regimes where such monies are being paid to the Administrator of Stool Lands, who is in the employment of the government.
UNFCCC REDD+ safeguard (C): ***"Respect for the knowledge and rights of indigenous peoples and members of local communities, by taking into account relevant international obligations, national circumstances and laws, and noting that the United Nations General Assembly has adopted the United Nations Declaration on the Rights of Indigenous Peoples;"***		
Constitutional provisions refer to traditional knowledge of local communities without providing a definition. The Constitution does recognize that there are local communities in Ghana who are subjects of a Chief that rules over them on the basis of a set of customary laws, which as a matter of fact, continue to evolve[106].	Constitutional provisions refer to traditional knowledge of local communities, although no express definitions are provided.	There is most likely a need to look at provisions in the Constitution that accords legal recognition to traditional local communities in the sense contemplated by some of the international agreements to which Ghana is a signatory. However, this is not a suggestion that the right of self-determination should be accorded to persons in these communities.

[105] The Legal Framework allows to meet this indicator through a combination of the Constitution and the Ghana Forest and Wildlife Policy.

[106] Constitution, Article 11 and Article 272

The Constitution provides for the collective ownership of timber rights by local communities. It states that all stool lands in Ghana shall vest in the appropriate stool on behalf of, and in trust for the subjects of the stool in accordance with customary law and usage.[107]	Although the PLRs recognize the payment of revenues collected on behalf of the stools to be paid, these are paid to institutions and thus the communities and subjects of the stool do not necessarily receive direct benefits of the revenue collected.	Future legislations may contemplate a situation where monies due to communities whose lands have been compulsorily acquired are paid directly to the heads of these communities instead of the present regimes where such monies are being paid to the Administrator of Stool Lands, who is in the employment of the government. Obviously, such legislation would also provide for a means of ensuring that all such monies are properly accounted for.
Constitutional[108] and Statutory[109] provisions combine to define the mechanisms for the sharing of the benefits arising out of the utilization of forest resources in a fair manner.	n/a	A flexible and inclusive benefit-sharing model should be developed with a clear structure for potential dispute resolution. Financial support should be provided to ensure its viability, as well as a good governance structure to ensure proper accountability.
UNFCCC REDD+ safeguard (D): ***"The full and effective participation of relevant stakeholders, in particular indigenous peoples and local communities;"***		
The Constitution recognises and guarantees generally, the public's right to participate in policy making.[110] This general right has been applied in the decision-making process in the forestry sector	The constitution does not define the procedure for this participation and international law procedures have not been domesticated on this issue The laws provide for public participation but do not clarify how these views are to be reflected in the final outcomes/decisions.	A review of the powers of the Minister under section 13 of the EPA Act, 1994 to ensure that he shall take into account, recommendations made by a committee consisting of persons with technical knowledge in environmental projects and their effects on the environments to ensure that the requirements of an EIA are strictly complied with at all times.
The Legal Framework makes provisions for the stakeholders' participation in decision making as far as Timber Resources Management and Environmental Assessment regulations are concerned.	There are no provisions that require that an assessment of the relevant stakeholders shall be conducted prior to the decision-making process.	legislation clearly requiring an identification/mapping of relevant stakeholders prior to the decision-making process
PLRs provide dispute resolution mechanisms that are equitable, transparent, accountable, independent, confidential and affordable (or free) and that respect customary justice systems	The PLRs make provisions for public participation but are silent on the incorporation of culturally sensitive traditional and community structures for decision making processes that are relevant to the forest sector.	N/a
UNFCCC REDD+ safeguard (E): ***"That actions are consistent with the conservation of natural forests and biological diversity, ensuring that the [REDD+] actions are not used for the conversion of natural forests, but are instead used to incentivize the protection and conservation of natural forests and their ecosystem services, and to enhance other social and environmental benefit;"***		
PLRs provide a clear definition for the term biological diversity in accordance with relevant international law.	The Laws [112]provide no clear definition of the term natural forests that do not allow for	Future Parliamentary enactments should include a clear definition of natural forests that do not lend themselves to monoculture plantation. Stakeholders in

[107] Constitution, Article 267 (1):

[108] Constitution of the Republic of Ghana, Article 267

[109] Administration of Lands Act, 1963 (Act 123), Section 18 and 19

[110]Constitution, Article 37. (2), Article 35 (6)(d), Article 240 (2), Article 125 (2)

The Wetland Management (RAMSAR SITE) Regulations provides a definition for ecosystem[111].	monoculture plantations. Forests or natural forests are not concepts that have been defined within Ghanaian laws.	the forestry sector should ensure that they develop policies that would form the basis of new enactments for this sector and that such policy briefs should contain a definition of these terms, and the rationale for so defining them
UNFCCC REDD+ safeguards (F) and (G)): ***"Actions to address the risks of reversals; Actions to reduce displacement of emissions."***		
The Land Use and Spatial Planning Act 2016 contemplates a framework for the development of land use plan.	Although the Land Use and Spatial Planning Act 2016 provides a general framework for the development of land use plans, the Act is not Forest specific, it is skewed more towards planning outside the forest areas.	Ensure co-ordination between the various agencies of state whose roles cut across forest and forest resources, There is a need for future enactments to contain provisions that places an obligation on all stakeholders to monitor changes in forest cover in Ghana
The Ghanaian legal framework provides for the sustainable utilization of forests and other relevant resources[113]. Liabilities and compensation for actions that affect the conservation and management of forests have been taken care of within the laws[114].	The present state of the PLRs does not make any provisions aimed at addressing the drivers of deforestation and forest degradation. Ghanaian PLRs make absolutely no provisions for alternative livelihoods for persons who are affected by the exploitation of forest resources in the communities where they live	The intendment of the drafters of the Ghana Forest and Wildlife Policy should be taken into account in future enactments on Forest laws by Parliament. Clear and unambiguous provisions must be made to adequately address this gap, and measures of punishing offenders should be included in such enactments. The Ghana Forest and Wildlife Policy promotes the development of viable forest and wildlife based industries and livelihoods, and this should be taken into account in future enactments.

[112] Forests Act, Section 2, Section 10, Section 17; Forest Plantation Development Fund Act, Section 22; Traditional Medicine Practice Act, Section 42;
[111] Wetland Management (RAMSAR SITE) Regulations, Regulation 10
[113] Constitution, Article 35 (6) (d) and Article 41 (k).
[114] Timber Operations (Government Participation) Act, 1972 (NRCD 139): Section 8(2), (3) and (4) (2); Forests Protection Act, 1974 (NRCD 243), Section 2; Trees and Timber Act, 1974 (NRCD 273): Section

14.1.3 Clarifying the Cancun Safeguards

The first draft of the clarification of the Cancun Safeguards within the Ghanaian context, which followed the legal analysis, was completed in March 2017 and is currently going through stakeholder review. It is expected that draft CAS roadmap, draft legal analysis of the Cancun safeguards and the draft clarification of the Cancun Safeguards will all be validated and final reports produced by the last quarter of 2017. This clarification is viewed as a more precise and substantive 'standard' against which Ghana will report on the extent to which it is ensuring consistency with the Cancun Safeguards during implementation of REDD+ and the GCFRP in Ghana and what the specific terms of the Cancun safeguards mean in the Ghanaian context.

The clarification of the Cancun safeguards presents Ghana with a very good basis to submit its first Summary of Information (SOI) to the UNFCCC. This first SOI will outline how existing country initiatives and programs are going to support and promote the Cancun Safeguards during the implementation of REDD+ policies and measures (PAMs). With a full and functional SIS expected to be developed and running by 2018, the next SOI would provide concrete information on how safeguards are being addressed and respected.

14.2 Description of arrangements to provide information on safeguards during ER Programme implementation

As part of the implementation of REDD+ and the GCFRP, the NRS and the Safeguards Sub-Working Group (SSWG) will continue to work in close collaboration with the EPA to ensure that safeguards information is available to the general public and to key stakeholders of the programme, and that the country fulfills its safeguards reporting requirements to the World Bank and the UNFCCC.

The arrangements that Ghana is actively putting in place include the development of a programmatic safeguards reporting structure with defined roles and responsibilities, the articulation of monitoring plans and indicators, and the development of a web-based safeguards information system.

The NRS's safeguard reporting structure for the programme extends from the HIA level up to the national level. Training programmes will be organized to build the capacity of all of the lead safeguards staff and officers, as well as HIA consortium partners and governing bodies, so that there is a full understanding of REDD+ safeguards to support best practice in implementation. Once trained, the safeguards focal persons and the Safegaruds Specialist will have primary responsibility for sensitizations, trainings, monitoring and reporting.

The responsibilities and reporting structure is described below and outlined in Figure 20 below. The terms of reference for the safeguards focal persons at all levels are now being drafted.

Data Sources:
Data will be collected from and in collaboration with the various consortium partners in each HIA, including private sector companies (licensed cocoa buying companies, chocolate companies and sector organizations, etc), government bodies (Cocoa Board district offices, FC-FSD district offices, community and farmers, traditional leaders, etc. As appropriate, data will also be sourced from higher level agencies and organizations, like the FC, when activities, policy reforms, or other interventions happen at the national or full programmatic level.

HIA & FC Safeguard Focal Points:
The first level of safeguards sensitization, data collection and data management responsibility will sit with the HIA Safeguard Focal Person (FP), who will be designated by the HIA and Consortium partners, and the National PMU Safeguards Specialist. The HIA Safeguard FP will work jointly with the FC Safeguard FPs at the FC District level. They will organize information sharing and any trainings and sensitizations on safeguards at the community and HIA level. With respect to reporting, they will also be responsible for data and information collection and, in collaboration with the various partners and stakeholders. Once collected, they will ensure that the data and information is checked and verified by the HIA partners before the HIA Safeguard FP sends it to the Regional Safeguard FP.

Regional Safeguard Focal Person:
The Regional Safeguards FP will be responsible for organizing safeguards activities at the regional and HIA level, managing safeguards data collection within relevant HIA, collating and analyzing data at a primary level, and communicating with the PMU. This person will sit in the FC Regional office and received safeguards data and information from the HIAs (and HIA Safeguard FPs) within the jurisdiction of the FC Region. This person will verify the data through interactions with the HIA Safeguard FP and the FC District Safeguard FPs, and then approve it and send it to the Safeguards Specialist at the PMU.

PMU Safeguards Specialist:
The PMU Safeguard Specialist will be responsible for operationalizing all safeguards aspects of the GCFRP and overseeing and organizing all activities related to safeguards trainings, monitoring, and reporting within the programme area. This person will receive all of the safeguards information and data from the Regional Safeguards. The Specialists will review and further analyze the data as required, provide final verification, and where questions or gaps arise, will work with the Regional FPs to make corrections and improvements. The PMU Safeguard Specialist will then send the programme's safeguard information and data on to the National Safeguards Specialist for final validation and approval, with the knowledge of the Head of the NRS.

National Safeguards Specialist:
At the national level, the Safeguards Specialist will oversee the entire REDD+ safeguards programme, including all safeguards activities, monitoring, and reporting related to the GCFRP. This person, in concert with the Head of the NRS, will give final validation of safeguards information and then trigger reporting to the EPA for the UNFCCC, the World Bank, and enable web-based publication and updates into the safeguards information system (SIS) for the public and for stakeholders.

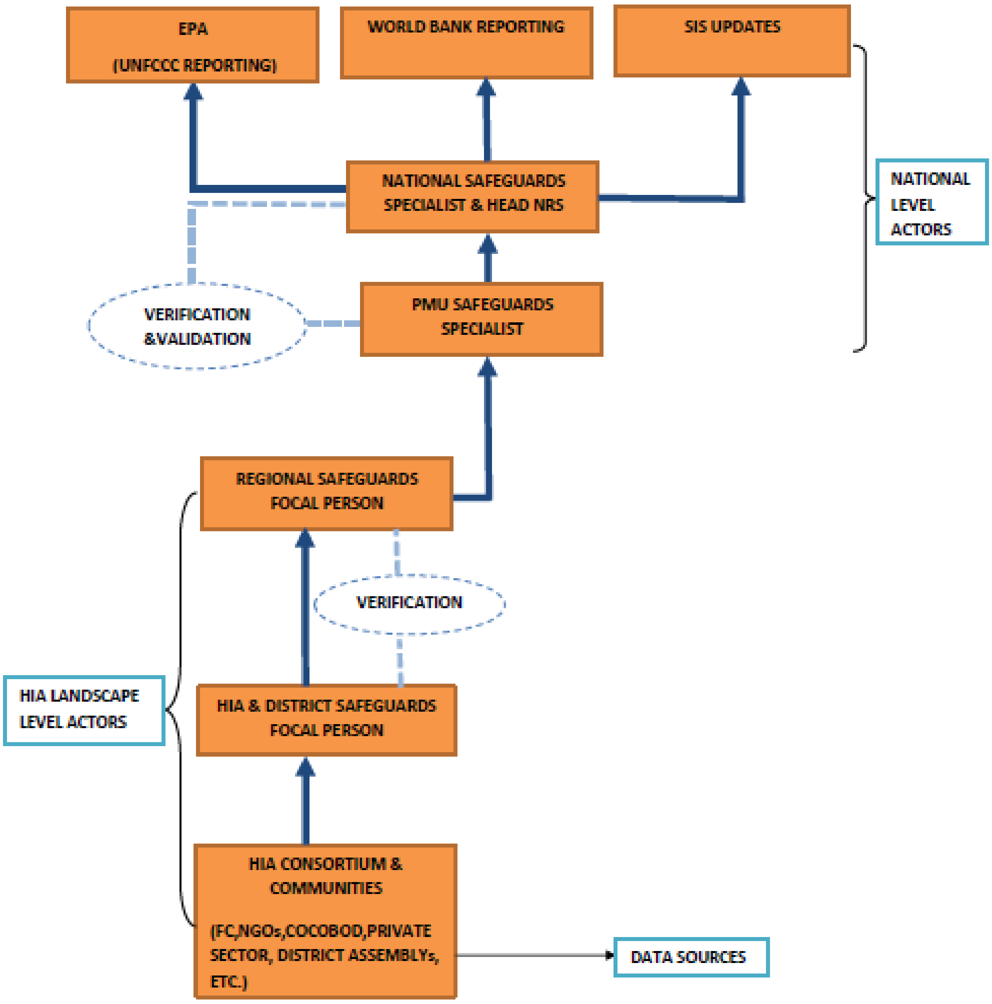

Figure 20: Ghana's safeguards reporting structure

Progress updates to the World Bank

Included in the various safeguards documents that have been prepared for Ghana's REDD+ programme and the GCFRP are a series of monitoring and evaluation plans. The sections of these documents identify environmental and social monitoring issues, verifiable indicators, and the responsible institutions. Section 9 of the ESMF for the REDD+ mechanism, Section 9 of the RPF for the REDD+ mechanism, Section 9 of the FIP ESMF, and Section 5 of the FIP PMP all detail the associated monitoring and evaluation plans and time frames. All of these documents are available on the FC website (www.fcghana.org/nrs). The safeguards officers with the NRS will ensure that the monitoring programme provided in the safeguard documents are implemented and where necessary, a Ghanaian environmental and social consulting firm will be engaged to assist with the provision of information on safeguards during implementation. The FIP has already procured an environmental and social consulting firm to assist the MLNR and the implementing agencies (FC, Cocoa Board and FORIG) with the provision of information on safeguards during implementation of FIP interventions to ensure that safeguard issues are not ignored or sidelined.

Reporting to UNFCCC
Ghana has made very good progress on safeguards through its readiness process, efforts towards national communications, and development of the GCFRP. In particular, Ghana's Gender Roadmap titled "Roadmap to mainstreaming gender considreationn into Ghana'REDD+ process"[115], which IUCN-Ghana developed in partnership with the NRS, has been commended as an example of REDD+ best practice on safeguards. Given this accomplishment and other achievements, Ghana intends to submit its first SOI to the UNFCCC by the end of 2017. To support this communication and to ensure effective implementation of the GCFRP, Ghana has made significant progress in building a SIS.

Development of the Safeguards Information System Platform
The NRS engaged a Ghanaian environment and social consultant firm to develop a web-based platform to host its SIS for the GCFRP, and more broadly for Ghana's REDD+ mechanism. The SIS will report on safegaruds for the GCFRP and provide information on how safeguards are being addressed and respected throughout the implementation of activities. The aim of the SIS platform is to ensure full transparency and accountability with respect to implementation of the GCFRP. The SIS, which will be web-based, will enable local, national and international stakeholders to effectively monitor Ghana's compliance with REDD+ safeguards. It also aims to facilitate efficient and accurate reporting to the World Bank, and to the UNFCCC (via Ghana's EPA) thru summary of information (SOI) reports.

The development of the SIS began in 2016, and to date has resulted in the completion of a prototype platform structure and system. Figure 21 (below) indicates the SIS development process being adopted by Ghana. Ghana has completed the first two steps (1. Define Scope of SIS; 2.Establish Institutional & Governance Arrangements), and is in the middle of the third step (Identify Indicators). Steps four (Collect & Analyze) and five (Report and Use) will only happen once implementation is underway.

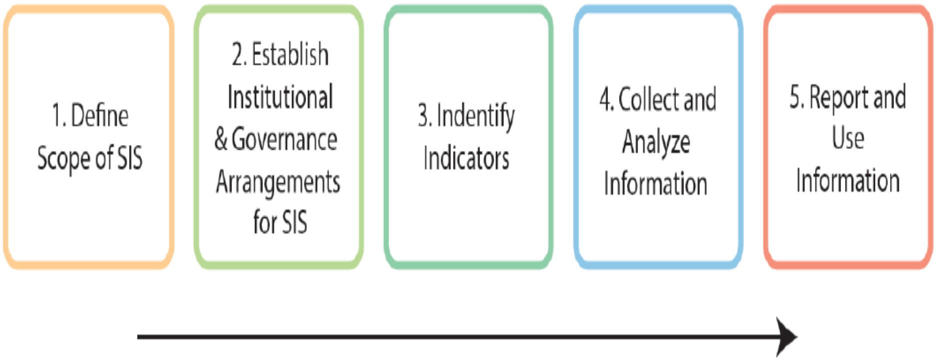

Figure 21: SIS development process[116]

As part of Step 3, and to complete the development of the SIS on-line system, Ghana will finalize the indicators, bring the platform "live" onto an agreed domain, test the system in order to make any necessary modifications, and then begin populating it with safeguard indicators that will be monitored at the various levels (HIA to national). Some of these indicators are known, including those related to the ESMF, while others are now being articulated, as evidenced by on-going work to develop the BSP. The partnership with SNV will contribute to this process by helping Ghana to identify the specific data needs, specific information sources, and specific monitoring indicators.

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[115] https://cmsdata.iucn.org/downloads/ghana_gender_and_redd_road_map_press_copy_final.pdf
[116] Source: Durban et al. 2014

Broadly, the SIS will report on the following indicator areas:

- Cancun safeguards;
- ESMF process, policy, and outcome indicators on risks, opportunities and how they are being addressed from the project to national levels;
- GCFRP benefit sharing
- Co-benefits;
- FGRM: Indicators on grievance redress (conflicts and resolutions)
- Additional indicators that will be determined to support effective implementation, as required.

The SIS has been developed to have two access areas; the front end which is open to the general public without any access credentials, and the backend which is accessible to only authorized and authenticated staff.

The front end, on-line area will contain multiple features, including a home page, information about SIS, GCFRP interventions (activities), publications, and consultations.

Figure 22: SIS Homepage

The back-end, user authorized area, will support the sharing of information about activities (activities), the sharing of documents with safeguards information (media), a setup module that provides a link to dynamically configure key controls in the SIS (setup), a user page that provides tools for user management such as permission, adding, edit, and deleting users (users), a reports module that provides information on activities undertaken under each major intervention (reports), a configuration module that allows authorized users to perform manual back and some configuration of forms (configuration), and a security feature that provides an audit trail of all activities on the SIS (security log feature).

Examples of some of these modules built into the SIS web-based system are shown in Figure 23 to Figure 25

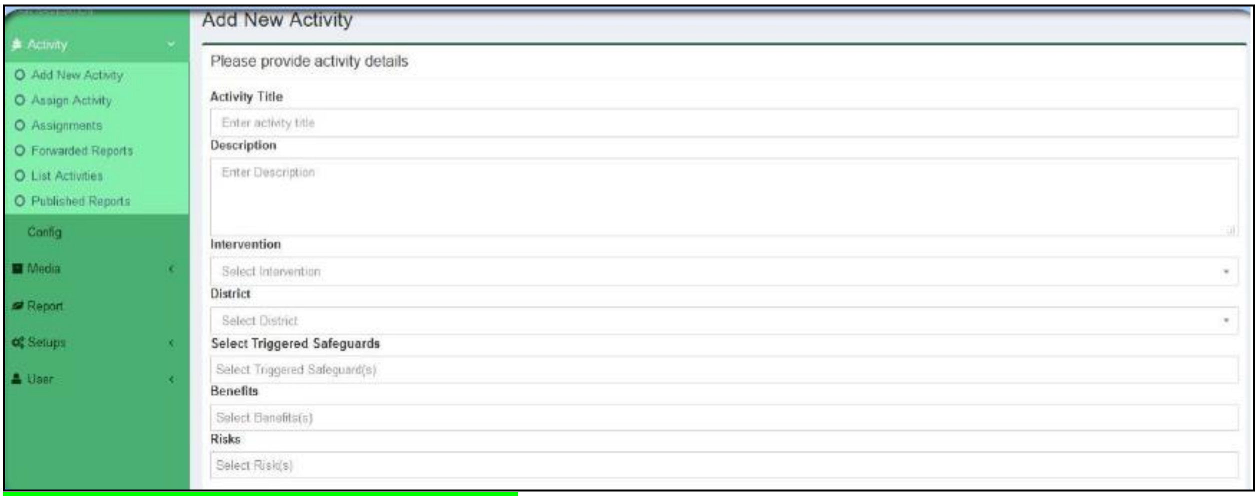

Figure 23: SIS back-end activity report page

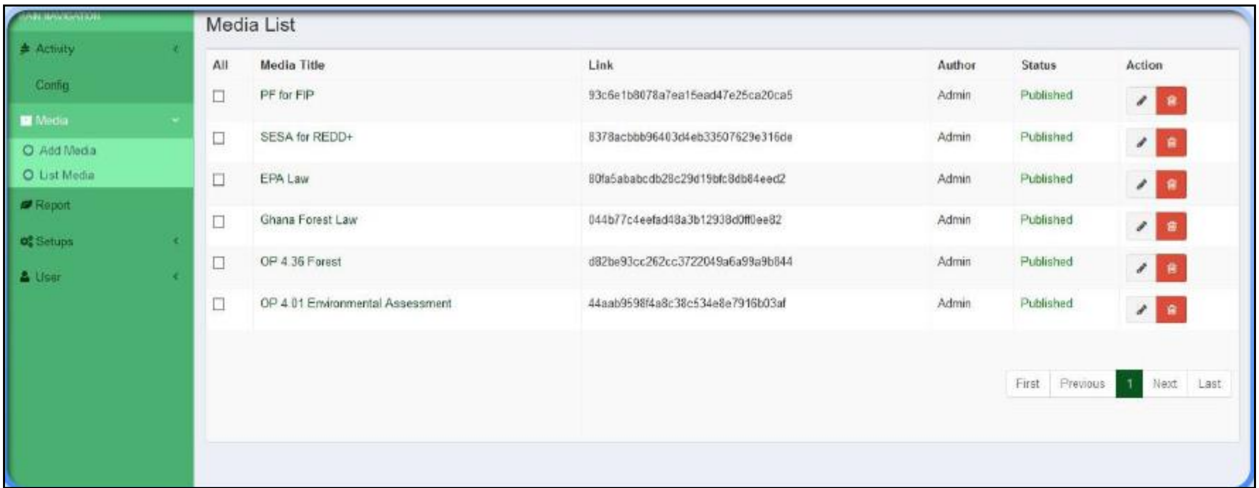

Figure 24: SIS back-end media list

log_user_id	zlog_activity	zlog_type	zlog_action	zlog_date	zlog_ip_address	zlog_pi
22	Hilma Kwakye made a report on Activity with id '5'...	Activity Report	Update Activity Report	2016-09-09 05:56:43	::1	147340
22	Hilma Kwakye made a report on Activity with id '5'...	Activity Report	Update Activity Report	2016-09-09 05:55:32	::1	147340
22	Hilma Kwakye made a report on Activity with id '5'...	Activity Report	Update Activity Report	2016-09-09 05:55:21	::1	147340
18	Gideon Boakye made a report on Activity with id '5...	Activity Report	Update Activity Report	2016-09-09 05:53:44	::1	147340
20	Michael Agyei made a report on Activity with id '5...	Activity Report	Insert	2016-09-09 05:49:37	::1	147340
22	Hilma Kwakye assigned Activity with id '5' on 2016...	Activity Assignment	Insert	2016-09-09 05:46:16	::1	147339
22	Hilma Kwakye edited 'Enrol farmers onto the scheme...	Activity	Update	2016-09-09 05:45:03	::1	147339
22	Hilma Kwakye edited 'Enrol farmers onto the scheme...	Activity	Update	2016-09-09 05:39:45	::1	147339
1	Redd+ Admin changed the details of user 'Michael A...	User	Update	2016-09-09 05:17:09	::1	147339
1	Redd+ Admin changed the details of user 'Gideon Bo...	User	Update	2016-09-09 05:16:01	::1	147339
1	Redd+ Admin added a new user 'Hilma Kwakye' to the...	User	Insert	2016-09-09 05:11:22	::1	147339
1	Redd+ Admin changed the details of user 'Amina Bin...	User	Update	2016-09-09 05:10:15	::1	147339
1	Redd+ Admin added a new user 'Ama Amoah' to the us...	User	Insert	2016-09-09 05:08:14	::1	147339
1	Redd Admin changed the details of user 'Redd Admin...	User	Update	2016-09-09 05:06:53	::1	147339
1	Redd Admin changed the details of user 'Prince Sen...	User	Update	2016-09-09 05:06:15	::1	147339

Figure 25: SIS security log feature

14.3 Description of the Feedback and Grievance Redress Mechanism (FGRM) in place and possible actions to improve it

Ghana has initiated the necessary steps to define its Feedback and Grievance Redress Mechanism (FGRM) for receiving and resolving REDD+ related grievances within the GCFRP accounting area from affected individuals or communities. In the 2014 FGRM/DRM (Dispute Resolution Mechanism) consultancy report, it was proposed that the scope of the Alternative Dispute Resolution (ADR) Act, 2010 (Act 798) be amended to allow for the Act to cover environmental disputes. This was because the Act created the legal framework through which the dispute resolution processes of arbitration, mediation and customary arbitration could be used to resolve disputes that produce legally-binding outcomes as an alternative to the formal court system that was slower, expensive and complex to the rural dwellers. As part of the 2014 consultancy, it was also proposed to set up dispute resolution teams, conditional upon agreements with the key stakeholders such as landowners or land users. Specifically, this included the development of District Dispute Resolution Teams (DDRT), Regional Dispute Resolution Teams (RDRT) and National Dispute Resolution Team (NDRT). The district, regional or national teams were to be made up of traditional leaders, as well as a representative from the district assembly, religious leaders, District Forest Managers, and/or other opinion leaders. The composition of the District Dispute Resolution Teams was to be decided through the NRS with input and support from local stakeholders. The higher level teams were to be similar in composition to the DDRT, and were to be convened to resolve disputes and conflicts that emerge at higher levels. A Regional Dispute Resolution Team was to include an appropriate representative of the Regional Coordinating Council, the Regional Forest Manager, the Paramount Chief or high level Traditional Authority, and other opinion leaders.
Other recommendations that came out of this consultancy included a sector-wide stakeholder consultation on the proposed mechanisms, and the drafting of a formal amendment to the existing law to allow for environment or forestry issues to be settled through formal ADR channels (ADR Act 2010). These recommendations were taken up and a consultancy was awarded in 2016 to develop operational modalities for the FGRM and to propose the review and amendment to the ADR Act (2010) to include environmental issues. Originally, environmental issues as a whole were excluded from the ADR so as to reduce the associated complexities and to ensure that potential criminal acts related to forestry issues did not “escape” the full prosecution under the law. However, in doing so, many non-criminal issues were effectively excluded. And yet, resolving them through the courts tends to be a lengthy and costly process. For this reason, the amendment of the ADR Act with respect to REDD+ was intended to help resolve delays in dispute resolution and provide legal backing to associated resolutions and decisions.

Through the 2016 consultancy, it has however emerged that it could take up to five years for Ghana to review and amend the ADR Act (2010), by which time REDD+ implementation would be well underway. Given the imminent implementation of the GCFRP and the valid concern about the length of time it would take to amend the ADR Act, the FGRM consultancy (2016) recommended the quicker option of developing regulations under the Forestry Commission Act, 1999 (Act 571) to establish an FGRM. This is because the processes require fewer resources and involves a smaller number of stakeholders. Critically, the effort will be spearheaded by the MLNR. As the Ministry that is responsible for this sector, the MLNR would be able to pursue the amendment of the FC Act 571 and the inclusion of an FGRM with the urgency that it requires. This is as opposed to the ADR Act, which falls under the purview of the Attorney General’s Department and Ministry of Justice, which is the ministry responsible for overseeing the implementation of and amendments to the ADR Act. There the matter is unlikely to garner the required attention as forestry issues are not a principal area of focus for the Attorney General’s department.

Discussions to amend the FC Act 571 are already underway in light of other issues that require amendments. This process is being led by the MLNR and it would be relatively simple to add the additional of an FGRM structure and process to the amendment. Under normal circumstances, effecting the FC Act amendment would take approximately 2 to 3 years, although there is the possibility of a one year fast-track. In order to facilitate a faster amendment to the FC's Act 571, a certificate of urgency will need to be obtained and this is determined by the Parliamentary Select Committee on Forestry. The Parliamentary select committee has been engaged by the NRS and they have shown commitment and support to ensure that the Act is amended accordingly and in a timely manner.

Even with the certificate of urgency, GCFRP implementation will start before the FGRM is legally adopted. Therefore, as an interim measure, and building from the modified structure proposed under the 2016 consultancy, the programme will begin to pilot the FGRM structure and process under the authority and traditional jurisdiction of designated Traditional Authorities (chiefs and queen mothers) within the HIAs, and with the support of other highly respected individuals of high ethical and moral standing, including religious leaders, District Assembly members, upstanding opinion leaders and other stakeholder representatives so the disputing parties have their grievances addressed.

A significant strength for the FGRM and for the proposed interim structure, is that traditional Chiefs, Elders and ''Queen Mothers'' already operate as recognized institutions for dispute resolution within their traditional jurisdictions, and have always been the "first port of call" in settling local level disputes and acting as agents of change at local, regional and national levels since time immemorial. Furthermore, the role of Chiefs and Traditional Authorities is already recognized under Ghana's Constitution, which supports the implementation of customary law. As such, their role in conflict resolution through mediation and arbitration is both key and appropriate on both cultural and legal grounds. Religious leaders also serve as important mediators of social and economic disputes amongst their congregations and followers, and respected opinion leaders also frequently facilitate resolutions or participate in mediations with the TA or religious leaders.

Furthermore, as stipulated in the R-PP, "the principle of subsidiarity will be used in establishing conflict resolution structures, with conflicts being addressed at the lowest or most localized level as appropriate. Should a large number of conflicts specific to the programme and REDD+ occur or it prove difficult for issues to be resolved at lower or localized levels, conflicts can be escalated to higher levels". The proposed structure for grievance redress and conflict resolution is described below, in the following sub-section.

14.3.1 FGRM Structure and Operational Guidelines

Draft operational guidelines for addressing forest and REDD+ related grievances have been developed in consultation with key stakeholders, and a final version has been completed, which will receive broader national stakeholder validation in the coming months.

FGRM Structure

To date, the existing practice is for forest users to report infringements of the principles and standards of the Forestry Commission Charter to the Customer Service Officers (CSO) at the FC's district offices and have them dealt with at this level. These complaints are limited to infringements of the provisions of the Charter and not forest grievances as a whole. In addition, recurring conflicts between FC officials and forest users make it imperative that the FGRM that is being created has autonomy and includes a wider array of mediation stakeholders. Therefore, it is proposed that each HIA will have a Dispute Resolution Team (DRT) made up of between 7 and 9 members. As much as possible the HIA body will be gender sensitive and have a good representation of both men and women. The HIA dispute resolution body will be hosted by a respected representative of the Traditional Authority with jurisdiction in the area of the HIA and co-convened with a trained FC Dispute Resolution Focal Person (DR Focal Person) at the FC district level. Other members of the HIA DRT will likely include (as appropriate) a respected religious leader, a representative from the HIA Consortium (CSO, private sector), a representative from the Cocoa Board district office, the local Assembly Person to the District Assembly, and opinion leader representatives of marginalized or minority groups.

The HIA DRT will sit on a regular basis to help resolve grievances. Should the body be unable to resolve any dispute, the grievance will be channeled to a 5-member panel of arbitrators at the national level. The rationale is not for the HIA DRT and Focal Person to take over the role of chiefs in dispute resolution, but for it to complement their work while also ensuring that people's rights are respected and met. A PMU FGRM Coordinator and the National Safeguards Specialist will manage a roster of mediators and arbitrators who would be empaneled as and when disputes need to be addressed at the national level.

An FGRM desk with an FGRM Specialist has been set up at the NRS with oversight from the National Safeguards Specialist. Together, they will oversee all aspects of FGRM trainings and implementation in the GCFRP, and in other programmes or localities in the future. They will also follow and support the amendment process, and ensure reporting on FGRM process and outcomes. At the level of the PMU, there will be a PMU FGRM Coordinator who oversee the process at the programme level and will be responsible for receiving complaints from the district DR Focal Person. FGRM forms have been developed by the consultant and there are efforts underway to synergize the FLEGT/VPA and FIP complaint forms as these programs are interlinked.

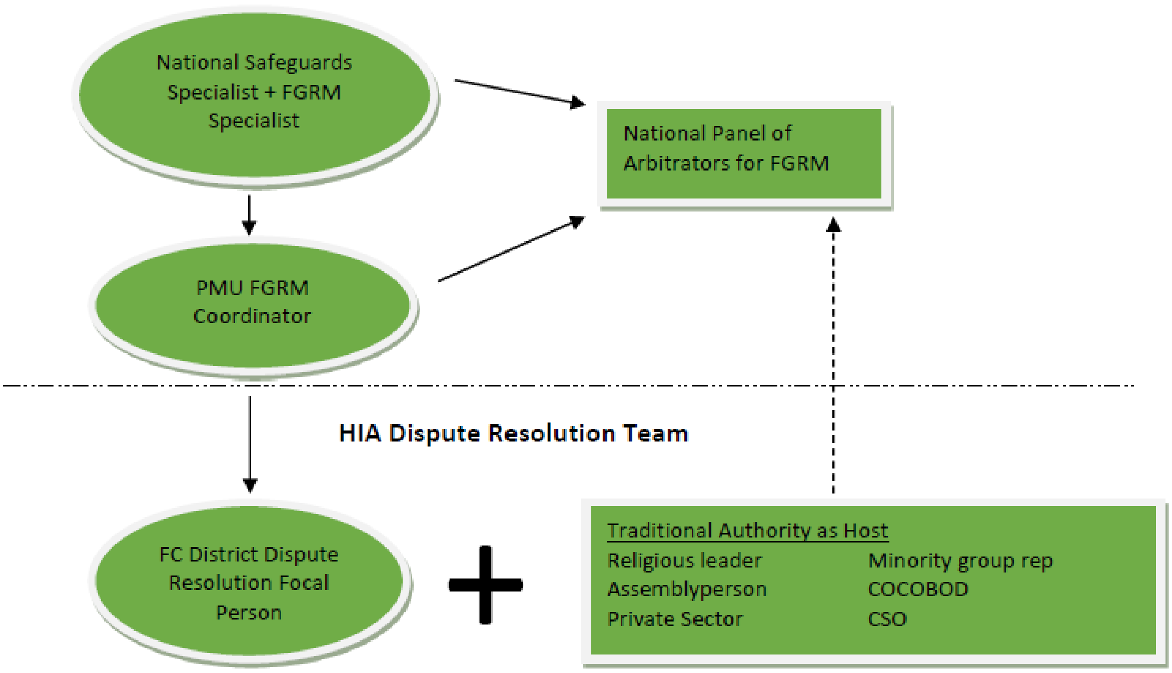

Figure 26: FGRM structure and operational bodies

FGRM Operational Guidelines

In order to effectively operationalizing the FGRM, training, continued capacity building, and a general broadening of understanding is required. The NRS will oversee trainings for the PMU FGRM

Specialist, the identified national arbitrators, and the selected members of the DRTs on the FGRM, mediation and conflict resolution principles, forestry laws, and REDD+ and the GCFRP. The NRS and the PMU will also oversee negotiations with the Traditional Authorities and other key stakeholders and opinion leaders in each HIA to negotiate the adoption of this structure and process. As adoption of the FGRM moves forward as an amendment to the FC Act, the NRS Safeguard Specialist and the PMU FGRM Specialist will also ensure that learning from the piloting process is incorporated into the recommended amendment, and that the DRTs in each HIA are kept abreast of the legislative process and any prospective changes to the structure.

More broadly, from previous studies and surveys on capacity building needs in relation to REDD+, it is clear that despite extensive consultations at national, regional, district and local levels, there remains a gap in knowledge about REDD+ and climate change issues among stakeholders, like farmers and communities, and within sub-national institutions that include the district assemblies and the traditional authorities. Growing the understanding of communities and institutions within the target areas of the GCFRP on REDD+ and the ERP is important for enabling the implementation of the FGRM process. In order to fill the above gap, there is a plan to hold trainings at appropriate levels and locations aimed at expanding people's understanding and building the capacity of key institutions, organizations, bodies, and individuals. These include, relevant ministries and agencies, NGOs, private sector and other interest groups, local communities, district FGRM officers, HIA DRT members, FC Range Supervisors, Metropolitan Municipal District Assembly members (MMDAs) within the ER Program area (once the consultancy is completed).

Broadly, the FGRM will be operationalized in five steps.

1. Parties seeking to have any REDD+ dispute resolved would file their complaint with the district or community FGRM officer within the ER project area where it will be received and processed.

2. If the parties are unable or unwilling to resolve their dispute through negotiation, fact finding or inquiry a mediator chosen with the consent of both parties would be assigned to assist the Parties to reach a settlement.

3. Where the mediation is successful, the terms of the settlement shall be recorded in writing, signed by the mediator and the parties to the dispute and lodged at the FGRM registry. The terms of the settlement will be binding on all parties.

4. If mediation is unsuccessful, the HIA dispute resolution team will convene to mediate and resolve the grievance.

5. If the mediation is unsuccessful, the Parties will be required to submit their dispute for compulsory arbitration, by a panel of 5 arbitrators, selected from a national roster of experts. The panel of 5 arbitrators will be composed of a qualified arbitrator, a lawyer, a forestry/natural resource expert, a traditional authority and a governance expert with at least 1 of them being a woman.

5. The awards of the arbitration panel will be binding on the Parties and can only be appealed to the Court of Appeal. All questions of law would be referred to the High Court.

For the purposes of the FGRM, REDD+ related grievances and relevant issues include: disputes relating to activities being promoted under the programme; disagreements about land rights or tree tenure; disputes relating to benefit sharing arrangements; disputes relating to participation in decision-making processes; disputes relating to access to and user rights of land, trees, and forests;

disputes related to gender inequality or migrant-local issues; and disputes related to access to resources. Examples of the nature of conflicts that might arise from the implementation of REDD+ is presented below.

- Land clearing for agriculture –Analyses of the drivers of deforestation and forest degradation suggests that expansive cocoa cultivation represents a major driver of emissions in the high forest zone (HFZ) and that encroachment into Forest Reserves and other protected areas is problematic. Through the development and implementation of land use management planning at the HIA level, the programme aims to reduce these patterns through community-based decision making and leadership. However, it is possible that given the current trends, conflicts or disputes could still occur, possible between FSD, farmers, landowners, and/or local fringe-communities and migrants.
- Tenure conflicts and/or boundary issues – The integration of REDD+ activities into existing tenure arrangements could result in new relationships or agreements between key actors like the state, traditional authorities and community stakeholders. If not carefully negotiated, it could create the potential for conflict. In addition, issues related to boundaries, land use, and user rights to tree and land could become more contentious and any latent conflicts or boundary disputes could be revived among traditional authorities, tenant farmers and landholders. If carbon rights are bundled with tree rights, then the existing confusion about tree ownership rights are likely to renew conflicts between the farmers, and landowners.
- Conflicts over tree rights – With the emergence of carbon-based benefits, whether perceived or real, concerns and grievances will emerge if there are no clear and secure tenure rights over trees. Lessons from existing benefit-sharing schemes in the natural resource sectors and as a result of the implementation of early REDD+ pilot projects (for example, IUCN-Ghana's work in Western Region) underscore the importance of well-defined tree tenure regimes with effective and equitable distribution of benefits. Especially in the initial months and year of implementation, as new tree tenure arrangements are implemented, there is the distinct possibility that conflict or disputes could arise.
- Benefit-sharing – The NRS has been very conservative in its consultations and sensitizations on REDD+ and the potential benefits. Nonetheless, as implementation begins perceptions of what benefits should accrue, to whom, and how could lead to conflicts. Clear discussions and agreements at the HIA level on carbon and non-carbon benefits will be crucial. But even when the BSP is clear and agreement is reached at the local level, conflicts can still emerge over time, as has happened with other legally backed benefits sharing arrangements, like that of the Social Responsibility Agreements (SRA) under legal timber operation. The FGRM will be important in helping to clarity issues and resolve conflicts.
- Gender Equality - Consistent with the National REDD+ Strategy, mainstreaming gender and equity concerns at all levels and in all decision making, particularly within HIAs, is key. The REDD+ Gender Road map will lead to the formulation of a gender strategy for REDD+ which would apply to the GCFRP. However, it is possible that groups who tend to carry less "power" within society (e.g. marginalized groups) such as women, children and migrants could feel that their interests are not adequately reflected in the HIA decision-making process, in the implementation of activities or in the sharing of benefits. The FGRM would provide an avenue to address and resolve these concerns and grievances. The NRS recognizes that the FGRM consultation process has to be gender sensitive to guide the engagement process of these groups. The proposed FGRM process should also be transparent, impartial, safe, timely, accessible, and provide special attention to women, the poor and marginalized and/or vulnerable groups.
- Forest Access- Access to the forest and user rights have also been the cause of disputes that sometimes attract the intervention of the police, military and law courts for settlement and

enforcement. Grievances about forest-user rights are also expressed on issues such as the illegal extraction of forest products, influence of elites, inequitable resource distribution and exclusion of resources to marginalized groups, including women.

- Access to resources- Access to resource, including CSC farming packages, insurance, extension and training are important elements of the BSP. It is possible, that as implementation begins, farmers or communities could context their access to the resources laid out in the GCFRP plan and how effectively they have been shared.

The proposed FGRM procedures and modalities for implementation within the ER programme is shown in the figure below (Figure 27). There are different modes for receiving complaints from aggrieved persons at the local level. Complainants can either choose to register their grievance with a designated Traditional Authority, or with the FC district DR Focal Person. Once a complaint is registered and assessed, receipt of the complaint is acknowledged back to the complainant, and an action along the appropriate channel for resolution is proposed. If the complainant does not agree on the recommended action, then it goes for review. Records of each step should be kept and remain within defined time frames.

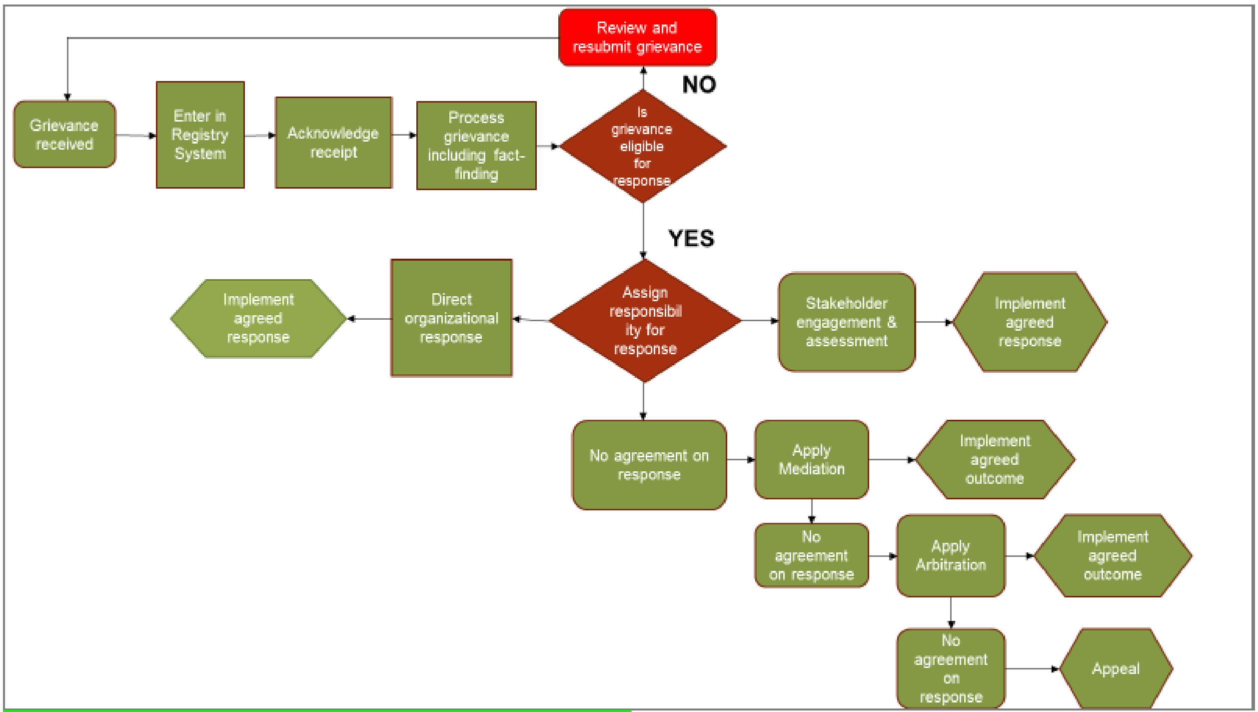

Figure 27: Proposed FGRM procedures and processes

Major Step 1: Receive and Register Complaints

i. Anyone affected by the implementation of the GCFRP programme is competent to make a complaint.

ii. All aggrieved persons with complaints related to GCRFP implementation should have the opportunity to register it with the TA or with the FC DR FP or FGRM desk at the national level.

iii. The district level DR Focal Person shall receive and collate the grievances or concerns of a complainant.

iv. Complaints can be received orally but must be recorded in writing by a representatives of the TA or the district DR Focal Person.

v. All complaints shall be recorded on a standard complaint form (FGRM Form A1) which must be submitted to the PMU FGRM Coordinator irrespective of whether the complainant is seeking redress or not.
vi. Where the complainant is illiterate, the district DR Focal Person or another literate individual nominated by the complainant shall complete the FGRM Form A1, read to the complainant what has been written and have them sign or thumbprint to indicate their approval of the written account, after which the FGRM Officer will also sign.
vii. A signed or thumb printed FGRM Form A1 is considered 'submitted' by the complainant. Where the complainant is a group/community/company, the person signing the complaint must be competent as a legal representative, however its own rules define it.
viii. The FGRM officer who receives complaints orally or in writing must complete the FGRM Form A1, sign and register it in the official complaints record book, noting date of receipt, complainant, handling officer and assign a case ID within a day before submitting those details to the head office within 3 days
ix. For purposes of uniformity, a case ID will follow the following format: District Code/year/00+number following in a chronological manner
x. A completed form that has been assigned a case ID is considered 'received' and must be processed
xi. Where there is a networked electronic registry accessible to the FGRM district DR Focal Person, the case shall be logged into the registry within 2 days
xii. Thus the processes of receiving and registering complaints at the District FGRM office MUST not exceed 3 working days.

Major Step 2: Acknowledge, Assess and Assign

i. All complaints received must be assessed for eligibility using an eligibility criteria that ought to be developed, before they are processed through the FGRM and assigned official responsibility within 3 working days
ii. The complaint, the reply and the decision on eligibility should be acknowledged, either through email, written letter, in person, telephone or, SMS
iii. The decisions on eligibility and actions assigned must also be recorded in the official District complains record book.
iv. In all cases, it is mandatory for the FGRM Form 2B to be completed
v. The FGRM officer is responsible for the assessment of the complaint and the reply. They may co-opt other people for the purposes of the assessment to propose a response and the response shall be recorded on FGRM Form 2B
vi. The party whom the complaint is made against ("responding party") must be notified of the complaint against them and invited to reply within 7 working days of receipt of complaint.

Major Step 3: Propose Response

i. Based on the assessment report recorded in FGRM Form 2B, the grievance redress strategy (including a clear statement of what must be done, by who and within what time) proposed will be communicated to the Parties, either directly or through the submitting FGRM district DR Focal Person within 14 days of receipt of complaint.

ii. The proposed action may involve negotiations between the Parties, direct actions by the FC or with other stakeholders to deal with the subject matter, or referral to an ADR process

iii. The agreed action shall be communicated to the relevant officer/persons/institutions for implementation by completing the FGRM Form 3C directing the action to be taken, stating what should be done, who should do it, when it should be done and when a report is to be submitted.

iv. In the event that mediation is proposed, the Parties will jointly select or agree on the method for selecting the mediator from the roster of mediators. In the absence of an agreement, the mediator will be chosen by the DR Focal Person.

v. A memo shall be written by the District DR Focal Person within 3 days after receipt of consent of complainant to the proposed action.

vi. Where the grievance has not been successfully resolved through mediation, the dispute will be referred for compulsory arbitration by the DR Focal Person.

vii. In the compulsory arbitration, a 5-member ad-hoc panel[117] consisting of a qualified arbitrator, a lawyer, a forestry/natural resource expert, a traditional authority and a governance expert with at least 1 of them being a woman will be constituted.

viii. Subject to the provisions of the Alternative Dispute Resolution Act, 2010 (Act 798), the panel shall be constituted by the parties or in absence of agreement, by the national coordinator of the FGRM from a roster of arbitrators maintained by the national coordinator.

ix. Awards by the ad-hoc arbitration panel shall be in writing and binding on both parties

Major Step 4: Closed Out

i. A dispute will be considered 'closed out' if the settlement terms have been implemented or a party files an appeal at the High Court, in which case the resolution of the case leaves the ambit of the prescribed FGRM

ii. Where the dispute has been fully settled and the terms implemented, the dispute would be considered to have been effectively resolved and recorded as such in the district and national FGRM records/database.

iii. Where one Party disagrees with the award, the Party may file an appeal at the Court of Appeal upon limited grounds such as on questions of law.

[117] the membership here is revised from the panel contained in the 2014 DRM Report

15. BENEFIT-SHARING ARRANGEMENTS

15.1 Description of benefit-sharing arrangements

The GCFRP is expected to generate monetary and non-monetary benefits. The Government of Ghana has conducted a thorough assessment of existing benefit sharing options within the forestry sector and their possible applicability to REDD+ benefit sharing, through extensive consultations during readiness. This section describes the GCFRP's draft Benefit Sharing Plan, outlining the source and type of monetary and non-monetary benefits, eligible stakeholders with rights and responsibilities, the terms of contribution, and the allocation of benefits.

The plan is based on the following five principles:

- VOLUNTARY PARTICIPATION: While no obligation or restriction of use is imposed on any private stakeholders (, participation will be encouraged through benefit incentives as well as continued stakeholder engagement;
- INCLUSIVE AND EQUAL ACCESS: Land owners, land users, local communities, and all stakeholders who are directly affected by the ER Programme are eligible for participation without discrimination on the basis of gender;
- TRANSPARENCY: The BSP is built and designed from within / by stakeholders and communities including women and vulnerable groups; its results, in terms of substance and process, are shared in detail with the public;
- EQUITY AND FAIRNESS: Benefits are shared equitably among stakeholders without discrimination to women and vulnerable groups, differentiating solely on the basis of different levels of contributions;
- RETURN FOR EFFORTS: REDD+ benefits are not rent-based revenues, but the return for efforts made by stakeholders.

The institutional/governance structure and the key components of the BSP has been described in Figure 29 and Table 59.

15.1.1 Types of benefits, financing mechanism and scale of benefits

The BSP proposes to distribute both monetary and non-monetary benefits to identified beneficiaries. The plan is designed such that direct programme participants (e.g. HIA farmers, HIA communities, HIA TA, and government institutions) who undertake activities that reduce emissions and enhance carbon stocks in the landscape receive monetary/non-monetary carbon and non-carbon benefits, while indirect participants (e.g. the "collective" HIA, including all communities, non-farmers, non-forest users, etc) within the programme area receive non-monetary benefits in the form of access support for community development projects of their own designation. The logic of this plan is to sufficiently incentivize, support, and appreciate activities and behaviors changes that result in land use practices that produce emissions reduction and effectively fosters wider legitimacy for REDD+ activities in the programme area. The plan also aims to directly support elements of programme management, implementation of activities, and monitoring, without which the programme could not function and which directly result in behavior changes or other key practices that lead to emissions reductions.

In terms of a financing mechanism, the BSP proposes the establishment of a Dedicated Fund (DF) with oversight by an independent Board drawn from relevant stakeholder groups and managed by an independent financial management institution. Payments from the Carbon Fund will be paid to the MoF, and then directly channeled into the DF. In a post-ERPA future, other payments or results based finance from bilateral, multilateral sources, as well as earnings from the potential sale of ER credits in compliance markets could also be paid into the DF.

Fifty percent (50%) of the Fund's accruals will be used to support key activities that directly influence emissions reduction and carbon enhancement in the programme area. The key activities include training and capacity building of participating farmers on adoption of Climate-Smart Cocoa (CSC) practices, on-farm tree management, provision of tree seedlings, and capacity building in improved law enforcement of forestry personnel and key law enforcement agencies, implementation of improved law enforcement, and support to programme monitoring (MMRV, SIS, FGRM). Post-ERPA, when the level of investment in the key activities may declines upon increased adoption of appropriate land use practices and improved capacity in law enforcement, the fifty percent (50%) share may be used to support new or emerging enabling activities that reduce emissions and enhance carbon stocks. The specific activities that the fifty percent (50%) share is used for should be reviewed every 5 years.

The remaining 50% of DF accruals will be distributed in the following proportions: thirty percent (30%) will be used to subsidize a cocoa yield insurance scheme for all participating farmers in the GCFRP; twenty percent (20%) will support the establishment and capitalization of a Community Development Fund (CDF) in each HIA within the programme area that can support the livelihood needs of farmers (Figure 28). The CDF will provide funds for community development projects agreed upon by local communities under the lead of the respective traditional authorities within the HIAs. The Board and NRS will supervise the transfer of the various percent shares, with PMU providing a practical management role.

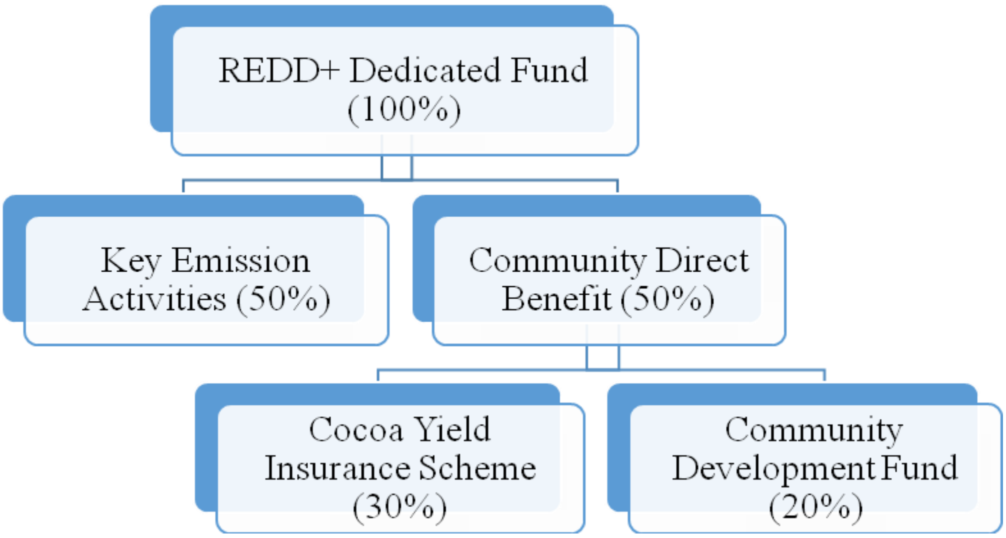

Figure 28: Percentage distribution of REDD+ Dedicated Fund

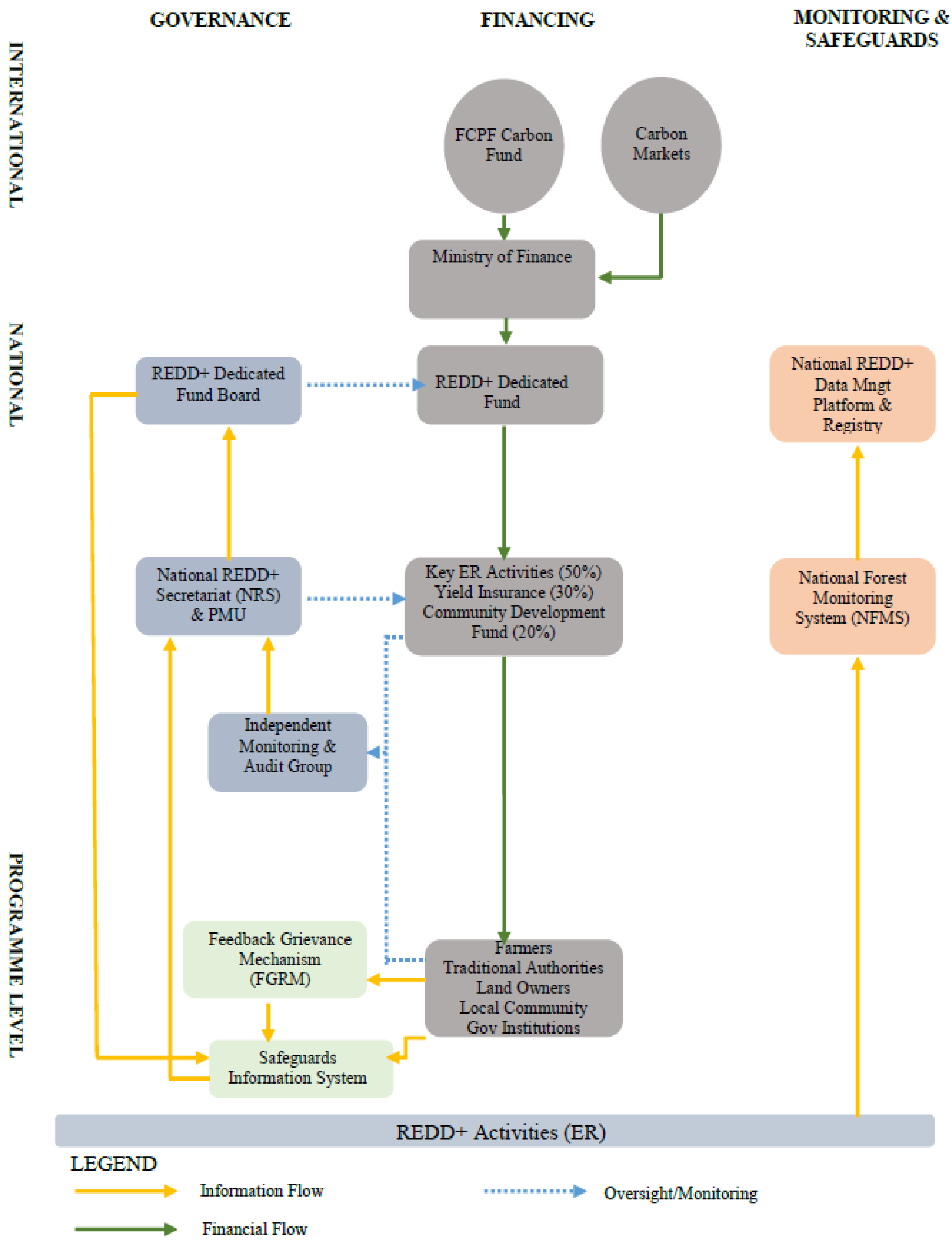

Figure 29: institutional/governance structure and the key components of the BSP

15.1.2 REDD+ beneficiaries and eligibility

The BSP identifies the following as beneficiaries of monetary and non-monetary carbon/non-carbon benefits: Farmers, Landowners, Traditional Authorities (TA), Forestry Commission (FC), Cocoa Board, and Local Communities in the programme area. The beneficiaries were identified based on three main factors (benefit sharing rationales) namely:

i. **LEGAL RIGHTS:** benefits should be allocated to actors with legal rights (statutory or customary) to trees and forests;
ii. **CONTRIBUTION TO EMISSION REDUCTION:** benefits should be allocated to actors who take verified actions (behavior change) to achieve emission reductions, or whose opinions strongly support emissions reductions;
iii. **FACILITATION & IMPLEMENTATION:** benefits should be allocated to actors who are responsible for implementing actions and activities that lead to remission reductions, and which are critical elements of the programme, including monitoring.

The beneficiaries and the bases for allocating benefits are presented in Table 58.

Table 58: REDD+ beneficiaries and the rationale for receiving benefits

Beneficiaries	Basis for allocating benefits	Benefit sharing rationale
Forestry Commission	• Coordination of REDD+ implementation • Monitoring and enforcement of illegal logging, forest fires • Support and monitor implementation of HIA landscape management plans • Supply of tree planting materials • Provision of training, capacity building and supervision of on-farm tree management and related CSC activities • Exercisecontrol and management rights in on/off-reserve forest • Training of security services and Bench (Judiciary) in processing and prosecution of deforestation and forest degradation related offenses and infractions • Recruitment and provision of logistics for FC Rapid Response Team • Liaise with EPA, Minerals Commission in the fight against illegal mining within the programme area	• Facilitation • Implementation • Legal rights
Cocoa Board	• Co-coordination of REDD+ implementation • Training, capacity building, and supervision of farmers on CSC practices • Support and monitor implementation of HIA landscape management plans.	• Facilitation • Implementation
Traditional Authorities, Landowners	• Custodians of forest lands • Assist with conflict and dispute resolution • Exercise use and control rights of forest lands • Support and participate in implementation of HIA landscape management plans	• Legal rights • Behavior change = ERs
Farmers	• Integrate and manage (nurturing, tending)on-farm trees • Undertake CSC practices • Exercise use, control and management rights of on-farm trees • Stop extensive cocoa farming and forest encroachment	• Legal rights • Behavior change = ERs
Local	• Support forest conservation activities (e.g. forest fires	• Implementation

Communities	prevention, illegal logging monitoring and reporting) • Exercise forest use right • Encourage women's and minority participation in CSC and HIA governance	• Supporting behavior change

15.1.3 Benefits distribution modalities

This section describes the form of benefits to be transferred to the beneficiaries, the timing of the distribution and the conditions to be met for the payment or distribution of the benefits. The draft BSP directs that carbon revenue should be distributed as both cash and non-cash benefits to beneficiaries.

The FC and Cocoa Board (via NRS as appropriate) will receive cash benefits to undertake activities such as training and capacity building of participating farmers on adoption of Climate-Smart Cocoa (CSC) practices, on-farm tree management, provision of tree seedlings, capacity building in improved law enforcement of forestry personnel and key law enforcement agencies, support to improved law enforcement activities, and support to key monitoring activities (MMRV, SIS, FGRM, Registry, etc).

Farmers will receive both in-kind and non-cash benefits. Farmers' in-kind benefits will be in the form of subsidies to support the enrollment of each participating farmer in the cocoa yield insurance scheme. Non-cash carbon benefits will be in the form of improved capacity in on-farm tree integration and management, improved capacity in application of CSC practices, and access to extension services, improved access to inputs and other farming resources, and perhaps most importantly significant increases in yield and thus incomes. Landowners, traditional authorities and local communities will receive non-cash benefits in the form of community development projects, and improved landscape management and planning.

The BSP envisages that grant funds (or other sources) will need to be identified to support key activities, like monitoring, in the initial years of implementation before performance-based payments begin. However, following the first monitoring, the distribution of cash and non-cash benefits will be on an annual basis. Eligibility for receiving benefits (carbon and priority non-carbon benefits) is set out in the indicators for monitoring. Table 59 provides a description of beneficiaries, modalities and the conditionality for receiving of benefits.

Ghana will fully test its MRV system in 2018, and expects to conduct the first programmematic MRV in 2019. Following a validation, one could expect that the first tranche of REDD+ payments to be received by late 2019, with follow-on distribution. Following the validation of the BSP, clear time lines will be established with HIAs for efficient sharing of benefits.

Table 59: Beneficiaries, modalities, types, conditionality of the distribution of benefits

Beneficiaries	REDD+ benefits	Type of benefits	Benefits distribution modalities	Conditionality for receiving benefits	Indicators
FC, Cocoa Board	- Benefit sharing revenue allocated to support implementation of activities, including forest law enforcement (illegal logging and mining, forest fire) and prosecution,	Carbon benefit	Cash	- Expansion and deployment of Rapid Response Teams in HIAs - Training and capacity development programmes conducted - Prosecuted cases of illegal activities	- Stationed RRT in HIAs - Equipped and functional fire brigade in HIA - Change in incidences of illegal logging and mining and forest fires - Percent change of prosecuted cases -No. of prosecutors and members of the Bench trained
Farmers	- Access to CSC packages, including shade-tree planting materials, trainings & capacity building, extension services, access to inputs, access to credit - Subscription subsidies for yield insurance - Improved capacity in CSC farming practices - Increased cocoa yield and income - Tree-tenure reforms	Carbon benefits Non-carbon benefits	Non-cash Non-cash	- Enrollment in CSC - Adopt recommended practices - Practice of on-farm shade tree management -Respect HIA management plan by-laws	- No. enrolled farmers - No. enrolled women farmers - No. shade trees planted/managed per ha per cocoa farm - No. farmers w/access to risk products and insurance - Passage of the proposed tree tenure reforms
Landowners, TA, LC	- Access to Community Development Fund in-kind support for projects - Improved landscape management and planning - Improved watershed management	Carbon benefit Non-carbon benefit	Non-cash	- Participation in and support to HIA management planning - Development of landscape management plans - Agree to by-laws - Community-based monitoring	- Implementation of plans for community projects - Executed community projects - Drafted landscape management pans -Women's roles in landscape gov & plans

FC=Forestry Commission, TA=Traditional Authorities, LC=Local Communities, RRT=Rapid Response Team, HIA=Hotspot Intervention Area

Monitoring and safeguard provisions

Appropriate indicators for monitoring, measuring and verifying compliance with modalities for distributing benefits to beneficiaries have been spelt out in the BSP and indicated in Table 59. These include *inter alia*, adoption of CSC practices, level of recommended shade trees planted or managed per hectare per cocoa farm, change in intensity of fire incidence, and change in intensity of illegal logging incidence. The BSP directs that, the monitoring indicators should be gender-disaggregated. Data generated on the indicators will be uploaded on the Safeguards Information System (SIS) so that all stakeholders can access the information. The proposed FGRM will be used to address any disputes, grievances and conflicts that will arise in distribution of benefits in the programme area. It is proposed that the BSP is reviewed every five (5years) to assess lessons learnt for improved delivery of benefits.

15.2 Summary of the process of designing the benefit-sharing arrangements

The process of establishing rules for REDD+ benefit sharing was initiated in 2013 by the NRS through a consultancy on benefit sharing options—Benefit Sharing Mechanism for REDD+ Implementation in Ghana—conducted by FORIG. Partner NGOs, like IUCN-Ghana have also provided input to the benefit sharing dialogue following the implementation of a project focused on benefit sharing arrangements within the GCFRP landscape. The MLNR, under the NREG-TA, also completed a review of benefit sharing options for trees in 2016—the Tree Tenure and Benefit Sharing Framework. As a result, benefit sharing options and ideas have been subjected to multiple discussions involving a wide range of public sector, civil society, traditional authority and other stakeholders.

In early 2017, the NRS convened a working group of experts on benefit sharing to design the first draft of the GCFRP's Benefit Sharing Plan (BSP). It was developed in alignment with the programme's Implementation Plan. The draft plan is based on the experiences of the experts, inputs from previous REDD+ consultations with NGOs and CSOs, as well as recommendations and findings from the benefit sharing studies described above. As a result, the draft BSP incorporates an in-depth understanding of what can work in Ghana, and the concerns and interests of stakeholders on benefit sharing in the GCFRP areas. Further, the draft plan aims to ensure gender equity and equality, and builds on the institutional structure and systems recommended for the implementation of GCFRP.

The next steps in the process of consultation and validation of the draft BSP will happen with the following stakeholders:

- Stakeholders within the HIAs, including community members, farmers, land owners and Traditional Authorities;
- Members of the HIA consortiums, including the District Assemblies, NGOs, and private sector partners working the programme area;
- Regional House of Chiefs from the programme area;
- Forestry Commission;
- Cocoa Board; and
- Other relevant stakeholders.

The following events and meetings will be prioritized in the coming months, leading to the finalization and implementation of the BSP:

- HIA Stakeholder consultation meeting.
- NGO, private sector and government consultation.
- Input from CF Participants.
- Validation of BSP.
- Establishment and operationalize benefit sharing entities and structures.
- Negotiation of benefit sharing agreements on individual HIA basis.

15.3 Description of the legal context of the benefit-sharing arrangements

The development and implementation of the BSP will respect all legal rights of land tenure holders in the accounting area and will be subject to legal review under both REDD+ specific dispute settlement rules and domestic law. The scope and inter-play of customary and statutory laws is clearly defined in the1992 Constitution, and there are already more than two decades of experience implementing benefit sharing systems in Ghana (e.g. CREMAs) in which the customary and statutory laws converge effectively and equitably on the ground for stakeholders. Despite existing uncertainties in pending legal reforms, the BSP will be supported by the directives laid out in the 2012 Forest and Wildlife Policy and grounded in the framework that authorizes benefit sharing of natural resources within CREMAs. Benefit distribution will also strictly comply with the international REDD+ framework as established by the Warsaw Framework for REDD+ and the Paris Agreement.

In addition, much of the BSP is compliant with other existing national laws, legislation and legal provisions on related to benefit sharing and forest management. The 2012 Forest and Wildlife Policy and Land Title Registration Act, 1986 (PNDCL 152)[118], The Head of Family (Accountability) Law, 1985 (PNDCL 114)[119] are significant on the issue of benefit sharing. The passage of the Wildlife Resources Bill[120] will also provide the legal basis for establishment of the HIAs, its governance structure and the HIA landscape management plans. Indeed, most of the identified HIAs cover significant number of CREMAs. Additionally, the proposed legal reforms on framework for tree tenure and benefit sharing scheme[121], and current consideration of proposed off-reserve timber tree management and exploitation guidelines[122], and guideline for devolution of off-reserve by MLNR provide strong legal basis for recognition of farmers and landowners' right to trees on farms and the benefits that are derived thereof.

Also of significant importance are the Bills that would be laid before Parliament by the Land Administration Project (LAP). Relevant outputs of the project that will enhance the implementation of REDD+ include demarcation of boundaries, land titling and registration, land use planning, information system for registration of land rights, and land transactions adjudication and resolution

[118] The Act provides legal basis for the registration of recognized titles to land, including allodial titles of (stools and other), freehold, and leases. It gives actual land tenure holdings in the programme area.

[119] The Act ensures that Heads of Families in charge of lands in the HIA's are accountable for every benefit received to be distributed to farmers within that community or area.

[120] The Bill is expected to consolidate and revise the laws relating to wildlife and protected areas, provide for the implementation of international conventions on wildlife, and provide legislative support for CREMAs. HIAs are modeled after CREMA.

[121] Akapame C. 2016. Development of a framework on tree tenure and benefit sharing scheme: Legal reforms proposals. Final Report. Ministry of Lands and Natural Resources.

[122] MLNR, 2017. Off-reserve timber trees management and exploitation guidelines. Draft Report. Ministry of Lands and Natural Resources.

of conflicts to achieve efficiency and equity. The outputs will culminate into series of legal considerations such as the Lands Acts; and Land Use and Planning Acts. The effect of these outputs would be to reduce incidents of disputes and enable greater security for land rights. However, in the event that the passage of the proposed legal reforms and Acts delay or deferred, legally bidding contracts will be entered between the programme implementing agency (i.e. Forestry Commission on behalf of the Ministry of Lands and Natural Resources) and the programme participants (i.e. farmers).

16. NON CARBON BENEFITS

16.1 Outline the potential Non-Carbon Benefits and identification of Priority Non-Carbon Benefits

Section 15 gives a thorough description of both carbon and non-carbon benefits in the draft BSP as both types of benefits are integral to the success of the project and it is felt that they must be discussed together. Furthermore, increased yields and incomes to farmers, a non-carbon benefit, is arguably the most important benefit for farmers and will largely underpin the successful implementation of the GCFRP.

Building from the previous section which already discusses non-carbon benefits in detail, this section simply outline the priority non-carbon benefits which are deemed to be critical to incentivizing the behavior changes that will produce ERs within the GCFRP area. :

- Increased yields via CSC: Farmer engagement package that gives farmers access to planting materials, access to inputs, access to technical extension, access to business extension, and access to financial and risk products will enable increases in yields and incomes. Ensuring transparency in cocoa purchases will further increase income for cocoa farmers;
- Tree tenure reform and resource use rights improved for farmers, land users, etc.;
- Improved law enforcement strengthened collaboration with HIA communities on monitoring and enforcement of local by-laws and national laws;
- Improved landscape management and planning in the HIA landscapes;
- Mandatory inclusion of women and marginalized/vulnerable groups representatives on decision making bodies such as the HIA Governance Boards
- Improved watershed management as a result of HIA landscape management planning;
- Improved capacity in on-farm tree management and CSC practices.

16.2 Approach for providing information on Priority Non-Carbon Benefits

Identifying, incentivizing, monitoring and reporting on NCBs under the programme can be partially covered by Safeguard Information Systems (SIS) and additional key information will be incorporated into the Data Management System. During the completion of the BSP and the Data Management System, key non-carbon benefits will be selected and indicators determined for monitoring for inclusion in multiple reports and outputs, and to maintain compliance with UNFCCC.

The selected indicators, where appropriate and possible, will benefit from the full and effective participation of HIA members (local people and forest-dependent communities) and HIA Consortium stakeholders (DAs). The use of community-based monitoring of co-benefits (e.g. forests, biodiversity, land use and land use changes, effective participation) will be prioritized.

17. TITLE TO EMISSION REDUCTIONS

17.1 Authorization of the ER Programme

Table 60: National Authority Responsible for ER Programme Approval

Name of Entity	Ministry of Lands and Natural Resources
Main Contact Person	Musah Abu Juam,
Title	Technical Director, Forestry
Address	P.O. Box MB40 Accra- Ghana
Telephone	+233-244362510
Email	abujuam@gmail.com
Reference to the decree, law or other type of decision that identified this entity as the national authority on REDD+ that can approve ER Programmes	MLNR established under section 11 of the Civil Service Law 1993 (PNDCL 327), is the sector Ministry for the FC, which was established under Act 571 (1999), and the FC is responsible for REDD+ coordination in Ghana, through the NRS. As such, the MLNR has the overall national authority to approve ER Programmes in Ghana.

A formal letter of approval by the MLNR is attached in Annex 4a.

17.2 Transfer of Title to ERs

Title to Emission Reductions is defined as "the full legal and beneficial title to [emission reductions] contracted for under the ERPA", but it does "not entail any rights, titles or interests to land and territories".[123] The genuine right to emission reductions is best understood as someone's capacity to generate and market carbon credits (or carbon units) from a certain number of metric tonnes of avoided carbon dioxide emissions, removals or sequestration within the ER Programme Accounting Area[124], and includes a legal commitment to exclusivity, i.e. the commitment not to generate and/or market any credits which would concern the identical emission reductions.

In light of the fact that ERs cannot be generated solely by individuals, but only occur through the collective actions of many stakeholders, and given the above definition of Title to ERs, the existing legal framework in Ghana will not create a barrier to the transfer of title to ERs and Ghana's land and resource tenure regimes have no implications on the GoG's ability to transfer titles to emission reductions. This is because Ghanaian law recognizes such a right, as shaped by the country's law of obligations, and allows for its transfer. By entering into the ERPA, the GoG, represented by the MoF, assumes the binding commitment to treat the emission reductions achieved in the ER Programme Accounting Area as unique and to transfer and market them, including any credits issued for them, exclusively to the FCPF Carbon Fund. The FCPF Carbon Fund, in turn, will receive full ownership over the emission reductions, including any credits attached, at the moment as defined in the ERPA. It

[123] FCPF Carbon Fund Methodological Framework, definition § 30.
[124] FCPF ERPA General Conditions, definition of "Emission Reduction" (italics added).

may retire them or transfer them further (to the donor participants of the Carbon Fund or otherwise), or keep them 'active' in its accounts, as it sees fit.

The MoF is by function the authorized institution to sign such a contract on behalf of government. The combined effect of Article 176(1b) and Article 181(7b) of the 1992 Constitution makes the Minister of Finance or its representative the rightful institution to sign on behalf of government. This is further supported by the MoF's function to serve as the government's advisor on monetary and financial issues. the Government's commitment towards the FCPF Carbon Fund does not impinge on any individual or collective rights nor does it impose an obligation for individuals or a collective, whether land tenure holders or other. Participation of stakeholders is strictly voluntary, and those who do not wish to engage with the programme, will not face any limitation of their rights and practices within the ER Programme Accounting Area whatsoever.

By contrast, those individuals, collectives or institutions that do choose to participate (i.e. become an HIA Consortium Partner or member of the HIA Governance Body) will replicate the title commitment which the Government assumes under the ERPA. This means that they would commit to treat the emission reductions achieved in the GCFRP area with their participation as unique and not to transfer and market them outside the commitment made by the Government towards the FCPF Carbon Fund.

The legal type, quality and classification of the relevant stakeholder commitment may vary according to the person, collective or institution in question. Each of these actors will be requested to produce a commitment instrument (i.e. M.O.U.) that confirms the key elements and targets of the ER Programme as well as the actor's terms of engagement (role, activity, consideration), coupled with a commitment to contribute to reducing deforestation. The Instrument may, but Ghanaian law does not require it to be legally enforceable. The binding nature of the commitment made by the Government to the Carbon Fund, in any case, will not be compromised. As described in Section 4.3, agreements will be signed with HIA consortium members, Governance Board members (including private sector or NGOs) and the PMU defining roles, responsibilities, and articulating investments as needed).

For example, District Assemblies, which hold political and administrative powers,[125] may make the commitment of participation (i.e. to participate in an HIA Consortium), and a commitment to support the ERPA by adopting a "development plan" (i.e. landscape management plan or HIA Management Plan) to such purpose in accordance with their mandate under § 10.4 (a) the Local Government Act of 1993. Additionally, the Regional Houses of Chiefs may transpose similar commitments through a Standing Order as provided under Section 4 of the Chieftaincy Act of 2008 or through such means as found opportune according to customary law. Private sector companies and NGOs, which will serve as investors and implementers on the ground, are also free to participate in the programme and commit to the HIA's management plan, activities, and emission reductions goals.

As the GoG (through the JCC and PMU) will mandate independent, privately organized institutions or organizations, in particular community , private sector, and NGO, to manage and operate programme implementation or parts thereof in the HIAs, dedicated horizontal memorandums of understanding between the PMU and the Implementation Partners Consortium, including its private

[125] Local Government Act 1993, § 10.1.

sector, civil society, government partners, as well as the Governance Board stakeholders (traditional authority, communities, farmers), and subject to approval by the GCFRP JCC, may be concluded. Such practice could well be modeled on the existing CREMA benefit sharing agreements which are concluded by member beneficiaries of the CREMA, authorized by the Minister (MLNR), and to be supported under law through the expected passage of the National Wildlife Resources Management Bill.

18. DATA MANAGEMENT AND REGISTRY SYSTEMS

18.1 Participation under other GHG initiatives

During the first phase of the programme, the GCFRP will prioritise the transfer of ERs to the Carbon Fund in order to fully fulfil the terms of the ERPA to be negotiated for the programme. Any additional ERs generated from the programme will be utilised to support the attainment of targets under Ghana's Nationally Determined Commitments (NDCs).

Establishment of forest plantations under the National Forest Plantation Development Programme (NFPDP) holds promise for contributing to removals to GCFRP. Ghana will utilise forest plantations established in the Accounting Area under the NFPDP to contribute towards the generation of ERs for programme. The only exception will be the plantations established by Form Ghana, a private forest plantation developer involved in large scale tree plantation establishment in the Asubima Forest Reserve in the Ashanti Region. Form Ghana's project in the Ashanti Region has earned validation and is presently seeking registration under the VCS.

A cook stove project, called African Improved Cooking Stoves Grouped project, under Vitol SA, is being implemented in Ghana. The purpose of the project is to disseminate improved cooking stove, using charcoal, to replace traditional cooking stoves and improve efficiency. The project has gone through validation under the VCS. The first phase is focused on cities in northern Ghana, which means that it would not have implications on ERs produced by the GCRFP.

Ghana is currently finalising two (2) Nationally Appropriate Mitigation Actions (NAMAs[126]) whose implementation will contribute to emission reductions from woodfuel. Though not considered to be a major driver of deforestation or degradation within the GCFRP area, woodfuel extraction for energy use is considered to be a modest driver of forest degradation and has therefore been incorporated in the forest reference level as one of the elements to be measured for assessment of ERs. Implementation of the NAMAs is envisaged to take place in three out of the five regions of the Programme Accounting Area – Eastern, Ashanti and Brong-Ahafo regions.

With a monitoring system fully set up for the GCFRP well advance compared to the implementation of the NAMAs and other GHG emissions reduction initiatives, Ghana will explore the possibility of aligning these interventions, if necessary, to contribute to the targets of the GCFRP. Nesting of projects within the programme, however, will not be allowed. If any practical difficulties arise which may preclude the incorporation of ERs from other existing interventions, like those already validated under VCS, these ERs will be deducted from the total in the accounting area or grandfathering of the projects could be negotiated.

[126] The NAMAs are: 1. Access to Clean Energy through Establishment of Market-based Solutions in Ghana; and 2. NAMA action on Sustainable Charcoal Supply Chain.

18.2 Data management and Registry systems to avoid multiple claims to ERs

Ghana is in the process of developing a data management system and registry that will consist of a database for the management of key data and information on programme activities and environmental indicators. The database will be programmed to produce designated reports/outputs, based on the data, which will make information available about programme activities, areas of implementation, the programme's estimated ERs, as well as other impacts. The system does not cover social and environmental safeguards, as this will be captured in the SIS, but the online platform will provide a passive link to that system. The data management system is being designed to ensure that data is documented and centrally administered to avoid multiple claims to ERs, and it will be publically available online so as to ensure transparency. The data management system is being develop to initially support implementation of the GCFPF, but over time it will be scaled up to operate at the national level, capturing other national estimates and other programmes as they are developed.

A consulting team, that includes both local and international experts, are already in the process of designing the system, with the expectation that testing and training will happen in May and that it will be fully operational by early June, 2017.

Broadly, Ghana's goal is to create a database and registry system that is user friendly, can easily generate emissions estimates and requisite reports, has the ability to generate spatial information for basic GIS analyses towards enhancing transparency in calculating ERs, has the potential for upgrading as date requirements become more complex, effectively serves as the online repository for Ghana's National Forest Monitoring System, and is easy to find via search engines.

From an operational standpoint, the system will be located at the Forestry Commission. The Head of the NRS and the Head of the FC's Information Technology (IT) Unit will have administrator rights to the system. For data to be published online and available for inclusion in any report, it must follow the agreed approval process, as shown in Figure 30.

The right to upload data will be designated by the system administrators. These rights will be given to members of the NRS, members of the PMU responsible for MRV/Data Management System and Registry, and/or a member of the FC's Information Technology (IT) Unit. As part of data capture, primary data will be entered into the online system from notes taken in the field and elsewhere. Scanned copies of the field notes will be uploaded along with the data entered to serve as originating documents. Secondary data will also be uploaded from simplified spreadsheets containing the emissions calculations. In the review of data and validation, the primary entered data will be validated against the scanned copies and approved for processing/publication. The secondary data will be uploaded from simplified spreadsheets containing the emissions calculations.

Review of data and validation will be conducted by an MRV/Data Management System and Registry specialist, a member of the FC's Information Technology (IT) staff, and/or other people designated by the administrator. There will be 2 levels of approval for all data uploaded into the system before the data is published and becomes live. An initial screening will check uploaded data for completeness and approve, correct, or reject. The primary entered data will be validated against the scanned copies and if correct then approved (or not) for processing/publication. The secondary data uploaded will be validated against the spreadsheet calculations. If rejected, the person who uploaded the data will need to re-enter the data. Once approved, the Head of the NRS or IT staff will be alerted and will give final approval that will result in the data being published onto the live website. Revisions to already published information will be published with comments, retaining previous publications for reference.

Table 61lists the types of data that will be included in the database along with the format in which the data will be stored. The table was created after careful review of transparency, NDC, and MRV sections of UNFCCC COP decisions and the FCPF Methodological Framework to ensure compliance with transparency and other requirements, the data used to calculate Ghana's reference level. All data will be public, and will follow the same uploading and approval process described below. Data may be updated on a rolling basis, with historic records archived and available for viewing and reporting as needed.

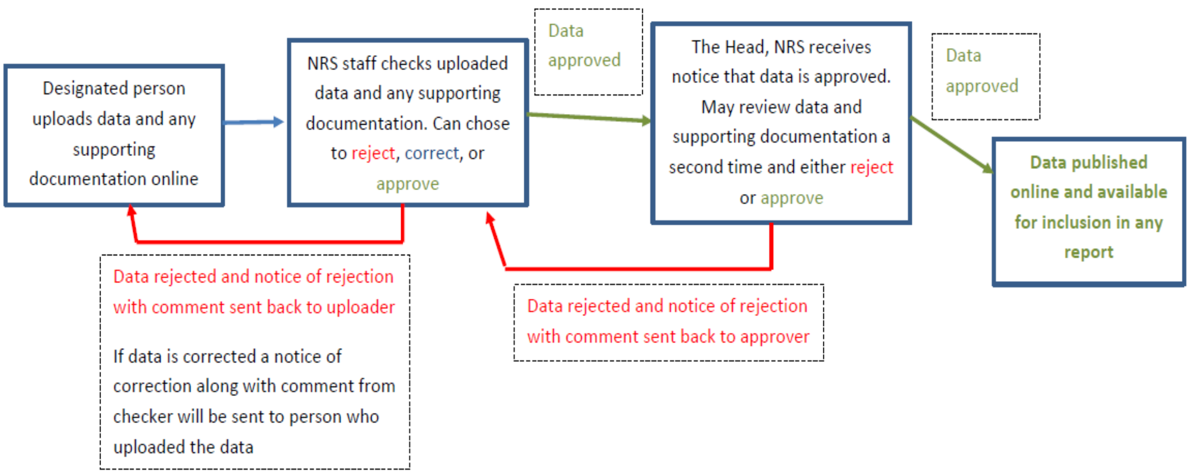

Figure 30: Data approval process

Table 61: Types of data, format, outputs, and spatial component to be captured in database

Types of input data to be captured	What format is the data captured in. What is the unit of data? If electronic, what devices are used, what format is the file, etc.	Does the data have a spatial component? If so, how is this recorded? (shape file, GPS coordinates or point?)	Anything else to consider? Notes
	Data captured for ER and other calculations		
ERs deducted to avoid double counting; i.e. credits issued by other programs	Credits issued by other programs that need to be deducted from ERs claimed by Ghana will be recorded. Information is expected to include both PDFs of reports on the number of credits issued in the other system along with an excel table that records the number of credits and is uploaded into the database.	Yes, tbd	Potentially including but not limited to GHG, VCS, Gold Standard, and CDM.
Uncertainty from deforestation	Input parameter calculated by NRS according to Meth Framework Criterion 22.	No	Will be calculated by NRS as part of the monitoring system
Uncertainty from degradation	Input parameter calculated by NRS according to Meth Framework Criterion 22.	No	
ERs sent to the uncertainty buffer accounts	Input parameter calculated by NRS based on the reversal risk assessment - see Meth Framework Criterion 18	No	
ERs sent to the risk buffer accounts	Input parameter calculated by NRS based on the reversal risk assessment - see Meth Framework Criterion 18	No	
Historical annual emissions from deforestation	Input parameter calculated by NRS	No	
Historical annual emissions from legal logging	Input parameter calculated by NRS	No	
Historical annual emissions from illegal logging	Input parameter calculated by NRS	No	
Historical annual emissions from fuelwood extraction	Input parameter calculated by NRS	No	
Historical annual emissions from forest fire	Input parameter calculated by NRS	No	
Historical annual removals from on-reserve plantation programs	Input parameter calculated by NRS	No	
Historical annual removals from off-reserve plantation programs	Input parameter calculated by NRS	No	
Reported and verified emissions from deforestation since the program start or last	Input parameter calculated by NRS	No	

verification			
Reported and verified emissions from legal logging	Input parameter calculated by NRS	No	
Reported and verified emissions from illegal logging	Input parameter calculated by NRS	No	
Reported and verified emissions from fuelwood extraction	Input parameter calculated by NRS	No	
Reported and verified emissions from forest fire	Input parameter calculated by NRS	No	
Reported and verified removals from on-plantation programs	Input parameter calculated by NRS	No	
Reported and verified removals from off-plantation programs	Input parameter calculated by NRS	No	
Outputs calculated by the REDD+ Database automatically and stored in the database and made available for reporting			
Emission reductions and removals available for sale	Equation outlined in Inception Report	No	
Reference level emissions	Equation outlined in Inception Report	No	
Reported and verified emissions (since the program start or last verification)	Equation outlined in Inception Report	No	
Reference level removals	Equation outlined in Inception Report	No	
Reported and verified removals (since the program start or last verification)	Equation outlined in Inception Report	No	
Reversals	Equation outlined in Inception Report	No	
Total emissions (i.e. the cumulative sum of all reported and verified emissions to date)	Equation outlined in Inception Report	No	
Total removals (i.e. the cumulative sum of all reported and verified removals to date)	Equation outlined in Inception Report	No	
ERs in the transferred / sold account	Equation outlined in Inception Report	No	

Other Data Captured and Stored in the REDD+ database for record keeping, transparency, and report generation purposes			
Carbon stock	Scan of paper record will be uploaded and stored in database. Electronic records will be recorded in a Microsoft excel spreadsheet that can be uploaded into the database to create the electronic record.	Yes – GPS coordinate (points and polygons)	Methods for estimating will be available online
Deforested area	Raster files	Yes, georeferenced in satellite images.	Remote sensing analysis needed before data uploaded
Volume of logs extracted legally	Electronic records will be recorded in a Microsoft excel spreadsheet that can be uploaded into the database to create the electronic record.	Yes, GPS coordinates of the stump site.	Methods for estimating will be available online Over time, data from the Wood Tracking System (WTS) being implemented under VPA should be captured.
Volume of logs extracted illegally	Electronic records will be recorded in a Microsoft excel spreadsheet that can be uploaded into the database to create the electronic record.	Specific only to administrative units (locality).	Methods for estimating will be available online. Over time data from the WTS being implemented under VPA should be captured.
Biomass available for wood fuel harvest	Excel tables	Ability to capture spatially will be programmed into the database.	Methods for estimating will be available online
Forested area burned	Raster files	Yes, georeferenced in satellite images.	Remote sensing analysis needed before data uploaded
Area planted under NFPDP	Excel tables	Yes, specific to forest reserve and off-reserve areas	
Area planted outside NFPDP	Excel tables	Yes	Data not yet captured but expected to be in the future so functionality will be pre-programmed in.
Removal factors for plantation species	Data is estimated from Microsoft excel spreadsheets, and data from the spreadsheets will be uploaded into the database. Updates to how a removal factor is calculated will be made in the spreadsheet that is outside the database.		Calculation, not field-based Methods for estimating will be available online
HIA Boundaries / CREMA boundaries	Shape files	Yes	This supports transparency around the Implementation Plan
Carbon benefits – payments for ERs	Data on payments received from selling ERs. To be recorded next to the sold ER account.	No	Crucial issue for transparency
Non-carbon benefits – cocoa yields	Excel tables	Yes	Data likely be aggregated at HIA or sub-HIA levels, but not at farmer level to protect farmers' privacy
Other non-carbon benefits	The database will be able to store other documents of non-carbon benefits on a page for each HIA that contains files that can be	No	

	downloaded.		
Other Safeguard information	To be included in separate SIS database. A passive hyperlink will allow public to click to the other database for additional safeguard information.	NA	

ANNEXES

Annex 1: Overview of interventions and activities

A. Institutional Coordination and MRV	
1.	**Operationalizing Joint Coordinating Committee (JCC)**
1.1	Agree JCC roles and targets for Ghana Cocoa Forest REDD+ Programme implementation
1.2	Secure and maintain high-level government endorsement for GCFRP
1.3	Approval of overall/annual planning of the GCFRP implementation
1.4	Financial oversight of the GCFRP
1.5	Coordinate Inter-government collaboration and communication
2.	**Establish and support operations of Programme Management Unit (PMU)**
2.1	Establish and maintain PMU operations (office, equipment, vehicles, running costs)
2.2	Recruit PMU staff
2.3	Prepare GCFRP annual plans and implementation reports
2.4	Execute implementation agreements and supervise GCFRP annual plans
2.5	Coordinate discussions for additional REDD+ and CSC finance
2.6	Coordinate GCFRP MRV, safeguards and data management operations
3.	**GCFRP activity monitoring/MRV/Data management system**
3.1	Update and implement FRL/MRV
3.2	Monitoring activity implementation performance in HIA
3.3	Operate and maintain data management systems for GCFRP (safeguards, cocoa production, ERs)
3.4	Link to national NDC/UNFCCC (national communications)
4.	**Law enforcement of GCFRP area**
4.1	Support FC to reduce illegal activities (galamsey, chainsaw, bushfire)
5.	**Creation of CSC Hotspot Intervention Areas**
5.1	Entry level community engagements and key stakeholder meetings in target HIAs
5.2	Negotiations leading to formal decision to form HIA for CSC with due FPIC processes
5.3	Develop HIA governance structures and constitutions
5.4	Achieve key governance HIA decisions on CSC, ER and financial agreements
5.5	Ensure appropriate stakeholder communications of HIA progress

B. Landscape Planning within HIA areas	
1.	**Establish CSC consortium for each HIA**
1.1	Engage key stakeholders (LBCs, CSO, farmers associations, government)
1.2	Conclude formal agreements with clear roles and responsibilities of the consortium partners
2.	**Complete HIA landscape management plans**
2.1	Map farms, reserves and other land uses
2.2	Analyze HIA land uses and deforestation/degradation/enhancement areas
2.3	Negotiate CSC options and strategies for reducing emissions within HIA
2.4	Draft landscape management plan for each HIA
2.5	Public review and validation of HIA landscape management plans
3.	**Implement HIA landscape management plans**
3.1	Conduct awareness/training on CSC with community leaders and opinion makers
3.2	Conduct regular patrols of the HIA and confirm land use changes as part of MRV
3.3	Undertake land-use enhancement activities together with HIA leadership and FC
3.4	Negotiate grandfathering arrangements for irregular land uses
4.	**Establish CSC landscape level validation in HIAs—CSC Sustainability Standard**
4.1	Agree criteria and parameters for CSC validation protocol and Standard
4.2	Test draft CSC validation protocol in 1 HIA and revise
4.3	Implement revised CSC validation protocol across the GCFRP
4.4	Third party auditing and verification

C. Increasing Yields via CSC	
1.	**Ghana CSC Good-practices guidelines (on-farm and off-farm)**
1.1	Establish an expert working group, led by Cocobod
1.2	Review existing best practice recommendations for yield increases, sustainability, and climate-smart
1.3	Draft guidelines that include on-farm and off-farm elements.
1.4	Share draft guidelines with stakeholders (including HIA consortium partners) and hold consultations for input and comments.
1.5	Agree on guidelines for on-farm good-practices for Ghana's CSC.
1.6	Consortiums apply in HIAs
2.	**CSC farmer engagement package in HIAs**
2.1	Negotiate distribution of package with HIAs consortium stakeholders
2.2	Access to planting materials
2.3	Access to inputs
2.4	Access to technical extension

2.5	Access to business extension
2.6	Access to financial and risk products (credits and insurance)
2.7	Access to shade-tree planting material/promotion to assistant natural regeneration
2.8	Premium price on CSC bean
3.	**HIA CSC consortium implement with cocoa farmers (consortium vary by HIA)**
3.1	Farmers receive Free-prior information about CSC programme criteria, responsibilities and benefits
3.2	Register farmers and implement CSC package
3.3	Farmers receiving training and access to incentives and benefits through the engagement package
3.4	Farmers who fail to comply lose access to the package and associated benefits.
4.	**Increase transparency in cocoa purchases**
4.1	HIA Consortium members ensure that cocoa farmers are paid for the beans that they produce.
4.3	HIA Consortium members ensure that purchasing clerks are fairly compensated.
4.2	Spot checks are used to monitor compliance

D. Risk management/finance	
1.	**Access to financial credit for CSC**
1.1	Map existing credit channels for CSC farmers
1.2	Stimulate new credit programmes within existent finance institutions
1.3	Create new facility/fund to develop innovative business approach for CSC
1.4	Explore loan guaranties
2.	**Access to yield insurances**
2.1	Access historical yield and weather data
2.2	Identify insurances companies interested in assessing and developing a product for Ghana's CSC
2.3	Guarantee funds for insurance premium payments for short-term (piloting) and long-term
2.4	Pilot and test CSC's insurance product in 1 HIAs
2.5	Implement the insurance product across GCFRP
3.	**Marketing additional ERs above FCPF**
3.1	Assess additional opportunities for accessing REDD+ finance
3.2	Package and present the GCFRP to potential investors and funders
3.3	Additional long term funds secured for the GCFRP
4.	**Branding ER Cocoa/marketing**
4.1	Develop market studies and demand for Ghana's CSC
4.2	Design and develop Ghana's CSC brand
4.3	Stimulate demand and sell Ghana's CSC
5.	**Sustainable Finance of HIAs**
5.1	Identify diverse long-term financial sources to support HIA governance
5.2	Plan and develop financial plan for HIA governance

5.3	Support start-up costs of HIA financial plan for 5 years
5.4	Establish trust fund with 3rd party financial management
5.5	Implement financial sustainability for HIA

E. Legislative and Policy Reform	
1.	**Passage of legislation**
1.1	Ensure passage of Forest Wildlife Bill legislative instrument
1.1.1	Support Parliamentary Sub-committee engagements leading to LI passage
2	**Policy Reform and guidance to implementation of government policies**
2.1	Tree-tenure reforms
2.1.1	All HIAs are approved to pilot new tree-tenure arrangements (tree passport and tree benefit sharing reforms)
2.1.2	Independent studies within HIAs on tree-tenure arrangements
2.1.3	Prepare tree-tenure policy implementation guidelines
2.2	Clarification of carbon transaction rights + benefit-sharing agreements for GCFRP
2.2.1	Independent studies on transaction rights at multiple scales and benefit-sharing agreements
2.2.2	All HIAs approved to innovate carbon transaction and benefit-sharing agreements
2.2.3	Independent review on innovative carbon transactions
2.3	Reform of Cocoa Farm input system
2.3.1	All HIAs are approved to pilot farm input reforms
2.3.2	Independent review on farm input pilots
3.	**Modification to customary norms and practices**
3.1	Promote evolution away of perverse traditional land-use practices at Cocoa sector
3.1.1	Independent studies in HIAs to identify perverse land use norms
3.1.2	Support negotiation with traditional leaderships for HIAs level reforms
3.1.3	Independent review on implementation of land use reforms

Annex 2a: Summary of financial plan

ITEM	DESCRIPTION	Year 1	Year 2	Year 3	Year 4	Year 5	TOTAL
Costs related to administrative oversight of the ER Program	Items A1 & A2, Set-up of the JCC and the PMU	$ 1,402,600	$ 656,700	$ 664,995	$ 673,705	$ 682,850	$ 4,080,850
Operational and implementation costs related to the actions and interventions that are part of the ER Program (add separate rows for each of the ER Program Measures identified in	Items A4 & A5: Law Enforcement and Indetification of CSC Hotposts	$ 1,465,000	$ 2,120,000	$ 1,120,000	$ 1,120,000	$ 620,000	$ 6,445,000
	B. Landscape Planning within HIA areas	$ 2,098,300	$ 1,687,700	$ 1,079,000	$ 1,115,700	$ 965,700	$ 6,946,400
	C. Increasing Yields via CSC	$ 29,800,000	$ 29,570,000	$ 29,570,000	$ 29,570,000	$ 29,570,000	$ 148,080,000
	D. Risk management/finance	$ 260,000	$ 520,000	$ 55,590,000	$ 5,280,000	$ 5,280,000	$ 66,930,000
	E. Legislative and Policy Reform	$ 120,000	$ 100,000	$ 235,000	$ 140,000	$ 150,000	$ 745,000
Financing costs (e.g., interest payments on loans)		N/A	N/A	N/A	N/A	N/A	
Costs related to development and operation of monitoring systems (Reference Level and Forest Monitoring, Safeguards, FGRM, SIS	Items A3: GCFP activity monitoring/MRV/Data management system	$ 700,000	$ 700,000	$ 700,000	$ 700,000	$ 700,000	$ 3,500,000
Costs related to the Implementation of Benefit Sharing Plan		See * below	See * below	See * below	See * below	See * below	
Costs related to stakeholder consultations and information sharing		See * below	See * below	See * below	See * below	See * below	
Other costs							
TOTAL		$ 35,845,900	$ 35,354,400	$ 88,958,995	$ 38,599,405	$ 37,968,550	$ 236,727,250

*Costs related to stakeholder consultations and information sharing are built into all activites and not separate budget line.

Proposed Benefit Sharing investments from result based payments from CF

Activity	Amount
Update and implement FRL/MRV	2,100,000
Law enforcement of GCFP area	2,500,000
Conduct regular patrols of the HIA and confirm land use changes as part of MRV	1,520,400
Farmers receiving training and access to incentives and benefits through the engagement package	27,500,000
Access to yield insurances	15,200,000
Sustainable Finance of HIAs	1,170,000
Total	49,990,400

*Costs related to the Implementation of Benefit Sharing Plan have yet to be determined as BSP is still in draft form.

Annex 2b: Programme Budget Notes

#	Activity	Total	Notes
A. Institutional Coordination and MRV		**$ 14,025,850**	
1	**Operationalizing Joint Coordinating Committee (JCC)**	**$ 555,000**	
1.1	Establish JCC	$ 155,000	See budget detail
1.2	Agree JCC roles and targets for Ghana Cocoa Forest Programme (GCFP) implementation	$ 100,000	4 meetings/year @ $5K USD each
1.3	Secure and maintain high-level government endorsement for GCFP	$ 250,000	Annual support budget
1.5	Coordinate Inter-government collaboration and communication	$ 50,000	Estimate
2	**Establish and support operations of Programme Management Unit (PMU)**	**$ 3,525,850**	
2.1	Establish and maintain PMU operations (office, equipment, vehicles, running costs)	$ 1,852,800	
2.2	Recruit PMU staff	$ 1,673,050	
2.3	Prepare GCFP annual plans and implementation reports	$ -	Estimate
2.4	Execute implementation agreements and supervise GCFP annual plans	$ -	Estimate
2.5	Coordinate discussions for additional REDD+ and CSC finance	$ -	
2.6	Coordinate GCFP MRV, safeguards and data management operations	$ -	
3	**GCFRP activity monitoring/MRV/Safeguards/Data management system**	**$ 3,500,000**	
3.1	Update and implement FRL/MRV	$ 1,250,000	
3.2	Monitoring activity implementation performance in HIA (Safeguards, FGRM, M&E)	$ 1,250,000	
3.3	Operate and maintain data management systems for GCFP (Registry and SIS)	$ 1,000,000	
3.4	Link to national NDC/UNFCCC (national communications)	$ -	
4	**Law enforcement of GCFP area**	**$ 5,500,000**	
4.1	Support FC to reduce illegal activities (galamsey, chainsaw, bushfire)	$ 5,500,000	
5	**Creation of CSC Hotspot Intervention Areas**	**$ 945,000**	
5.1	Entry level community engagements and key stakeholder meetings in target HIAs	$ 600,000	$100/meeting X 200 Communities/HIA
5.2	Negotiations leading to formal decision to form HIA for CSC with due FPIC processes	$ 225,000	5 meetings * 6HIAs *$7,500
5.3	Develop HIA governance structures and constitutions	$ 120,000	$20K/HIA
5.4	Achieve key governance HIA decisions on CSC, ER and financial agreements	$ -	
5.5	Ensure appropriate stakeholder communications of HIA progress	$ -	Estimate

B. Landscape Planning within HIA areas		**$ 6,946,400**	
1	**Establish CSC consortium for each HIA**	**$ 120,000**	
1.1	Engage key stakeholders (LBCs, CSO, farmers associations, government)	$ 60,000	10,000/HIA
1.2	Conclude formal agreements with clear roles and responsibilities of the consortium partners	$ 60,000	
2	**Complete HIA landscape management plans**	**$ 1,608,000**	
2.1	Map farms, reserves and other land uses	$ 1,200,000	$200K/HIA frontloaded in year 1 @ 60%
2.2	Analyze HIA land uses and deforestation/degradation/enhancement areas	$ -	
2.3	Negotiate CSC options and strategies for reducing emissions within HIA	$ 120,000	$20K/HIA frontloaded in year 1 @ 60%
2.4	Draft landscape management plan for each HIA	$ 240,000	$20K/HIA each in years 1 & 2
2.5	Public review and validation of HIA landscape management plans	$ 48,000	
3	**Implement HIA landscape management plans**	**$ 4,118,400**	
3.1	Conduct awareness/training on CSC with community leaders and opinion makers	$ 450,000	$25K/HIA, years 1,2, & 4
3.2	Conduct regular patrols of the HIA and confirm land use changes as part of MRV	$ 2,738,400	See budget details
3.3	Undertake landuse enhancement activities together with HIA leadership and FC	$ 450,000	Estimate
3.4	Negotiate grandfathering arrangements for irregular land uses	$ 480,000	
4	**Establish CSC landscape level validation in HIAs**	**$ 1,100,000**	
4.1	Agree criteria and parameters for CSC validation protocol	$ 100,000	VCS grant likely
4.2	Test draft CSC validation protocol in 1 HIA and revise	$ 200,000	
4.3	Implement revised CSC validation protocol across the GCFP	$ 600,000	
4.4	Third party auditing and verification	$ 200,000	Estimate
C. Increasing Yields via CSC		**$ 148,080,000**	
1	**Ghana CSC Good-practices guidelines (on-farm and off-farm)**	**$ 180,000**	**Estimate**
1.1	Establish an expert working group, led by Cocobod	$ 100,000	Estimate
1.2	Review existing best practice recommendations for yield increases, sustainability, and climate-smart	$ 80,000	Estimate
1.3	Draft guidelines that include on-farm and off-farm elements.	$ -	Estimate
1.4	Share draft guidelines with stakeholders (including HIA consortium partners) and hold consultations for input and comments.	$ -	Estimate
1.5	Agree on guidelines for on-farm good-practices for Ghana's CSC.	$ -	

2	**CSC farmer engagement package in HIAs**	**$ 150,000**	
2.1	Negotiate distribution of package with HIAs consortium stakeholders	$ 150,000	
2.2	Access to planting materials	$ -	
2.3	Access to inputs	$ -	
2.4	Access to technical extension	$ -	
2.5	Access to business extension	$ -	
2.6	Access to financial and risk products (credits and insurance)	$ -	
2.7	Access to shade-tree planting material/promotion to assistant natural regeneration	$ -	
2.8	Premium price on CSC bean	$ -	
3	**HIA CSC consortium implement with cocoa farmers (consortium vary by HIA)**	**$ 147,500,000**	
3.1	Farmers receive Free-prior information about CSC program criteria, responsibilities and benefits	$ -	
3.2	Register farmers and implement CSC package	$ 120,000,000	cost of $25USD/hectre (PLACE HOLDER
3.3	Farmers receiving training and access to incentives and benefits through the engagement package	$ 27,500,000	
3.4	Farmers who fail to comply lose access to the package and associated benefits.	$ -	
4	**Increase transparency in cocoa purchases**	**$ 250,000**	
4.1	HIA Consortium members ensure that cocoa farmers are paid for the beans that they produce.	$ -	
4.3	HIA Consortium members ensure that purchasing clerks are fairly compensated.	$ -	
4.2	Spot checks are used to monitor compliance	$ 250,000	Estimate
D. Risk management/finance		**$ 66,930,000**	
1	**Access to financial credit for CSC**	**$ 50,050,000**	
1.1	Map existing credit channels for CSC farmers	$ 25,000	
1.2	Stimulate new credit programs within existent finance institutions	$ 25,000	
1.3	Create new facility/fund to develop innovative business approach for CSC	$ 50,000,000	
1.4	Explore loan guaranties	$ -	
2	**Access to yield insurances**	**$ 15,200,000**	
2.1	Access historical yield and weather data	$ -	
2.2	Identify insurances companies interested in assessing and developing a product for Ghana's CSC	$ -	
2.3	Guarantee funds for insurance premium payments for short-term (piloting) and long-term		
2.4	Pilot and test CSC's insurance product in 1 HIAs	$	

		-	
2.5	Implement the insurance product across GCFP	$ -	
3	**Marketing additional ERs above FCPF**	**$ 160,000**	
3.1	Assess additional opportunities for accessing REDD+ finance	$ 30,000	Estimate
3.2	Package and present the GCFP to potential investors and funders	$ 30,000	Estimate
3.3	Additional long term funds secured for the GCFP	$ 100,000	
4	**Branding ER Cocoa/marketing**	**$ 290,000**	
4.1	Develop market studies and demand for Ghana's CSC	$ 30,000	
4.2	Design and develop Ghana's CSC brand	$ 60,000	
4.3	Stimulate demand and sell Ghana's CSC	$ 200,000	
5	**Sustainable Finance of HIAs**	**$ 1,230,000**	
5.1	Identify diverse long-term financial sources to support HIA governance	$ 30,000	
5.2	Plan and develop financial plan for HIA governance	$ 30,000	
5.3	Support start-up costs of HIA financial plan for 5 years	$ 450,000	
5.4	Establish trust fund with 3rd party financial management	$ 600,000	
5.5	Implement financial sustainability for HIA	$ 120,000	
E. Legislative and Policy Reform		**$ 745,000**	
1	**Passage of legislation**	**$ 220,000**	
1.1	Ensure passage of Forest Wildlife Bill legislative instrument	$ 100,000	
1.2	Support parliamentary sub-committee engagements leading to LI passage	$ 120,000	
2	**Reform and implementation guidance of government policies**	**$ 270,000**	
2.1	Tree-tenure reforms	$ -	
2.1.1	All HIAs are approved to pilot new tree-tenure arrangements (tree passport and XX)	$ 20,000	
2.1.2	Independent studies within HIAs on tree-tenure arrangements	$ 50,000	
2.1.3	Prepare tree-tenure policy implementation guidelines	$ 30,000	
2.2	Clarification of carbon transaction rights + benefit-sharing agreements for GCFP	$ -	
2.2.1	Independent studies on transaction rights at multiple scales and benefit-sharing agreements	$ 80,000	
2.2.2	All HIAs approved to innovate carbon transaction and benefit-sharing agreements	$ 20,000	
2.2.3	Independent review on innovative carbon transactions	$ 30,000	
2.3	Reform of Cocoa Farm input system	$ -	
2.3.1	All HIAs are approved to pilot farm input reforms	$	

		20,000	
2.3.2	Independent review on farm input pilots	$ 20,000	
3	**Modification to customary norms and practices**	**$ 255,000**	
3.1	Promote evolution away of perverse traditional land-use practices at Cocoa sector	$ -	
3.1.1	Independent studies in HIAs to identify perverse land use norms	$ 30,000	
3.1.2	Support negotiation with traditional leaderships for HIAs level reforms	$ 200,000	
3.1.3	Independent review on implementation of land use reforms	$ 25,000	
GRAND TOTAL		**$ 236,727,250**	

Annex 2c: Initial Discounted Cash Flow Analysis

Assumptions					
Productivity					
Current Productivity	400	kg/hectare			
effectiveness (Increase in yields)	25% achieved in year 2, 50% thereafter				
Farmgate Cocoa price	7600.00	GHC/tonne			
	7.60	GHC/kg			
World Cocoa Price	$ 2,000	USD/tonne			
	$ 2.00	USD/kg			
% World price to Cocoa Board	30%				
Exchange rate	4.000	GHC/USD			
Hectares in programme	800,000	hecatres			
Carbon price	$5	USD/tonne			
Estimated Ers	2,001,510	tonnes/year			
Productivity (kg/hectare) =	400				
Year	1	2	3	4	5
Revenue					
Emissions reductions ($10/tonne)	$10,007,550	$10,007,550	$10,007,550	$10,007,550	$10,007,550
Increase yield farmers		$0	$0	$0	$0
Increase yield to Cocoa Board		$0	$0	$0	$0

Total Revenue	$10,007,550	$10,007,550	$10,007,550	$10,007,550	$10,007,550
Programme Expenditure	($35,845,900)	($35,354,400)	($88,958,995)	($38,599,405)	($37,968,550)
Net flows	($25,838,350)	($25,346,850)	($78,951,445)	($28,591,855)	($27,961,000)
IRR	N/A - negative return				
NPV* @ 10%	($140,644,811)				
@20%	($109,848,840)				
@30%	($88,351,328)				
*The % are an expected rate of return from an investment perspective					
Productivity (kg/hectare) =	600				
Year	1	2	3	4	5
Revenue					
Emissions reductions ($5/tonne)	$10,007,550	$10,007,550	$10,007,550	$10,007,550	$10,007,550
Increase yield farmers		$76,000,000	$152,000,000	$152,000,000	$152,000,000
Increase yield to Cocoa Board		$48,000,000	$96,000,000	$96,000,000	$96,000,000
Total Revenue	$10,007,550	$134,007,550	$258,007,550	$258,007,550	$258,007,550
Programme Expenditure	($35,845,900)	($35,354,400)	($88,958,995)	($38,599,405)	($37,968,550)
Net flows	($25,838,350)	$98,653,150	$169,048,555	$219,408,145	$220,039,000
IRR	438.16%				
NPV* @ 10%	$471,536,424				
@20%	$339,045,193				
@30%	$251,527,959				
*The % are an expected rate of return from an investment perspective					
Productivity (kg/hectare) =	800				

Year	1	2	3	4	5
Revenue					
Emissions reductions ($10/tonne)	$10,007,550	$10,007,550	$10,007,550	$10,007,550	$10,007,550
Increase yield farmers		$152,000,000	$304,000,000	$304,000,000	$304,000,000
Increase yield to Cocoa Board		$96,000,000	$192,000,000	$192,000,000	$192,000,000
Total Revenue	$10,007,550	$258,007,550	$506,007,550	$506,007,550	$506,007,550
Programme Expenditure	($35,845,900)	($35,354,400)	($88,958,995)	($38,599,405)	($37,968,550)
Net flows	($25,838,350)	$222,653,150	$417,048,555	$467,408,145	$468,039,000
IRR	936.00%				
NPV* @ 10%	$1,083,717,658				
@20%	$787,939,226				
@30%	$591,407,246				
*The % are an expected rate of return from an investment perspective					
Productivity (kg/hectare) =	1000				
Year	1	2	3	4	5
Revenue					
Emissions reductions ($10/tonne)	$10,007,550	$10,007,550	$10,007,550	$10,007,550	$10,007,550
Increase yield farmers		$228,000,000	$456,000,000	$456,000,000	$456,000,000
Increase yield to Cocoa Board		$144,000,000	$288,000,000	$288,000,000	$288,000,000
Total Revenue	$10,007,550	$382,007,550	$754,007,550	$754,007,550	$754,007,550
Programme Expenditure	($35,845,900)	($35,354,400)	($88,958,995)	($38,599,405)	($37,968,550)
Net flows	($25,838,350)	$346,653,150	$665,048,555	$715,408,145	$716,039,000
IRR	1423.31%				
NPV* @ 10%	$1,695,898,893				
@20%	$1,236,833,259				
@30%	$931,286,533				

*The % are an expected rate of return from an investment perspective					
Productivity (kg/hectare) =	1200				
Year	1	2	3	4	5
Revenue					
Emissions reductions ($10/tonne)	$10,007,550	$10,007,550	$10,007,550	$10,007,550	$10,007,550
Increase yield farmers		$304,000,000	$608,000,000	$608,000,000	$608,000,000
Increase yield to Cocoa Board		$192,000,000	$384,000,000	$384,000,000	$384,000,000
Total Revenue	$10,007,550	$506,007,550	$1,002,007,550	$1,002,007,550	$1,002,007,550
Programme Expenditure	($35,845,900)	($35,354,400)	($88,958,995)	($38,599,405)	($37,968,550)
Net flows	($25,838,350)	$470,653,150	$913,048,555	$963,408,145	$964,039,000
IRR	1907.29%				
NPV* @ 10%	$2,308,080,127				
@20%	$1,685,727,291				
@30%	$1,271,165,819				
*The % are an expected rate of return from an investment perspective					

Annex 3: Request for Exemption and Justification for 2015 Reference Period end date

Ghana requests an exemption from the Carbon Fund limitation of 2013 as the latest end date for a Reference Period (Criterion 11; Indicator 11.1). Ghana has experienced increasing deforestation in the years following 2012, and its period of performance under a REDD+ programme would not start prior to 2017. There have been steep rises in rates of deforestation, largely attributable to a major upsurge in the incidence of wildfires, illegal logging, and illegal mining in the GCFRP Accounting Area, especially during 2013 and 2014. Therefore, a reference period ending in 2012 does not adequately represent the actual rate of deforestation and forest degradation that has been occurring in recent years, and therefore serves as an inadequate representation of historical emissions. Ghana has the capacity, Government commitment and opportunity to reduce emissions from deforestation while preserving important habitats. However, forcing Ghana to take a reference level that will likely ensure failure will have broad-reaching negative consequences.

This reality of rapidly rising deforestation emissions is reflected in the analyses forming the basis of the reference level presented in this ER-PD as well as in local knowledge and global data. Figure A1displays annual area of deforestation in the GCFRP Accounting area derived both by the imagery analysis of Ghana and from the global analyses of the University of Maryland (http://glad.umd.edu/). The analysis strongly demonstrates the recent increases in forest pressures in the GCFRP Accounting Area.

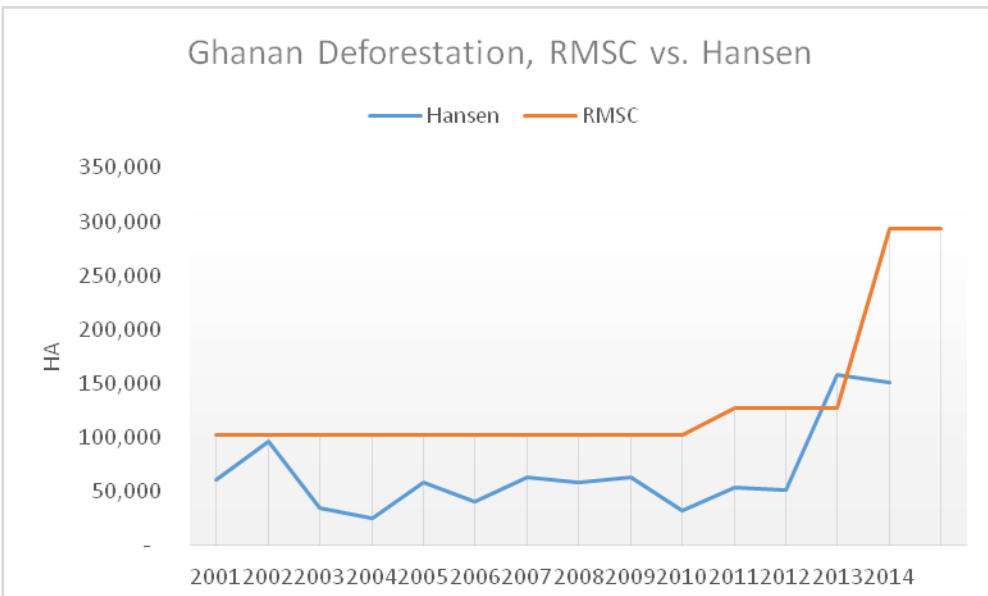

Figure 31: Annual deforestation in the GCFRP Accounting Area of Ghana as derived by the analyses of Ghana's Forestry Commission and by the Global Land Analysis & Discovery team of the University of Maryland

The analysis demonstrates that deforestation emissions between 2013 and 2015 were more than double those recorded between 2000 and 2010. Emissions even rose 23% from 2010-2013 to 2013-2015.

This discrepancy poses significant challenges in achieving emission reduction benefits under a REDD+ programme. Even assuming the deforestation rate does not continue to climb, Ghana would have to decrease its deforestation by 37% even if the reference period continues through 2015. If the period were limited to 2012 Ghana would have to reduce its emissions by almost 50% before a single emission reduction credit could be earned. This reality may severely undermine the programme's potential for success and render it a non-starter.

Table A47 below shows the options for calculating average annual deforestation. The final column shows the proportional reduction needed prior to eligibility for crediting and clearly illustrates the importance of a later end date for Ghana's reference period.

Table 62: Options for reference periods with accompanying deforestation rates

Reference Period	Reason	Annual Average (t CO_2e/yr)	Difference (t CO_2e/yr)	Needed Reduction Prior to Crediting (%)
2013-2015	Most recent data	53,410,328	-	-
2000-2012	Methodological Framework	21,006,742	32,403,586	61%
2000-2015	Proposed Reference Period	27,279,790	26,130,538	49%

As such, Ghana requests an alteration in the dates of the reference period for the calculation of the average historical emissions to more closely reflect land use and land use change dynamics

Annex 4a: Letter of Support from MLNR

Telephone: 233-302-665949
Tel/Fax: 233-302-666896
Email Address: info@mlnr.gov.gh

In case of reply, the number and date of this letter should be quoted.

Our Ref. No. SCR/FC-78/105/01

Your Ref. No.................................

MINISTRY OF LANDS AND NATURAL RESOURCES

P. O. Box M 212 Accra.
Website: www.mlnr.gov.gh

REPUBLIC OF GHANA

April 20, 2017

THE COORDINATOR,
FOREST CARBON PARTNERSHIP FACILITY,
WORLD BANK HEAD OFFICE,
WASHINGTON D.C.
UNITED STATES OF AMERICA

Dear Madam,

LETTER OF SUPPORT FOR THE PROPOSED GHANA COCOA-FOREST REDD+ PROGRAMME (GCFRP)

The Government of Ghana deeply appreciates the assistance of the Forest Carbon Partnership Facility (FCPF) under the World Bank in our efforts to curb carbon emissions from deforestation and forest degradation.

Under the readiness phase (I and II, from 2011-2014 and 2015-2017 respectively) of FCPF support, some notable achievements have been made in putting Ghana on a firm footing for concrete action towards tackling the major drivers of deforestation and forest degradation. These include the articulation of the Ghana REDD+ Strategy as a blueprint for long-term action, enhanced capacity for effective cross-sectoral coordination of REDD+ interventions, a draft National Forest Reference Level and a functional National Forest Monitoring System. This is evidenced by the endorsement of Ghana's Readiness Package (R-package) at the 22nd Participants Committee Meeting of the FCPF which was hosted by Ghana in September 2016.

In our transition towards a decarbonized development trajectory in the coming years, the Government of Ghana has provided clear policy direction in this regard for various sectors of the economy which are well-aligned with an overarching National Climate Change Policy which was adopted in June 2012 after extensive stakeholder consultations. Steps are also being taken under the watch of my Ministry to address other important policy gaps necessary for incentivizing various endeavours in climate mitigation, including tree tenure. Also, there is renewed efforts at strengthening law enforcement whilst raising public awareness about attitudes and behaviours that negatively impact the environment.

My Ministry, which hosts the National REDD+ Working Group, is very much pleased with the significant progress made in the development of Ghana's draft Emission Reduction Programme (ERP) document for submission to the Carbon Fund Participants for consideration. The main thrust of the programme, is to stem forest cover loss through the promotion of climate-smart cocoa production systems that ensure environmental quality whilst securing rural livelihoods and making the cocoa sector of Ghana sustainable and climate-resilient.

The programme design places great emphasis on private sector participation, and I am particularly delighted that at a high-profile event in mid-March 2017 in London, which was convened by the Prince of

Wales, key players in the global chocolate industry announced their commitment to a deforestation-free cocoa supply chain in Ghana and Cote d'Ivoire as the leaders in cocoa production globally. Locally, a lot of energy has been invested in mobilizing private sector support for the programme with highly encouraging results, and such efforts will be sustained going forward.

The Forestry Commission and the Ghana Cocoa Board, as the joint proponents of the ERP, are poised to work together with all relevant stakeholders to deliver on the objectives of the Programme, working through the National REDD+ Secretariat. Major strides have also been made to ensure that the various climate-focused programmes and projects in the land-use sector are synergized to maximize their possible outcomes.

I wish to assure the Carbon Fund Participants of the strong political commitment and leadership that will be essential for achieving the ambitious targets of the programme, and to entreat them to take this into account in considering Ghana's proposal.

Yours sincerely,

JOHN PETER AMEWU
MINISTER

Annex 4b: Letter of Intent from World Cocoa Foundation

World Cocoa Foundation

11 April 2017

Hon. Kwadwo Owusu Afriyie
The Chief Executive Officer
The Forestry Commission of Ghana
Accra, Ghana

Subject: Letter of Intent to support the Emissions Reductions Programme for the High Forest Cocoa-Forest Mosaic Landscape of Ghana

Dear Hon. Kwadwo Owusu Afriyie,

As the industry membership organization representing over 80% of the global cocoa and chocolate industry, the World Cocoa Foundation (WCF) is proud to confirm its support of the Ghana Cocoa Forest REDD+ Program (GCFRP), under the Emissions Reductions Programme for the High Forest Cocoa-Forest Mosaic Landscape of Ghana. As per our earlier discussion, WCF would be pleased to sign a Memorandum of Understanding with the Forestry Commission of Ghana that lays out specific areas of collaboration. WCF supports the GCFRP's ambitious commitment to significantly reducing greenhouse gas emissions, including those generated by cocoa farming as well as other agricultural drivers. The Forestry Commission and WCF share a common vision of sustainable growth in Ghana, that will create an environmentally and economically sustainable balance of improved livelihoods, agriculture growth and the conservation of protected forests and natural resources.

In Ghana, WCF is currently implementing activities that directly support the GCFRP. We recently launched the Feed the Future Partnership for Climate Smart Cocoa with support from the United States Agency for International Development and nine WCF member companies. This program aims to increase private sector investment and engagement in climate smart cocoa (CSC) practices, and to empower smallholder farmers to adopt CSC practices that improve supply chain and ecosystem resilience. Secondly, last month, the world's leading chocolate and cocoa companies agreed to a statement of intent to work together, in partnership with others, on ending deforestation and forest degradation in the global cocoa supply chain, with a key focus also on both Ghana and Cote D'Ivoire. This Cocoa + Forests Initiative, in collaboration with the Sustainable Trade Initiative (IDH) and The Prince's Trust International Sustainability Unit (ISU), focuses on a multi-stakeholder process to develop and present a joint public-private framework of action at the United Nations Framework Convention on Climate Change 23rd Conference of the Parties (COP 23) meeting in November 2017. We look forward to collaborating with you and your staff directly on ensuring that this framework for action directly supports Ghana's REDD+ program and your Commission's priorities.

Under our proposed collaboration, WCF envisions contributing its technical expertise and that of our member companies present in Ghana to the GCFRP. Additionally, we would foresee convening the private sector and helping to coordinate their support of the GCFRP priorities. WCF looks forward to working with the Forestry Commission and Ghana Cocoa Board to determine the most appropriate venue and forum for the private sector to dialogue and work with

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Abidjan Office: Abidjan, Cocody Attoban, Rue J 153, Lot 23, Ilot 3215, Côte d'Ivoire. T +225 22 50 17 41
Washington Office: 1411 K Street, NW, Suite 500, Washington DC 20005. T +1 202 737 7870

www.WorldCocoa.org

government on the implementation of the GCFRP. WCF also commits to working with the GCFRP partners and WCF members on pilot proposals and on the identification of best practices within this framework.

We look forward to collaborating with the Forestry Commission on the implementation of the GCFRP and remain available should you require any additional information.

Sincerely,

Richard Scobey

Richard Scobey
President

Annex 4c: Collective Statement of Intent for the Cocoa and Forests Initiative

The world's leading cocoa and chocolate companies agreed to a statement of collective intent committing them to work together, in partnership with others, to end deforestation and forest degradation in the global cocoa supply chain, with an initial focus on Côte d'Ivoire and Ghana.

Preamble

Recognising the vital role of the cocoa sector in bringing jobs and wealth to local communities, while at the same time seeking to be environmentally and socially sustainable and striving to protect the world's tropical forests;

Noting the importance of the cocoa sector in national economic development, the reduction of rural poverty, and in accelerating the transition to sustainable livelihoods for the millions of smallholder farmers who grow cocoa;

Emphasising the critical role of forests, biodiversity and conservation in addressing global climate change, regulating the local and regional climate, and providing other critical ecosystem services that underpin the resilience of the cocoa sector and local livelihoods;

Acknowledging the role of agricultural commodity development, including the cocoa sector, as a driver of deforestation and forest degradation, and recognizing the contribution that the cocoa sector can make in many countries to the restoration of forests and resilient landscapes;

Understanding the importance of public-private partnerships in sustainable and inclusive economic development, and our commitment to supporting the achievement of the Sustainable Development Goals;

Conscious of the need to promote, foster and accelerate the economic and social development of tropical forest countries, in order to improve living standards and people's well-being;

Recognising that agricultural commodity production must contribute to national commitments to reduce greenhouse gas emissions agreed in the United Nations Framework Convention on Climate Change, as well as other relevant global commitments;

We, the undersigned companies, commit to working together, pre competi- tively, to end deforestation and forest degradation in the cocoa supply chain, with an initial focus on Ghana and Côte d'Ivoire.

Declaration

To this end, we will:

Promote and participate in multi-stakeholder coalitions that bring together public, private, and civil society partners, to support the development of a common vision and joint framework to end deforestation and forest degradation in the cocoa sector;

Align individual company action plans with the common vision and joint framework by 2018, to reach our respective deforestation commitments in the cocoa sector;

Build on existing initiatives and catalyze further efforts to improve cocoa productivity and resilience to reduce pressure on existing forests, working in partnership with producer country governments, farmers and farmer organisations, civil society organizations, development partners, and other stakeholders; and promote improved practices through our supply chain relationships;

Work in partnership with producer country governments and all relevant stakeholders to professionalize and economically empower farmers and their families, and deepen support for inclusive and participatory development of cocoa-growing communities, with a strong focus on gender empowerment;

Ensure evidence-based decision-making by generating and sharing data and research on forests, forest loss and degradation, and patterns of land use in cocoa landscapes; and by promoting collective learning on sustainable commodity production across geographies, sectors and actors;

Work with producer country governments, farmers and farmer organizations, civil society organizations, development partners, and other stakeholders to jointly advance effective approaches to land use policy and planning, forest protection, and where appropriate, forest and land restoration; and integrated landscape scale management;

Encourage increased mobilization of financial resources from all sources (including public and private, bilateral and multilateral, and alternative sources of finance) as well as the use of innovative financial tools and mechanisms, to address the challenge of financing for sustainable development in the cocoa sector;

Ensure effective and transparent monitoring and reporting on progress on our respective deforestation commitments in the cocoa sector;

Seek to extend the initiative to other cocoa-growing countries and regions based on the experience of the initial collaboration in Ghana and Côte d'Ivoire.

Joint Framework for Action

Following this meeting, we undertake to work collectively with producer country governments, farmers and farmer organizations, civil society organizations, development partners, and other stakeholders to prepare a joint framework for action to give substance to the commitment above by November 2017, with a view to announcing the framework and associated commitments at the 23rd session of the Conference of the Parties (COP 23) to the UN Convention on Climate Change (UNFCCC) in Germany.

Signatories

- Mr. Antonie de Saint-Affrique, Chief Executive Officer, **Barry Callebaut**
- Mr. Peter Blommer, President and Chief Executive Officer, **Blommer Chocolate Company**
- Mr. Axel d'Hauthuille, Director General, **Callivoire**
- Mr. Harold Poelma, President, **Cargill Cocoa and Chocolate**
- Mr. Patrick Poirrier, Chief Executive Officer, **Cémoi**
- Mr. Adam Lechter, Senior Director of Research and Development, **Clasen Quality Chocolate**
- Mr. Arjen R. Thiescheffer, Director, **Cocoanect**
- Mr. Brian Beck, President, **Cococo Chocolatiers**
- Mr. Alain Poncelet, Deputy Chief Executive Officer, Cocoa and Coffee, **ECOM Group**
- Mr. Aldo Uva, Chief Officer, Operating Supply and Strategic Business Platforms, **Ferrero**
- Mr. Gary Guittard, President and CEO, **Guittard Chocolate Company**
- Mr. Mohamed Elsarky, Chief Executive Officer, **Godiva Chocolatier, Inc.**
- Ms. Michele Buck, CEO, **The Hershey Corporation**
- Mr. Dieter Weisskopf, Group CEO, **Lindt & Sprüngli Group**

- Ms. Hazel Culley, Senior Food Sustainable Product and Raw Material Manager, **Marks & Spencer Foods**
- Mr. Blas Maquivar, President, Chocolate UK & Global Retail, **Mars Chocolate**
- Mr. Kazuo Kawamura, President and Representative Director, **Meiji Co., Ltd.**
- Mr. Hubert Weber, Executive Vice President and President, **Mondelez Europe**
- Ms. Sandra Martínez, Global Head of Confectionery, **Nestlé**
- Mr. Gerry Manley, Chief Executive Officer, **Olam Cocoa**
- Mr. Bob Tavener, CEO, **Ovaltine**
- Mr. Cem Karakas, CEO, **Pladis**
- Mr. Andreas Ronken, CEO, **Ritter Sport**
- Mr. Giles Bolton, Responsible Sourcing Director, **Tesco PLC**
- Mr. Gregory Hess, CEO, **Tree Global**
- Mr. Patrick de Boussac, Chief Executive Officer, **Touton**
- Mr. Toussaint N'guessan, President, **Uirevi**

Annex 5: Stakeholder Consultation

Event	**Stakeholders/ Participants**	**Issues/Presentation**	**Comments /Question**	**Feedback/Responses**
ERP Information Sharing and Kick-Off for High Level Stakeholders, March 4th, 2015, Fiesta Royale Hotel, Accra.	Parliament, MLNR, MESTI, MOFA, COCOBOD, CRIG, FC, FORIG, Mondelez Cocoa Life, Armajaro, Touton, NCRC, Solidaridad, Rainforest Alliance, National House of Chiefs, SNV, Agro Eco, IUCN, Olam	Overview of Ghana's National REDD+ Strategy, Emission Reduction Programme and Incorporation of REDD+ Within FC - *Yaw Kwakye & Edith Abruquah*; Ghana Cocoa Board's Climate Smart Cocoa Strategy and The ERP – *Dr. Anim Kwapong;* Facilitating climate smart Cocoa Production in Ghana - *Christian Mensah (Rainforest Alliance) and Isaac Gyamfi (Solidaridad West Africa)*; Olam's interest in ERP: Growth Sustainability; Touton-PBC Cocoa Sustainability Programme.	Why so much overlap between the FIP and the ERP? How are these programmes working together and how are they different?	The FIP area is falls within the ERP area and share the same objectives. The two programme areas are characteristics by the same drivers of deforestation and forest degradation. There are to synchronize work plan of the two programmes to avoid duplication of efforts. Whiles the ERP is a performance based payment, the FIP is not. Rather, FIP sought to pilot readiness activities that would later be upscale to put Ghana in a position for implementation performance based payment ER Programme.
Synergy between REDD+ and FLEGT/VPA with respect to Benefit Sharing, Legality and Safeguards, March 13th, 2015, Forestry Commission Auditorium, Accra.	FC, CRIG, MLNR, COCOBOD, NHC, FORIG, Solidaridad, COCOBOD, FC, Olam, Touton, IUCN, Ministry of Finance, MESTI	"Analysis of linkages and opportunities for synergies between FLEGT, REDD and national forest programme in Ghana". Four technical areas under investigation are: *Regulation of the domestic market; Benefit sharing; Legality & safeguards; and*	Is there a way of institutionalizing coordination and capturing synergies between REDD+ and VPA with respect to benefit sharing, conflict resolution, and complaint mechanisms?	The GCFRP and REDD+ in general are synergistic with a number of other key initiatives like the VPA, FIP, etc. The JCC and the various sub-working groups represent efforts to ensure that there is serious institutional collaboration and coordination. For instance, on the NRWG and the Consultation and participation sub-working groups, there are representatives from FLEGT/VPA serving. In the same manner, the Head of the NRS also serve on the VPA Multi-stakeholder implementation Committee.

		Monitoring. Overview REDD+ VPA FLEGT Synergy Programme - *Samuel Nketia*; Benefit Sharing Framework For Ghana's REDD+ Process - *Robert Bamfo*; Legality and Safeguards under FLEGT VPA and Areas of Synergy with REDD+ - *Kwame Oduro.*		
Consultation with stakeholders implementing REDD+ activities across the country—REDD+ Finance Tracking Initiatives (REDDX), 23rd June, 2015, FC Auditorium, Accra.	MLNR, FC (CCU, FSD,WD), Olam Ghana, Hamilton Resources and Consulting, FORIG, Conservation Alliance, Ghana Integrity Initiative, IUCN, A Rocha Ghana, Portal Forest Estate, UNDP (GEF), Solidaridad, SNV, Rainforest Alliance, CERSGIS		How is the programme addressing tree tenure? How is it aiming to motivate farmers to plant trees and how will farmers stand to benefit?	It is apparent that planted trees on-farms are owned by the planter. Under FIP tree seedlings are being distributed freely to farmers, and education and sensitization on the non-carbon benefits including provision of micro climate, soil conservation and fertility improvement of trees on farm are being undertaken.
			How will ERP programme engage all stakeholders, not just at high levels but also at the district and local level where the deforestation is taking place?	The programme will have specific HIAs and in each intervention area there will be HIA consortium which will have a constitution, Management plan and district bye laws and the intervention area management board. The management board will be made up of the traditional authorities, village committees etc. There is already ERP stakeholder consultation plan.
			How would the sustainability of the ER programme be guarantee	Non-carbon benefits are likely to be the most sustainable and important to farmers. The non-carbon benefit of E such increased yields, access to farming inputs, and rights to trees will drive the sustainability of the programme.
Training for Staff of Ghana's COCOBOD and FC	Participants were drawn from various departments, units	Ghana's National REDD+ Architecture and the Readiness Processes– *Yaw*	How will the benefits sharing mechanism and/or bonus payment system under the	This viewpoint, which was widely shared by COCOBOD participants, aligns with the logic of Ghana's ERP and has informed the design of the programme's benefit

on the GCFRP, Sept 21-24, Aqua Safari, Ada, Ghana	and divisions of the COCOBOD (including the Research Monitoring and Evaluation Department (RMED), Seed Production Department (SPD), Cocoa Health and Extension Department (CHED) and the Cocoa Research Institute of Ghana (CRIG)). For FC, regional managers were selected from the Wildlife Division (WD) and the Forest Services Division (FSD).	*Kwakye*; Examples of REDD+ Projects in Africa – *John Mason*; Status of REDD+ Markets – *Rebecca Ashley Asare*. Moving from projects to programmes: evolving REDD+ finance – *John Mason;* Jurisdictional REDD+ issues*: – Tesfaye Gonfa*; Case Study on Oromia REDD+ Programme, Ethiopia – *Tesfaye Gonfa;* Case Study on Brazil REDD+ programme – *Rebecca Ashley Asare;* Co-benefits, Safeguards, and FPIC – *Hilma Manan.* Briefing on Ghana's Cocoa Forests REDD+ programme – *Yaw Kwakye;* Synergies between Cocoa Board Strategy and REDD+ programme – *Mr. Eric Amengor;* Climate-smart cocoa: what is Ghana selling*? – Rebecca Ashley Asare*; How can Cocoa ER programme be implemented on the ground? – *Rebecca Ashley Asare*.	COCOBOD inform the design of the Ghana's ERP benefit sharing mechanism?	sharing mechanism.
			What existing measures are in place particular on safeguards and for which lessons or experiences could be learnt to enhance the implementation of the ERP.	COCOBOD has extensive experience dealing with safeguard issues in its sector (e.g. child labor), as well as benefit sharing (bonuses). The Research, M&E Department of COCOBOD has the responsibility to monitor safeguard results and the staff on the ground are required to report as part of their results framework how safeguards issues are addressed. Again, CHED has developed best practices guideline for cocoa production. Lessons learnt are being incorporated into the design of ERP.
Community Consultation on	FC (CCU, FSD, WD), COCOBOD (CHED),	Climate Change and REDD+ - Meaning of Climate	Provision of incentives such as mobile phones, stipend,	

Ghana's ERP at the Catholic Diocesan Pastoral and Social Center, Goaso in the Brong-Ahafo Region on 1st October, 2015	National Forest Forum, Chiefs and Cocoa Famers from 39 district within the Goaso forest district.	Change, Signs of Climate Change, Activities that humans do to bring about Climate Change, Negative effects of Climate Change on human life, Tree protection and tree planting as a means to mitigate Climate Change - *Mr. Abaka Haizel*; Operational Measures for Climate Smart Cocoa Cultivation - *Mr. Tweneboah Koduah*	bicycles, motorbikes and duty post will motivate the Forest Guards to efficiently check illegal logging; Farmers, they should be supplied with tree seedlings for planting; restrict the importation of chainsaw machines; FC should collaborate with COCOBOD and register cocoa farms that have been intercropped with trees since it is a means to increase their cocoa yields and also to contribute to emission reduction; provide extension services to the farmers	
Community Consultation on Ghana's ERP at Ench in the Forest District of the Western Region of Ghana, on 7th October, 2015				Unresolved tree tenure issues (Fear of planted trees being taken over and felled by TUC holders); More Cocoa Extension Officers needed to educate farmers on modern; Law enforcement - Forest Managers should be given the power to prosecute forest offences; political interference in forest management; CBOs (CFCs, CBAGs, CREMAS, NFFG, etc.) should be strengthened and made vibrant to support forest protection.
Community Consultation on Ghana's ERP at Owuram near Asamankese, Eastern Rgion of Ghana. 9th October, 2015	FC (WD, FSD),NFF,COCOBOD (SPD,CHED), MOFA, NADMO, Care International, Famers from the following communities (Yaw Basi Krom, Foaso Nkrankrom,	1. The role of forests in Ghana's Emission Reduction Programme – *Mr. Attah Owusu, FSD-FC*. 2. The effect deforestation on wildlife population – *Mr. Bernard Asamoah-Boateng, WD-FC.* 3. Rehabilitation of Cocoa	How will the GCFRP change the BAU on the ground with respect to contractors felling trees without farmers' consent and not paying compensation, and farmers' inadequate access to seedlings and fertilizer? The situation is not good for farmers.	The ERP through stakeholder consultation at various levels including local communities has been sensitizing people particularly farmers on the legality of ownership of planted trees as well as the conditions under which contractors could fell trees on farms. The ERP learnt lessons from the free distribution of tree seedling and improved access to some farming inputs

	Odumase, Gyasikrom, Kasapim, Bitre Abeebrese, Manhyia, Atimponya, Kensere, Kwame Bour, Yaw Krakrom, Maanfadwen, Moseabo, Kodiekrom, Gambia, Ayomso etc.)	Farms outside Forest Areas – *Mr. Gyimah Gyamfi, CHED - COCBOD*. 4. Cultivation of Cocoa under shade: a potential means to mitigate global warming – *Dr. J.E. Sarfo, QCC-COCOBOB.*	Gender considerations in REDD+ and the programme should be stronger and clearer. How is gender being considered in REDD+ and in the design of the ERP?	Gender consideration are being given careful attention in the design of the ER Programme. Under the readiness phase of REDD+, the Forestry Commission in collaboration with IUCN engaged several stakeholders towards ensuring that gender issues are mainstream in the design and implementation of any REDD+ programme. The product of that collaboration in the design of a gender Road Map for REDD+ in Ghana. The roadmap guided gender considerations in the development of REDD+ Strategy.
Community Consultation on Ghana's ERP at Assin Fosu Forest District of the Central Region of Ghana. 13th October, 2015		**Radio Talk Show Panelist**: 1. Mrs Lucy Amoh Ntim - Assistant Regional Manager, FSD-FC. 2. Dr. Ofori Gyamfi, Regional Cocoa Health and Extension Division - COCOBOD. 3. Mr. Solomon Bagaseh, Regional Forestry Forum. 4. Mr. Samuel Essuman, CHED-COCOBOD.	**Questions panelist sought to answer during the radio talk show include the following**: What is climate change? What are the effects of climate change on the environment? How can climate change affect cocoa production? How can climate change be mitigated? What is the role of forest in mitigating climate change? Why should we encourage tree planting in the environment? What are the benefits in establishing tree plantation? **Question asked during the actual consultative meeting are:** participants asked whether contractors were made to plant trees to replace those that they remove? Do land lords have rights to sell trees on their farms without their notice?	1. Cocoa thrives well under shade than when it is left at the mercy of the sun. 2. Cocoa farmers should maintain some amount of shade on the cocoa trees to prolong its lifespan and increase production /yield. 3. Presence and maintenance of shade trees in cocoa farms help to control the spread of 'Akate' in cocoa farms. 4. Discourage the conversion of cocoa farmland to rubber plantation since cocoa has ready market and stable price as compared to rubber. 5. The need for effective collaboration between the FC, COCOBOD (CHED), Traditional Rulers, Land Owners, Farmers, NGOs, and CBOs for good result from the programme. 6. There is also the need for periodic interaction with the media in the form of radio talk show on the state and local FM stations to educate the communities about the importance of trees. 7. There is the need to expand and cover the whole Central Region (including Twifo Praso, Dunkwa-on-Offin, Breman, Nyakrom) where there are cocoa and forest. 8. There is the need for a roadmap towards reaching

			What can forestry commission can do to save the destruction timber contractors cause to their cocoa farms without compensation under the position of **"this is my TUC area". (answers to the above questions were not provided in the report)**	out to all farmers in the region
Community Consultation on Ghana's ERP at Bibiani in the Forest District of the Western Region of Ghana, held on 8th November, 2015	stakeholders and participants at the event include representatives from the following: Forestry Commission, COCOBOD, MOFA, Bibiani Anwiaso Bekwai District Assembly, Farmers, NGOs and CSOs,			Unresolved tree tenure issues (Fear of planted trees being taken over and felled by TUC holders); More Cocoa Extension Officers needed to educate farmers on modern; Law enforcement - Forest Managers should be given the power to prosecute forest offences; political interference in forest management; CBOs (CFCs, CBAGs, CREMAS, NFFG, etc.) should be strengthened and made vibrant to support forest protection.
REDD+ Strategy Multi-Stakeholder Consultation Workshop, Nov 5th, FC Auditorium, Accra	Tropenbos, NFF, Censudi, Rise – Ghana, FORIG, MOFA, FC (Participants from the southern zone of the country: Central; Eastern; Greater Accra and Volta Regions.	Mr Kwame Adyei delivered on sections of Ghana's REDD+ Strategy: Overview of REDD+ in the world and Ghana's position in the REDD+ programme; Introduction to REDD+ Readiness towards implementation; Achieving REDD+; Governance and; Tracking REDD+.	How will the programme address the lack of compliance with and enforcement of timber harvesting rules and regulations?	The programme implementation will support national efforts towards passage of legislation, reform and implementation of government policies, modification to customary norms and practices
				The strategy should clearly indicate how to address land tenure issues, tree tenure issues and carbon right as they emerge.
				Wildfire should be part of the drivers especially considering the savannah ecological zone. The diagram showing drivers of deforestation and degradation needs to be expanded to cover other drivers aside from the five mentioned.

				On financing, focus has been on the international market, but we should also look at the local market for financing for example Agricultural Development Bank and some internally generated system to support the implementation of the programme under the strategy.
IUCN BMU REDD+ Benefit Sharing Project Learning Event, 9th - 11th November, 2015 at Aqua Safari Resort, Ada	MLNR, A Rocha Ghana, FORIG, Colandef, IUCN, FC (RMSC,FSD,WD), Portal Forest, Hamilton Resources, Civic Response, KASA Ghana, Tropenbos International	**Component 1:** Understanding and contextualizing: understanding the local/national context and the different factors involved. **Component 2:** Designing for Pilot - formulating concrete proposals, validating. **Component 3:** Mainstreaming - how the project mainstreams baseline and output from 1 and 2, and at which scale	Although individual landowners and land users do not have economic rights to naturally occurring trees, they do have the right to fell trees off-reserve during the land-clearing process and frequently nurture or eliminate species based upon their farming agenda and experiences. How will the programme address this problem?	
			The current tree tenure system where the State owns all naturally-occurring trees and farmers have no ownership right over such economic trees in their farms, creates a disincentive for farmers to keep naturally economic trees in cocoa farms. How will the programme address this problem	The ER Programme is transformational and therefore seek to push for significant changes and reforms in the forestry sector policies and strategies which include issues of tree tenure.

SNV Knowledge Event on Ecosystem Services in Ghana's Cocoa Landscape, 12 November, 2015 Mensvic Hotel, East Legon Accra, Ghana.		Potential for enhancing on-farm tree tenure and carbon stocks; Pest and disease control; Nutrient cycling and pollination; Way forward with SNV's Sustainable Cocoa Landscape Programme.	Landscape has low carbon stocks, hence, it has the high potential for accumulating carbon with the implementation of REDD+; Non-timber species are more dominant in the landscape; more trees do not necessarily translate into greater canopy cover as it is dependent on species and tree characteristics; Shade tree canopy coupled with modest fertilizer application can have a positive impact on yields under low input smallholder cocoa cultivation. Landscape has low carbon stocks, hence, it has the high potential for accumulating carbon with the implementation of REDD+; Non-timber species are more dominant in the landscape; more trees do not necessarily.
National REDD+ Forum Held at the Accra International Conference Centre (AICC) on Wednesday 25th of November 2015	Dr. Ismael Yamson (Chairman – Yamson and Asociates) H.E. John Agyekum Kuffuor (Former President and UN Special Envoy), Mr. Samuel Afari-Dartey (CEO, FC), Chief Executive Officer Dr. Stephen K. Opuni (CEO, COCOBOD) Hon. Nii Osah Mills (Minister, MLNR) Prof. John Nabilla (President – NHCs), Ms. Christine Evans-Klock, Country Rep. UNDP, Prof. Henry Kerali World Bank Country Director Key forest, REDD+ and other land use sector actors from the government institutions, private sector, NGOs, CSOs traditional authorities, community	The following presentations were delivered: National Efforts to Combat Climate Change, *by Mr. Peter Dery - MESTI* REDD+: The State of Play in Ghana *by Mr. Robert Bamfo - FC* Private Sector Participation in Addressing Climate Change by *Mr. Isaac Gyamfi – Solidaridad WA* Mobilising Climate Finance in Ghana, *By Dr. Rebecca Ashley Asare, Nature Conservation Research Centre, Accra – NCRC.* The Role of Traditional Leaders as Advocates for Climate Actions, *by Nana Frimpong Anokye Ababio – NHCs.* Keynote address on the	Is there funding available for individuals for tree planting to help reduce emissions? There are opportunities available for individuals to engage in plantation and funding for such programmes. These activities should be seen as a business opportunity and Technical Assistance is provided to ensure trees grow in order to get returns. Trees shouldn't be seen only for timber. REDD+ ensures that the trees are maintained to help in carbon stocks enhancement. Law enforcement should be beefed up and any programmes put in place to enforce environmental laws. REDD+ plans for climatic conditions and need to support and bring back traditional by-laws to sanction people who degrade the forest. African leaders should sit up and come up with policies to safeguard our environment. The continuous decline in forest cover is largely going to affect food and agricultural production and also going to jeopardize Ghana's longstanding position as an important supplier to the international timber market, thereby diminishing revenue from the import sector. The emergence of REDD+ in Ghana presents an opportunity for the country to further complement ongoing efforts towards the sustainable management and conservation of our forests. Ghana's readiness to tackle the drivers of deforestation and forest degradation will therefore benefit the poor. He indicated that, the inclusion of REDD+ in Ghana's INDC demonstrates the importance of REDD+ contribution to the world's efforts in addressing climate change. Success of REDD+ will not only mean reducing carbon emissions but

	representatives, farmer groups, academia, development partners and students were among participants.	theme *"Conserving our forests for better lives and a better climate" by H. E. John Agyekum Kuffour, former President of the Republic of Ghana and UN Special Envoy for Climate Change*	healthier forests which will provide livelihoods for the poor.	
The National REDD+ Strategy (NRS) Validation workshop 17th December, 2015 at the FC Auditorium, Accra.			How does the programme/strategy sought to address the challenge of land use planning; what are domestic sources of funds - the document did not stress on domestic financing;	The programme will promote local level institutional coordination, stakeholder consultation and involvement in sub-national level land use planning. The development of an ER implementation plan which a consulting firm will be contracted to design will outline the various possible or funding or financing sources for implementing the ER Programme and for that matter any the REDD+ programme for Ghana.
			The document lacks strategic components such as setting ambitious carbon targets for the identified drivers of deforestation and forest degradation.	MRV has not been verified so setting our own targets will be difficult at this stage; Specific carbon targets cannot be provided now to due limitation in MRV - Implementation plan will provide specific details on carbon targets;
			Scope of REDD+ does not give much information on how biodiversity will be monitored. How is the issue of biodiversity conservation being addressed	We need to clearly define land use systems and land tenure in our Safeguards Information Systems
			How is cocoa strategy align with REDD+ strategy - there should be a close linkage.	The basic reason for the establishment and inauguration of the JCC between the FC and the COCOBOD is the general understanding that sustainability of cocoa production hinges on the sustainable management of forest. The Ghana National Cocoa Strategy II is at the draft stage of

				development. The strategy focus on climate smart cocoa production and sought to ensure combinations of cocoa trees and shade crops/trees that have both economic and environmental benefits. In fact, the cocoa strategy mention the collaboration between FC and COCOBOD in the ER Programme and the FIP as current sustainability programmes.
Youth Event - REDD EYE	Second cycle institutions, church youth groups, NGOs and Second cycle institutions including Amasaman Senior High, Presbyterian Boys Senior High School, Presbyterian Senior High School Mampong, Benkum Senior High School, Ideal College, Presett Pacesetters Senior High School and Life International Senior High School.	Message 1: Why should the youth be concerned about climate change? (Causes, manifestations and impacts of climate change) – *by Mrs. Saadia Bobtoya Owusu-Amofah;* Message 2: Why does protecting our forests matter in addressing climate change? - *Mr. Kwame Mensah*; Message 3: REDD+ and Ghana's progress in implementing the mechanism - *Ms. Hilma Manan*; Message 4: The role of the youth in forest conservation: A case-study of A Rocha's campaign aimed at the conservation of the Atewa Range Forest Reserve - *Mr. Daryl Bosu;*	How does Trees help to fight climate change? How do we benefit from not cutting trees for charcoal and export?	As trees grow, they help stop climate change by removing carbon dioxide from the air, storing carbon in the trees and soil, and releasing oxygen into the atmosphere; Trees can be cut for charcoal and export but it must done within the law and new seedlings must be planted to substitute the old ones.
Multi-Stakeholder Project Inception Workshop:	MLNR, FC, SNV, KASA, A Rocha Ghana, IUCN Ghana,	Introduction to REDD+ Safeguards and UNFCCC requirements: *by Linda*	Some key entry points at subnational level and activities for the target area include the	Some activities include the following: Background analyses (institutional/stakeholder, drivers, spatial); Safeguard review process; multi-stakeholder planning

Operationalizing National Safeguards Requirement for Result Based Payment From REDD+. 10th March, 2016 at the Tulip in Hotel, Accra.	Climate Law and Policy	*Rivera - Senior Legal and Policy Advisor*; Introduction to Project Work Packages in designing a Country Approach to Safeguards and a SIS in Ghana: *by Ugo Ribet - Legal and Policy advisor*; Integrating Safeguards and Multiple Benefits into Subnational Activities: Lessons from SNV and proposed activities in Ghana: By Reuben Ottou,	following: Integrated Low Emission Development Plans; Relevant Policies and Measures; Benefit Distribution Systems; Participatory Forest Monitoring. How will REDD+ safeguard for Ghana maintain biodiversity and ecosystem service?	and review workshops; Integrating REDD+ and other land use related climate change mitigation strategies and actions into appropriate development planning; Explore trade-offs across multiple economic; Support integration of land use planning using a multi-stakeholder approach for adoption in HFZ; Support priority Policies and Measures to maximize co-benefits and meet safeguard requirements; Contributes to deepening the emerging institutional collaboration towards addressing commodity driven deforestation in Ghana's cocoa-forest mosaic landscapes; Participatory approaches to monitoring (e.g. PFM).
Capacity Enhancement on Forest Reference Level/Measurement, Reporting and Verification System for REDD+ (MRV Training) 4th – 15th April, 2016 at the Forestry Commission Training Centre, Kumasi.	Ghana Cocoa Board, Forestry Commission (FSD, WD, NRS, RMSC) FORIG, Touton SA, Solidaridad West Africa	Presentation include the following: Proposed Forest Reference Level and Measurement Reporting and Verification Approaches for Ghana. *By Alex Grais and Gabriel Sidman - Ecosystem Services Unit, Winrock International;* Application of standard operation Procedure (SOPs) developed by Indufor OY *by Dr. Carly Green and Mr. Juho Pentilila*	How are errors taken into consideration for projections of emissions and removals?	Activity data of specific statistics through sampling often has an error factor with it. Provisions of UNFCCC and FCPF give room for some errors based on the requirements of the organization you are submitting to. Data sampling and maps gives room to report on uncertainty of emissions reduction specific uncertainty for each deforestation strata.
			What stratification of forest is used for Ghana and how are capacities of local experts being built for MRV?	For stratification of the forest, it is important that the strata needs to be identifiable/verifiable using remote sensing/ satellite imagery. Strata could include; accessibility, openness of forest, vegetation area, terrain. Team of experts from Winrock and Applied Geo-Solutions to train specific institutions/individuals who will be involved in the MRV. Knowledge sharing on delineation of cocoa from forests

			Is Ghana reporting on Tier 1, 2 or 3 data for the reference level taking into consideration Forest Preservation Programme? Any difference between Tier 2 and Tier 3?	FPP is under Tier 2 because we have country specific data on above-ground biomass, below-ground biomass, litter and deadwood. However, soil data is not very easy to fall under Tier 2 because it should look at change in stock rather the available stock Ghana has. In this case Ghana can use Tier 1 for soil. Tier 3 allows negotiating at different levels using models as informative tool rather than just activity data. Indonesia and Kenya are the REDD+ countries using Tier 3 supported by Australia. Canada has Tier 3 and supporting Mexico. A country can still use national datasets to achieve Tier 3 but will use these repetitive data to as well as remote sensing for modelling. However this setup is very costly and is a decision of the country to see if it's imperative to use Tier 3
Private Sector Stakeholder Consultation Workshop on the Ghana Cocoa Forest REDD+ Emission Reduction Programme – Draft Implementation Plan, at Accra City, 6th June, 2016.	Ministry of Finance, MLNR, FC, COCOBOD, Solidaridad, Touton, Koapa Kokoo Ltd, Cargill Ghana Ltd, Unicom Com. Ghana Ltd, Cocoa Processing Co. Ltd, Barry Callebant Com. Ltd, First Sky Commodities, Olam Ghana, Kuman Koma Company, BD Associates, Armajaro	Ghana Cocoa Forest REDD+ Emission Reduction Programme – Draft Implementation Plan, by *John J. Mason, Nature Conservation Research Centre, Accra.*	We always talk about over 2million, CHED is also talking about 1.7million. Which one should we reference?	In order to achieve the objective the ERP will be implemented wall to wall, thus across the entire landscape. But, of course activities will not be implemented at the same scale across the entire landscape at the same time. There is the need to start from priority areas and later scale up to cover the entire landscape.
			There is high deforestation identified particularly along the middle vertical stretch of the programme area, and this could be attributed to 'galamsey'. Why were these areas left out in the selection of the HIAs?	The issue of mining and illegal mining has become a national security issue. The ERP resources could not be used to solve national security problem. It is therefore advisable to start with areas that do not have much gold deposit and therefore free from issues associated with mining.

	Ghana, Nyonkopa Cocoa Buying Ltd, Produce Buying Company Ltd, Cocoa Merchants Ghana Ltd, Mondelez International Cocoa Life, Federation Commodities.		Is there significant location those undertaking surface mining will move to when the resource get exhausted at their current deposit sites.	We will have to hear from some other state agencies on what government is doing to resolve the problems and also ensure that such activities are not moved into other areas within the landscape.
			Concerning the premium price of the commodity – who pays the difference in the price Who will be responsible for paying the differential premium	It is the consumer who will be responsible for paying the differential premium. This is because the principle is to internalize the externality. There has to be a Ghana cocoa It is not a premium but a different commodity
			The role of the traditional authorities, district assemblies. The byelaw made at local levels are more adhere to than the national laws. If the traditional authorities and local people understand the importance of the programme.	At the HIA levels there will be landscape and land use planning will be undertaken and at that level all these stakeholders will be brought together to discuss issues amicably and find solution to addressing them. Reference to the HIA Consortium min the implementation plan
Multi Stakeholder Workshop on Ghana Cocoa Forest REDD+ Emission Reduction Programme – Draft Implementation Plan. 14th June 2016		Ghana Cocoa Forest REDD+ Emission Reduction Programme – Draft Implementation Plan, by *Dr. Rebecca Ashley Asare, Nature Conservation Research Centre, Accra*	We always talk about further assessment and analysis of data What happened to the FPP data – is not useful?	The FPP data were used by the consultant in this assignment. However, there were some constrains. For instance, FPP data used only up to 2010. There is therefore the need for some additional analysis in order to fill some gaps in available data.

at the Auditorium of the Forestry Commission			There are lots of other things going on in the landscape apart from cocoa as well as very important stakeholders like traditional authority and farmers. How are they being consulted and involved?	HIA is the cocoa farmer – initial the stakeholder analysis under this assignment focused on who has the money to invest in the programme to achieve the desired result. Going forward with implementation, there will further stakeholder mapping and analysis in each HIAs. The HIAs are going to have their own consortium and will have to work on all other things including which stakeholders should be involved in the implementation of the programme to be involved. For instance, apart from political commitment at the highest level, we are also looking at political commitment at the local level where the traditional authorities are in charge.
			Will international world accept our proposal that we are not tackling mining which is a key driver of DD	For the mining area, there is little the programme can do at this stage. What we focus on at this stage is the inter-institutional collaboration with those that are in charge of regulating mining activities in the country. The issue of mining has become a national security concern and will therefore be tackled from another direction with other stakeholders leading the process. Going forward there is the need to adopt the CREMA concept.
			Since HIA were determined based on cocoa sector stakeholders, is it not possible to miss other important non-cocoa sector stakeholders who are also working in the landscape and whose activities could impact the programme positively or negatively?	The cocoa sector is a 2billion dollar investment sector. The question therefore is how we leverage on the cocoa sector investment in the landscape to achieve the emission reduction.
			With the decision to go with the administrative district – do we envisage some challenges that may arise during the implementation	There may be some challenges, but the good thing that this is a landscape programme and the use of administrative district suitable means of defining the landscape because COCOBOD and Forestry district are different. The fact is even COCOBOD has two sets of districts.

			Public and private funding in the programme area. Mobilizing public finance for initiative like this has always been very challenging. What is the potential source of funding for the programme?	The potential source of funding will be the private sector and that will be cocoa money. Private cocoa companies have their sustainability programmes and these programmes are not helping our forest.
			How best will HIAs be integrated into the District Assembly system so that it will benefit from the district in term of district planning	The HIA is a landscape and the consortium that will include all stakeholders (public private NGO CSO etc.) and with this it can then be integrated into the District assembly development plan. The programme has to be sustainable and cocoa alone cannot make it sustainable and this is why the role of other stakeholders including the district assembly will be very important in ensuring the sustainability of the programme.
Consultation with Key Policy Makers held on 7th July, 2016.				
Consultation with the parliamentary select committee on Lands and Forestry on Ghana's ER Programme held on 21st July, 2016 at Villa Victoria	Hon. Henry Kwabena Kokofu; Hon. Benito Owusu-Bio; Hon. Seidu Amadu (Alhaji); Hon. Alijata Sulemana Gbentie (Hajia); Hon. Kwame Anyimadu-Antwi Mr. Yaw Kwakye Hilma Manan Charles Sarpong Kwame Agyei Raymond Kofi Sakyi Sena Tabiccah	Presentation on "GCFRP" by Mr. Yaw Kwakye, Head of the Climate Change Unit; and "Ghana's REDD+ Strategy" by Mr. Kwame Agyei, MRV Specialist	Is the 2015 land cover map to show current state of our forest cover?	Analytical work is underway to have 2015. The result of the assignment will include the 2015 maps.

			Was it a policy directive that Pamu Berekum forest reserve should be cleared? What is FC doing to address the problem? Are there sensitization in the area to educate the people on the effects of forest lost?	FC has been implementing diverse programmes including high forest biodiversity, FIP and NREG-TA are undertaking restoration activities within depleted forest reserve etc. Steps taking to recover forest loss at the Pamu Berekum forest reserve includes sustainable forest plantation programme and education and sensitization of the public on the adverse effects of climate change.
			To what extent is the programme attracting private sector investment?	The GCFRP is designed in such a way to leverage on the support from the private sector in Implementing the programme.
			who ensures that the lands are reclaimed after mining?	Mining has highlighted in the REDD+ Strategy document, but FC and its stakeholders cannot solve the issue of mining alone. It needs a strong political commitment and cooperation between stakeholders in the mining sector.
			The participants indicated that the petroleum industries rely on arbitration and mediation to resolve disputes and i.e. Environmental issues could be resolved through the ADR act after amendment, they indicated that the legal section of parliament has already and continue to discuss this issues.	
Consultation with Metropolitan, Municipal and District Assemblies (MMDA's) on Ghana's ER Programme held in	Districts and municipal El and district assemblies: Elembelle; Sefwi Wiawso; Juaboso; Aowin Suama; Juaboso; Wasa Amenfi East; Ellembelle; Assin North;	"Ghana's REDD+ Strategy" by Mr. Kwame Agyei, MRV Specialist; "Overview of Ghana's ER Programme" Mr. Yaw Kwakye, Head**,** CCU of FC; "The importance of the programme to cocoa sector"	Who gives charcoal burners permit to produce charcoal? Charcoal production has been identified as a major contributor to forest degradation. What is the REDD+/ERP doing about this? Also, the Sustainable	The Energy Commission has a unit designated to ensure that charcoal production is regulated. Unfortunately, they do not have enough offices and staff strength especially at the transition zone where charcoal production is on the rise. The FC encourages communities to establish wood lots by planting fast growing species for harvesting and leave natural forests to develop.

Takoradi on 16th and in Kumasi on 18th August 2016.	Twifo-Atti Morkwa; Upper Dankyira East; Denkyembour; Asutifi; Adansi South; Ahafo Ano North; Adansi South; Birim Central; Asunafo South and North; Amansie West;	Mr. Kissiedu Kwapong, Deputy Director of Research, Monitoring and Evaluation of COCOBOD	Development Goal (SDG) 17 talks about partnerships for achieving these goals. What is currently being done?	
			Why is the ERP focusing on agriculture, specifically cocoa? Why is the Volta region not included in the GCFRP as cocoa is also grown there?	There is a special reason why cocoa is the focus. The ERP is targeting the cocoa forest mosaic landscape within the High Forest Zone of Ghana as the initial step. Agricultural expansion (conversion of forest to cocoa) is a major driver of carbon emission within that landscape. There are other ERP being designed for the Savanna, Coastal and Togo Plateau (which will cover the Volta Region).
			How does the programme address tenant farmers seeking clarity from land owners?	The ERP engages with chiefs to keep them abreast with the programme and equipped to support reforms of land tenure systems in Ghana.
			How can the ERP contribute to law enforcement as Ghana has a lot of laws but enforcing the laws has always been a major problem?	Law enforcement has been a problem for all institutions. There are problems with personnel especially as most forest guards are over-aged or not motivated to perform their mandate to the fullest. We need collective effort in this regard to enable Ghana realize the goal of the ERP and REDD+.
			How will sensitization of the programme be done in the communities?	The REDD+ programme has a Communication Strategy with clear approaches for engaging various stakeholders including local communities and the private sector. HIA will be established with governance body MoFA, traditional authorities and district assemblies. The capacity of the governance body will be built to support the sensitization and awareness creation on the ERP.

			How can the programme provide community members with alterative livelihood schemes other than forest products?	Alternative livelihood is a very important initiative; there is a need to effectively implement and monitor it. Most MMDA's present reiterated the fact that the programme must focus on providing alternative livelihood schemes for natives to concentrate on other income generating avenues rather than on forests to avoid further degradation.
Consultation with Traditional Authorities on Ghana's ER Programme Held in Kumasi on 23rd August 2016.	participants included paramount chiefs from the following traditional authorities: Akyem Abuakwa; Juaso; Wassa Mpohor; Wassa Amenfi; Ajumako; Kukuom; Goaso; Mampong; Agona;Yamfo; Begoro; Akyem Bosome; Ayem Tafo; Assin Owirenkyi; Asebu; Mankessim; Dunkwa	"Ghana's REDD+ Strategy" by Mr. Kwame Agyei, MRV Specialist; "Overview of Ghana's ER Programme" Mr. Yaw Kwakye, Head, CCU of FC; "The importance of the programme to cocoa sector" Mr. Kissiedu Kwapong, Deputy Director of Research, Monitoring and Evaluation of COCOBOD	*How will REDD+ contribute to Legislation?*	Issue of legislation is a major driver and a high priority activity. Law enforcement has been a major problem in Ghana for several years. Over the years chiefs have been able to enforce local laws in their communities and impose sanctions which have worked effectively. Capacity building programmes have been organized for frontline staff of the FC in all 10 regions. The training is a continuous process. Through REDD+ and support from traditional authorities and other stakeholders the FC is poised to effectively engage in emission reduction programmes.
			How can traditional authorities contribute to sensitization?	Chiefs could use the opportunity during festivals or durbars when engaging with communities to sensitize communities. Also the NRS is willing to attend programme or durbars upon invitation from chiefs to talk about the programme. The GCFRP is committed to supporting traditional authorities in terms of sensitization and high level advocacy on the programme.
			What has COCOBOD done in reducing emissions and contributing to the ERP?	COCOBOD has engaged with farmers in capacity building programmes by using community extension agents. Staff of COCOBOD have also been trained on the ERP and REDD+ and staff of FC and COCOBOD work together to help reduce emissions.

Meeting of the Participants Committee of the Forest Carbon Partnership (FCPF), 26th – 30th September, 2016 @ Kempinski Hotel, Accra - Ghana	Members from FCPF participants countries	Presentation on Ghana's R-Package – *By Yaw Kwakye*; Summary TAP-Expert Review on the Self-Assessment Process – By *Peter J. Graham*; Ghana's Progress on FCPF Readiness Grant Activities *By Asferachew Abate Abebe*		
REDDEYE Regional Campaign Launch, 1st November, 2016 at the Presbyterian Junior High School Park, Anyinam, Eastern Region.	Participants included representative from junior and senior high schools, tertiary Institutions. Other include representatives from the Ghana education, fire service,, police service, National commission for civic education, and some private companies including the mining companies drawn from the districts: Atiwa, West, Fanteakwa, Kwaben	The theme for the regional launch was "Promoting Youth Awareness and Involvement in REDD Actions". Various presentation by heads or representatives of the following: CEO COCOBOD, CEO FC, Head CCU of FC, Eastern Regional Minister, Regional FSD Manager, DCE of Atiwa,	What is the role of the public / youth in mitigating climate change?	Climate change is largely human induced - Illegal felling of trees; illegal mining (galamsey); unsustainable land use; over dependence on fuel wood and charcoal instead of renewable or clean energy; wildfires; indiscriminate dumping of refuse, among others cause climate change.
			What is the theme for this launch and why was such a theme chosen?	The youth form the bulk of the population and are mostly catalysts in activities such as illegal logging and illegal mining which destroys our forest ecosystem. Creating awareness among the youth on the impacts of these actions on future generations is essential to prevent resource depletion.

			Why it become important for the Forestry Commission to be involved in issues of climate change?	There is a relationship between forests and climate change. The most important GHG of concern is CO_2. Plants use CO_2 during photosynthesis, therefore there is a direct relationship between forest/trees. When trees are cut down there is a release of carbon but when they are planted or left standing they sequester CO_2 from the atmosphere. It is therefore, important to plant, nurture and maintain healthy forests.
			The public is being encouraged to desist from all these acts and plant more trees to absorb the greenhouse gases which are produced in the atmosphere. Youth could be attitudinal change ambassadors for REDD+ and also propagate the REDD+ message.	
Briefing Meeting on Ghana's REDD+ Process for Forestry Commission Management Staff	Forestry Commission Management Staff	Establishment of a Forest Reference Level and Development of a Measurement, Reporting and Verification System (MRV) for REDD+ Implementation in Ghana –- Kwame Agyei Progress Update on REDD+ Implementation for FC Management – Yaw Kwakye Ghana's REDD+ Safeguards Update –- Roselyn Adjei	In other to have specific interventions to strengthen the REDD+ programme shouldn't there be the need to clearly define forest with respect to REDD+?	There is basically one definition for forest and that is what REDD used.

			How is reward going to be shared under the REDD+ programme?	In terms of benefit sharing that would be based on the actors involved in the project where their roles and responsibilities would be enumerated and then the benefit sharing proceedings would be stated. Also managers of naturally reoccurring would be also be considered.
			What is the progress of REDD+ programme with respect to synergies?	The REDD+ unit has made substantial progress with respect to synergies notwithstanding there could be more collaboration between the VPA and the REDD+ going forward.
Training workshop on Ghana's REDD+ Safeguards requirement Implementation	staff of the following institutions: Forestry Commission, Ghana Cocoa Board, Ministry of Finance, staff of selected CSO's	Overview of REDD+ – Yaw Kwakye Introduction to REDD+ Safeguards Requirements –Roselyn F. Adjei Presentation on Safeguards Institutional Arrangements – SAL Consult	Does the country have a baseline reference level for the emissions? Without pilot stage, what makes Ghana better placed to achieve successful implementation. How far have plans gone with benefit sharing.	Ghana has developed a draft national forest reference level and submitted to the UNFCCC. It is not only a challenge to Ghana. Funds were made only available for readiness and not for piloting. It is the onset of FIP that gives Ghana the opportunity to learn lessons. Benefit sharing, a pillar of REDD+. Under the equity, benefits accruing under REDD+ are equitably shared. FORIG were appointed to do a study on benefit sharing options and building on that, a more detailed work has been commissioned
Launch of Ghana Forestry Development Master Plan, Ghana Forest Plantation Strategy and National REDD+	Omanhene of Dormaa traditional area and Chairman of the occasion, Osagyefo Agyemang Badu; the Minister of Lands and Natural Resources Hon. Nii	Ghana National REDD+ Strategy, Mr. Yaw Kwakye, Head of the Climate Change Unit of the Forestry Commission; Ghana Forest Plantation Strategy, Mr. Hugh Brown, Head of the Plantations		The three documents contain strategic interventions that seek to contribute to reducing emissions from deforestation and forest degradation, sustainable supply of timber and wood-fuels, reducing poverty and helping to conserve biodiversity within the framework of sustainable global and national while promoting collaboration among stakeholders improve forest governance, restore degraded landscapes and

Strategy at the Accra International Conference Center on November 23rd, 2016.	Osah Mills; Raphael Yeboah, Executive Director of Forest Service Division; heads and representatives from different sectors and institutions.	Unit of the Forestry Commission; Ghana Forestry Development Master Plan, Mr. Joseph Osiakwan Principal Planning Officer (Ministry of Lands and Natural Resources.		tackle the adverse impacts of climate change.
Safeguards Sub-Working Group Meeting on the 9th and 10th February, 2017 at Golden Bean Hotel, Kumasi	Forestry commission (Wildlife Division, Forest Services Division, RMSC), KASA Ghana, A Rocha Ghana, Tropenbos Ghana, IUCN, SAL Consult, SNV Ghana,Y.B. Osafo Legal services.	Updated SESA, ESMF, maps and SIS Reports by Emmanuel Acquah, SAL Consult; Overview of the draft Roadmap for Country Approach to Safeguards (CAS) and Safeguard Information System (SIS) development by Reuben Ottou, SNV; Highlights of the Legal Analysis of the Cancun Safeguards Consultancy repeport. Robert Bamfo, Feedback and Grievance Redress mechanism (FGRM) Report by Yaw Osafo, Y.B. Osafo Legal Services.		The institutional arrangements and framework should be clear-which institution is gathering which information for the SIS Identification of indicators/parameters to populate the SIS. District Assemblies (DAs) can serve as third parties in completing the complaint forms for the purposes of verification. training modules developed including a framework for monitoring and evaluation There is the urgent need for sector coordinated effort in ensuring synchronization and integration of on-going initiatives in order to avoid duplication of efforts.

MRV and Reference Level Meeting with Directors and key management staff of FC at FC Conference room on 17th February, 2017	Forestry Commission staff	Ghana's Draft National Forest Reference Level: Work Completed and Proposed Next Steps	How accurate is the MRV results. Are there other ways to verify the results? Aside Rosewood exploitation, wildfire is also a serious threat to the forest therefore the need to look at interventions to pursue the REDD+ agenda at the savannah zone of Ghana Have areas known as forest in the Savannah zone mapped out?	In relation to accuracy level the MRV cannot be 100% however there is a lot verifications done internally and also internationally to ensure that the Maps generate are of high Yes mapping has been done across all the project areas quality and accuracy.

Annex 6: Safeguards measures

Key environmental/ social and governance in ER Programme	Cancun Safeguards	Relevant World Bank Safeguard Policies and Procedures	Remarks
Policies, Laws and Regulations	(a) That actions complement or are consistent with the objectives of national forest programmes and relevant international conventions and agreements	OP 4.01 on EA takes into account the country's overall policy framework, national legislation, and institutional capabilities related to the environment and social aspects; and obligations of the country, pertaining to project activities, under relevant international environmental treaties and agreements. OP4.36requiresprojectstoabidebyinternationalenvironmentalagreementsandforestcertificationsystemstoadheretoallrelevantlaws.	The GCFRP is consistent with both the Cancun safeguards and OP 4.01. The SESA and the REDD+ strategy documents confirm consistency with the World Bank Safeguards policy. The ER Programme is pushing for the passage of the National Forest and Wildlife Bill consistent with the new Forest and Wildlife Policy-2012.
Transparency and national forest governance structures	(b) Transparent and effective national forest governance structures, taking into account national legislation and sovereignty	World Bank OP4.36requiresforestcertification systemstoimplementtransparentdecision-makingprocedures.TheBankalso has a Policy on Access to Information. (Relevant sections in World Bank Safeguard Policies include: Access to Information policy, in particular para. 1 OP 4.01 on Environmental Assessment, in particular paras. 3 and 13 OP 4.36 on Forests, in particular para. 14 BP 4.04 on Natural Habitats, in particular para. 5 BP 4.12 on Involuntary Resettlement, in particular para. 2).	The ER Programme will adopt the World Bank Safeguard policy on Access to Information in the absence of a national law. The 1992 Constitution of Ghana guarantees a fundamental Right to Information under Article 21. However the regulation (the Bill) is yet to be passed by the parliament.
Rights of local communities/	(c) Respect for the knowledge and rights of indigenous peoples and members of local	OP4.10 refers to the right of indigenous communities to free, prior, and informed consultation, though it does not refer to consent. (Relevant sections include:	There are no indigenous people in the country and therefore OP 4.10 is not triggered. However, the ER Programme makes provision for consultations with local communities to ensure support and buy-in from

indigenous people and Free, Prior and Informed Consent (FPIC) Vulnerable groups	communities, by taking into account relevant international obligations, national circumstances and laws, including the adopted UN Declaration on the Rights of Indigenous Peoples	OP 4.10 on Indigenous Peoples, in particular para. 1; para. 16; paras. 19 to 21 OP 4.36 on Forests, in particular paras. 10 and 14 BP 4.36 on Forests, in particular para. 4) OP4.10 requires consultations and benefit allocation to be performed in a gender inclusive manner. OP4.20 states that the World Bank will occasionally assess the gender dimensions of development in member	these stakeholders. The RPF prepared for the ER Programme/REDD+ activities makes provision for vulnerable groups.
Stakeholder Participation	(d) The full and effective participation of relevant stakeholders, in particular indigenous peoples and local communities, in the actions referred to in paragraphs 70 and 72 of this decision;	OP4.10. The policy states consultations must be performed in indigenous language at a culturally appropriate venue with adequate time for stakeholders to build consensus, in instance where indigenous and local people are affected. (Relevant sections include: OP 4.01 on Environmental Assessment, in particular paras. 14 and 15 OP 4.10 on Indigenous Peoples, in particular para. 1 OP 4.04 on Natural Habitats, in particular para. 10 OP 4.12 on Involuntary Resettlement, in particular para. 7 OP 4.36 on Forests, in particular paras. 11 and 12)	Multi-stakeholder consultations and participation approach was adopted in the design of the REDD+ document including the strategy and the implementation plan. Stakeholder consultation platforms were established for REDD+ and ERP for that matter, which cut acrossrepresentatives from public, private CSO groups, traditional authorities, local communities, cocoa farmers, women and disabled/physically challenged persons.
Biodiversity and other ecosystem services	(e) Actions are consistent with the conservation of natural forests and biological diversity, ensuring that actions referred to in paragraph 70 of this decision are not used for the conversion of natural forests, but are instead used to	OP4.01 on Environmental Assessment (paras2-3 and Annex A, paras 7 and 9), OP 4.04 on Natural Habitats (paras 1,4,5, and 9 and Annex A, para 1) and OP4.36 on Forests (paras 1, 5and 7) address the preservation of areas with high biodiversity value and promote the protection of environmental services. OP4.01 on Environmental Assessment is used to identify, avoid, and mitigate potential negative environmental impacts. This policy is considered the umbrella policy on environmental safeguards. OP4.0 4 on Natural Habitats	An opportunity and risk matrix for the intervention were carried out and included the SESA report (See Section 6). The ER Programme/REDD+ activities and the FIP developed ESMF which identified potential adverse impacts and provide for mitigation measures. Article 19 in the VPA developed Joint Monitoring and Review Mechanism (consisting of EU and Ghanaian officials) to assess the environmental, social and economic impacts of the Agreement and how they will be addressed consistent with World Bank OP 4.01

Mitigate adverse environment al impacts	incentivize the protection and conservation of natural forests and their ecosystem services, and to enhance other social and environmental benefits4	and OP4.36 on Forests also outline mitigation of negative impacts including forest displacement, conversion, and degradation. It states the World Bank will not support projects that result in the significant degradation or conversion of critical natural habitats.	
Address risk of reversals and displacement of emissions	(f) Actions to address the risks of reversals	The Operating Procedures do not explicitly outline reversals; however this could be covered in the OP 4.01 on Environmental Assessment, in particular paras. 1 and 2 OP 4.36 on Forests, in particular para. 14	Inherent reversal risks include illegal mining, potential cocoa price volatility/climate change on cocoa production, and forest fires. Risk Management and Finance in the implementation plan embraces the development of a climate risk insurance facility for farmers (i.e. consistent with paragraph 28a of Decision 1/CP. 16 Cancun Agreement). The Ghana Cocoa Board, a major stakeholder in the ER Programme, regulates the price of cocoa in Ghana, which therefore moderates potential future price volatility.
	(g) Actions to reduce displacement of emissions	The Operating Procedures do not explicitly outline displacement; however this could be covered in the OP 4.01 on Environmental Assessment, in particular para. 2; para. 3 OP 4.04 on Natural Habitats, in particular para. 4 and Annex A, para. 1(c)	There are potential for displacement (leakage) from the implementation plan developed. The programme is providing permanent climate-smart agriculture options. The VPA/FLEGT initiative seeks to address the issue of illegal logging in the programme area in particular. The limits for harvesting timber from plantation forests in the programme area will be incorporated into the national allowable cut (under the GFPDP) to minimise the incidence of unsustainable harvesting in the programme ER Programme area.
Safeguards Information System (SIS)– Monitoring	(UNFCCCDecision12/CP.17)	OP4.12, OP4.20, OP4.10, OP4.04, OP4.01, and OP4.36 all contain references to the development of monitoring and/ or reporting systems depending on the context and scope of the project being implemented.	The development of SIS and operationalization of a comprehensive approach to safeguards (including a SIS) for Ghana REDD+, when adopted and integrated into the national policies and laws will be applied in ERP

and Reporting			implementation.
Land tenure, tree tenure and benefit sharing	-	OP4.10 requires that legal recognition be obtained for projects being implemented on lands belonging to Indigenous Peoples.Op4 .12 requires involuntarily resettled persons to be provided with "adequate" land tenure	Major areas to support reforms for programme implementation include tree tenure reforms, clarification of carbon transaction rights and benefit-sharing agreements and reform of cocoa farm input system.Under the NREG TA, the MLNR developed (draft) for tree tenure and benefit sharing. The framework is expected to contribute to Ghana's drive at halting deforestation, enhancing its forest estate and promoting good forest governance.
Resettlement related and Livelihood issues	-	OP4.12 requires that involuntary settlement is avoided or minimized, and where unfeasible, assistance is given to displaced persons to improve or restore their livelihoods.	A Process Framework (PF) has been prepared in line with World Bank requirements. A RPF has been developed to guide implementation of any resettlement related issues that may arise. The GFPS under its strategic objective 3, aimed to create employment opportunities and sustainable livelihoods in rural communities through forest plantation development. Over 2million jobs are to be created over the 25-year period with about 500,000 as full time jobs.
Grievance Mechanism	-	OP4.12 outline conflict resolution procedures to be followed in resolving potential conflicts arising from displaced persons.	A Grievance Redress Mechanism has been prepared for the ER Programme/ REDD+ for implementation. Further details are provided in the next section, 14.3.

Annex 7: Methodologies for Estimating Emissions and Removals

Deforestation
Emission Factors
In accordance with the stock-difference[127] method, C emissions were estimated as the difference in carbon stocks before deforestation and the carbon stocks following deforestation, including carbon in living and dead biomass[128] and carbon released from the soil. The emission factor is calculated as follows:

$$EF_{def(t,x,y)} = (C_{bio.pre(x)} - C_{bio.post(t,y)} + \Delta SOC_{(t)}) * 44/12$$

Where:

$EF_{def(t,x,y)}$ = Emission factor for year t for deforestation for stratum *x* and driver *y*, $tCO_2e\ ha^{-1}$
$C_{bio.pre(x)}$ = Carbon stock in biomass in stratum *x,* prior to deforestation, $t\ C\ ha^{-1}$
$C_{bio.post(t,y)}$ = Carbon stock in biomass in year t post-deforestation, for driver *y*, $t\ C\ ha^{-1}$
$\Delta SOC_{(t)}$ = Change in soil carbon stocks in year t following deforestation, $t\ C\ ha^{-1}$
44/12 = Conversion factor from carbon to CO_2

Pre-deforestation carbon stocks for the GCFRP ACCOUNTING AREA include all carbon pools (aboveground carbon, belowground carbon, deadwood, litter, non-tree vegetation, and soil). Estimates of the magnitude of carbon stocks in these poolswere mostly derived from the results of a forest biomass mapping and inventory project undertaken through the Mapping of Forest Cover and Carbon Stock in Ghana project (conducted under the Forest Preservation Programmeme (FPP), through support from the Government of Japan).
The only carbon pool for which FPP data were not used for pre-deforestation carbon stocks was the deadwood carbon pool, as stocks appeared to be significantly over estimated[129]. Instead, IPCC defaults were applied for this pool (aboveground carbon stocks multiplied by 0.06)

The Wet Evergreen, Open Forest statum did not have data on belowground carbon stocks, so the Mokany (2006) root-to-shoot ratio of 0.2 was applied to the aboveground carbon stocks to derive an estimate.

Pre-deforestation carbon stocks were calculated as follows:

$$C_{bio.pre(x)} = (C_{agb(x)} + C_{bgb(x)} + C_{dw(x)} + C_{lit(x)} + C_{veg(x)})$$

Where:

$C_{bio.pre(x)}$ = Carbon stock in biomass in stratum *x,* prior to deforestation, $t\ C\ ha^{-1}$

[127] 2006 AFOLU Guidelines, Chapter 2 Generic Methodologies Applicable to Multiple Land-Use Categories, http://www.ipcc-nggip.iges.or.jp/public/2006gl/pdf/4_Volume4/V4_02_Ch2_Generic.pdf
[128] For Ghana's reference level for deforestation emissions,carbon stored in harvested wood products was not included
[129] This was explained in the FPP Report on Mapping of Forest Cover and Carbon Stock in Ghana (2013) pp.128: "Deadwood in large quantities was discovered in Moist Evergreen plots, most likel due to trees felled on the cocoa farms admitted to expand into the forest reserves and palm pruning residues of palm trees in off-reserve areas." Nevertheless, when plot deadwood carbon pool estimates were extrapolated to per-hectare values were unrealistically high (e.g,, Moist Evergreen Closed Forest 2914 t CO2/ha and Moist Semi-diciduous NW Closed forest 399 t CO2/ha - over double the aboveground tree biomass).

$C_{agb(x)}$ = Carbon stock in aboveground live tree biomass in stratum *x*, t C ha^{-1}
$C_{bgb(x)}$ = Carbon stock in belowground live tree biomass in stratum *x*, t C ha^{-1}
$C_{dw(x)}$ = Carbon stock in deadwood pools in stratum *x*, t C ha^{-1} (includes both standing and lying deadwood)
$C_{lit(x)}$ = Carbon stock in litter in stratum *x*, t C ha^{-1}
$C_{veg(x)}$ = Carbon stock in non-tree vegetation in stratum *x*, t C ha^{-1} (includes shrubs, sapling, and herbaceous understory)

Applied Pre-Deforestation Carbon Stocks:

Confidence interval (95% of the mean +/- %) noted in parenthesis.

		AGB (tC/ha)	BGB (tC/ha)	Dead Wood Carbon Stocks (tC/ha)	Litter Carbon Stocks (tC/ha)	Non-tree Carbon Stocks (tC/ha)	Total C stocks (not soil) t C/ha
Wet Evergreen	Closed Forest	124.1 (0.7)	7.9 (108.0)	7.4 (184.0)	2.7 (32.0)	0.0 (N/A)	142.2
	Open Forest	30.3 (2.3)	6.1 (N/A)	1.8 (N/A)	0.0 (N/A)	0.0 (N/A)	38.1
Moist Evergreen	Closed Forest	139.4 (0.2)	23.5 (28.0)	8.4 (69.0)	2.7 (33.0)	0.5 (40.0)	174.5
	Open Forest	39.8 (0.8)	3.0 (48.0)	2.4 (4.0)	1.1 (192.0)	1.6 (773.0)	47.9
Moist Semi-deciduous SE	Closed Forest	123.5 (0.6)	23.2 (23.2)	7.4 (93.0)	0.0 (46.0)	1.1 (63.0)	155.2
	Open Forest	35.2 (1.4)	7.6 (171.0)	2.1 (190.0)	3.5 (55.0)	0.3 (250.0)	48.7
Moist Semi-deciduous NW	Closed Forest	40.4 (0.2)	15.3 (12.0)	2.4 (74.0)	2.2 (23.0)	1.1 (23.0)	61.3
	Open Forest	17.5 (0.3)	9.0 (31.0)	1.0 (165.0)	2.2 (50.0)	0.8 (50.0)	30.5
Upland Evergreen	Closed Forest	73.1 (0.4)	23.5 (99.0)	4.4 (176.0)	1.4 (36.0)	0.3 (279.0)	102.6
	Open Forest	26.2 (0.8)	12.8 (47.0)	1.6 (113.0)	1.1 (67.0)	0.8 (173.0)	42.5

Post-deforestation carbon stocks correspond to the land uses comprised of IPCC land use classes (forest land, cropland, grassland, wetlands, settlement, bare land, other land), and their carbon stocks were derived from a combination of sources including:

6) Cropland: Given the complex set of post-deforestation land uses found in Ghana, particularly due to the wide range of agricultural land uses, the 'cropland' post-deforestation land use was subdivided into:

   a) Cropland: The FPP project collected data on cropland carbon stocks for each strata, reflecting all cropland (currently cropped or in fallow), rice fields, and agro-forestry systems. Estimates included above and belowground carbon stocks (other carbon pools in cropland are not considered significant), and post-deforestation carbon stocks were calculated as follows:

$$C_{bio.post(y,t)} = (C_{agb(y)} + C_{bgb(y,t)})$$

Where:

$C_{bio.post(y,t)}$ = Carbon stock in biomass in land use y at time t, post-deforestation, t C ha^{-1}
$C_{agb(y)}$ = Carbon stock in aboveground live tree biomass in land use y, t C ha^{-1}

$C_{bgb(y,t)}$ = Carbon stock in belowground live tree biomass in land use y at time t[130], t C ha^{-1}

b) Plantations:Carbon stocks in plantations were treated as a time-weighted average of stocks in the cycle, and were sourced from Konsager et al. (2013)[131]'s study of carbon stock accumulation potential of tree plantations in Ghana. The values for plantation carbon stocks represent time-averaged carbon stocks for a 30-year rotation, based on the results of that study, as cited in a presentation by the same author. The study only estimates aboveground carbon stocks, so belowground carbon stocks were derived by applying Mokany (2006) root-to-shoot ratio of 0.2 for tropical moist semi-deciduous forest with aboveground biomass stocks <125 t d.m. ha.

7) Grassland: FPP data were applied where available per strata, otherwise the IPCC default of 3.1 t C/ha was applied.
8) Wetlands: Assumed to be zero
9) Settlement: FPP data were applied where available per strata, otherwise post-deforestation carbon stocks were assumed to be zero.
10) Bareland/other: Assumed to be zero

Applied Post-Deforestation Carbon Stocks:

Stratum				Average Carbon stocks (tC/ha)	Source
Wet Evergreen	Cropland	Cropland (herbaceous and slash and burn)		30	FPP data
		Plantations	Oil Palm	36	Kongsager et al. 2013
			Citrus	55	Kongsager et al. 2013
			Rubber	90	Kongsager et al. 2013
			Cocoa	55	Kongsager et al. 2013
	Grassland			3.1	IPCC Grasslands Table 3.4.2 value for tropical moist & wet
	Wetlands			0	
	settlement			0	
	Bareland/other			0	
Moist Evergreen	Cropland	Cropland (herbaceous and slash and burn)		39	FPP data
		Plantations	Oil Palm	36	Kongsager et al. 2013
			Citrus	55	Kongsager et al. 2013
			Rubber	90	Kongsager et al. 2013
			Cocoa	55	Kongsager et al. 2013
	Grassland			3.1	IPCC Grasslands Table 3.4.2 value for tropical moist & wet
	Wetlands			0	
	settlement			0	
	Bareland/other			0	
Moist Semi-deciduous SE	Cropland	Cropland (herbaceous and slash and burn)		51	FPP data

[130] If roots remain following deforestation, pre-deforestation belowground carbon stocks are assumed to decompose over 10 years. Therefore post-deforestation below-ground carbon stocks are estimated as $C_{bgb(x,t-1)} - (C_{bgb(x)}/10)$, where t equals years following deforestation.

[131] Konsager et al. The carbon sequestration potential of tree crop plantations. Mitigation Adaptation Strategies for Global Change (2013) 18:1197–1213. Time-averaged results from http://orbit.dtu.dk/files/55883745/Carbon_Sequestration.pdf

		Plantations	Oil Palm	36	Kongsager et al. 2013
			Citrus	55	Kongsager et al. 2013
			Rubber	90	Kongsager et al. 2013
			Cocoa	55	Kongsager et al. 2013
	Grassland			3.1	IPCC Grasslands Table 3.4.2 value for tropical moist & wet
	Wetlands			0	
	settlement			0.00	
	Bareland/other			0	
Moist Semi-deciduous NW	Cropland	Cropland (herbaceous and slash and burn)		31	
		Plantations	Oil Palm	36	Kongsager et al. 2013
			Citrus	55	Kongsager et al. 2013
			Rubber	90	Kongsager et al. 2013
			Cocoa	55	Kongsager et al. 2013
	Grassland			4.70	FPP data
	Wetlands			0	
	settlement			6.34	FPP data
	Bareland/other			0	
Upland evergreen	Cropland	Cropland (herbaceous and slash and burn)		34	
		Plantations	Oil Palm	36	Kongsager et al. 2013
			Citrus	55	Kongsager et al. 2013
			Rubber	90	Kongsager et al. 2013
			Cocoa	55	Kongsager et al. 2013
	Grassland			3.1	IPCC Grasslands Table 3.4.2 value for tropical moist & wet
	Wetlands			0	
	settlement			0	
	Bareland/other			0	

Changes in soil carbon stocks are related to the post deforestation land use and were estimated using the IPCC 2006 guidelines whereby changes in soil carbon stocks are based on the use of soil factors that account for how the soil is tilled, the method of management, and inputs in the post deforestation land use. This method is described through the following equation:

$$\Delta SOC = C_{soil} - (C_{soil} * F_{LU} * F_{MG} * F_{I})$$

Where:

ΔSOC = Soil carbon emitted, t C ha^{-1}

C_{soil} = Carbon stock in soil organic matter pool (to 30 cm); t C ha^{-1}

F_{LU} = Stock change factor for land-use systems for a particular land-use, dimensionless (IPCC AFOLU GL)

F_{MG} = Stock change factor for management regime, dimensionless (IPCC AFOLU GL)

F_{I} = Stock change factor for input of organic matter, dimensionless (IPCC AFOLU GL)

The change in soil carbon stocks is assumed to occur over a 20 year time period, but for simplicity in accounting emissions are considered to be committed and to occur at the time of conversion.
The following factors and assumptions were made for each strata:

- CROPLAND: Applied Table 5.10 in 2006 IPCC Guidelines FLU value for shifting cultivation, shortened fallow based on FAO Country Paper on Ghana, "Shifting cultivation (also known as "slash and burn") is the main farming practice in Ghana, ... land is left to fallow for some time (3 - 5 years, depending on the availability of land for farming."[132]
    - FLU: Long-term cultivated Tropical moist =0.48
    - FMG: reduced tropical moist/wet = 1.15
    - FI: Medium, dry and moist/wet = 1.0
- PLANTATIONS: Plantations assigned following factors:
    - FLU: Long-term perennial tree crops = 1.0
    - FMG: No till, tropical, moist/wet = 1.22
    - FI: Medium, dry and moist/wet = 1.0
- GRASSLAND: IPCC Table 6.2, FMG: Moderately degraded grassland
- WETLANDS: As seen from activity data, the areas converted to wetlands over the reference period were along the coast, so it was assumed this was due to flooding. As such, zero emissions were assumed.
- SETTLEMENT: From IPCC Chapter 8, "for the proportion of the settlement area that is paved over, assume product of FLU, FMG and FI is 0.8 times the corresponding product for the previous land use (i.e., 20% of the soil carbon relative to the previous land use will be lost as a result of disturbance, removal or relocation);"
- BARELAND/OTHER: “Other Land” includes bare soil, rock, ice, and all unmanaged land areas that do not fall into any of the other five land-use categories. Assumed to be land devoid of vegetation and likely to be at some point in a cropping cycle. Therefore, the same values for cropland were applied.
    - FLU: Long-term cultivated Tropical moist = 0.48
    - FMG: reduced tropical moist/wet = 1.15
    - FI: Medium, dry and moist/wet = 1.0

Activity Data

Activity data for deforestation consisted of four land cover maps for the years 2000, 2010, 2012, and 2015. All maps used Landsat 7 images, with the 2010 map using ALOS images in addition to Landsat images. Originally, a map for 2013 was planned, but due to poor Landsat images for this year, a map of 2012 was used instead. For the 2010 map, efforts were made to harmonize it with the 2000 map to ensure comparability and change calculation. The 2000 and 2010 maps were produced during the FPP project, while the later maps were produced in 2016 by the RMSC of the Ghana Forestry Commission.

Due to the similarity in the spectral signature of agricultural tree crops, especially cocoa, rubber, oil palm and citrus, the land cover maps were not able to distinguish these non-forest plantations from natural forestlands. For this reason, a high-resolution remote sensing methodology was applied (as described in Annex 8), to determine the proportion of the mapped forest that is actually agricultural tree plantations. This analysis was able to distinguish areas of forestland, cocoa, plantation (which included rubber, oil palm, and citrus), and other non-plantation and non-forest land cover types. The results showed that of the areas mapped as deforestation in the land cover maps, between 1-4% were actually transition of cocoa to non-plantation non-forest types, and between 12-39% were actually transition of plantation to non-plantation non-forest types, depending on the ecozone (Figure 21). Emissions from deforestation were subsequently reduced by the percentage of mapped deforestation that was determined to actually be movement of agricultural tree plantations to non-plantation non-forest land cover types.

[132] M. O. Abebrese, 2002. ROPICAL SECONDARY FOREST MANAGEMENT IN AFRICA:Reality and perspectives, Ghana Country Paper. Available at: http://www.fao.org/docrep/006/j0628e/j0628e53.htm

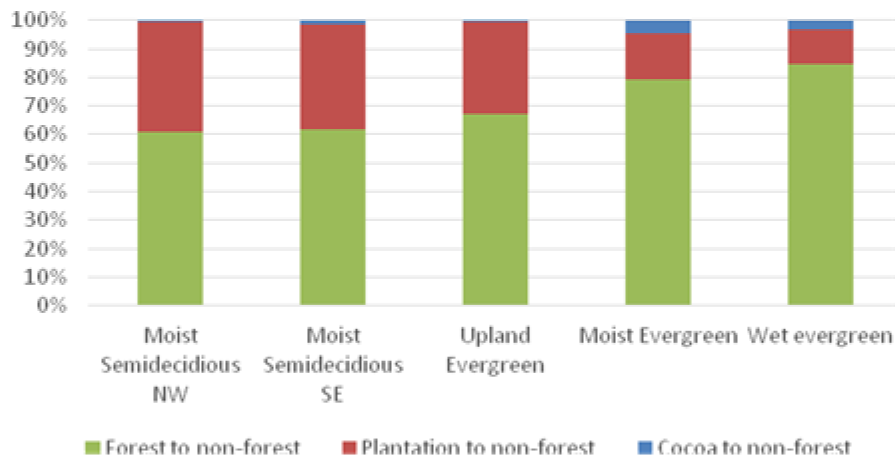

Figure 32: Results of high resolution analysis, showing percentage of areas classified as deforestation that were actually transition of agricultural tree plantations to non-plantation non-forest land cover types.

The high resolution analysis was also applied to determine the percentage of area classified as forest remaining forest in the land cover maps that was actually forest transitioning to agricultural tree plantations (and thus qualifying as deforestation). Results showed that of all the classes that the land cover maps classified as forest remaining forest, forest to cocoa made up between 12-18% and forest to plantation made up between 2-5% (Figure 22). Emissions from deforestation were subsequently increased by the percentage of mapped forest remaining forest that was determined to actually be deforestation resulting from movement of forest to agricultural tree plantations.

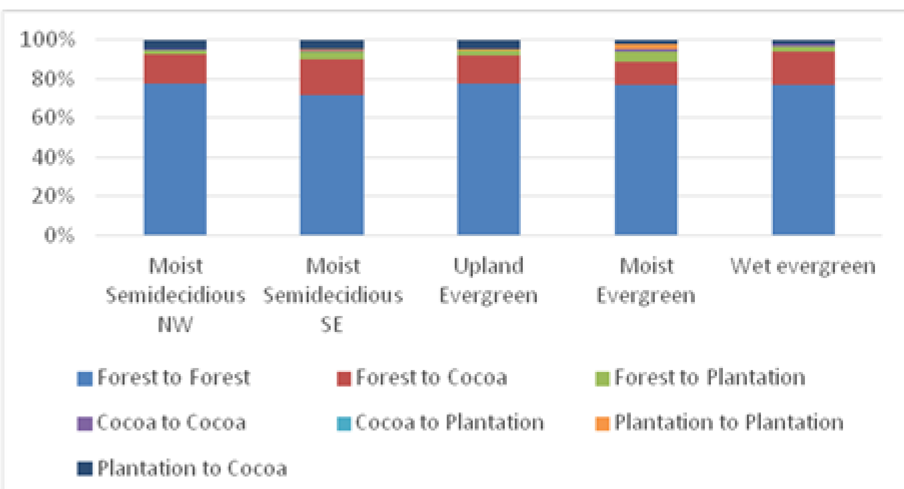

Figure 33: Results of high-resolution analysis, showing percentage of areas classified as forest remaining forest that were actually transition of forestland to agricultural tree plantations.

Enhancement Removal Factors

Teak:

The study conducted by Adu-Bredu S., et al. 2008[133] assessing tree carbon stocks in teak stands in Moist Evergreen forest in Ghana was used to develop removal factors for teak stands in the GCFRP ACCOUNTING AREA. The value of 97.69 Mg C ha^{-1} included both above and belowground tree carbon stocks.
A removal factor in t CO_2/ha was calculated by applying the molecular weight ratio of carbon dioxide to carbon, of 44/12 to get 358 t CO_2/ha. To derive annual removals over the lifetime of the plantation, the removal factor was divided by a typical rotation length of 25 years in Ghana, to get a final removal factor of 14 t CO_2 ha^{-1} yr^{-1}.

Non-teak broadleaf species:

Due to a lack of data available on carbon stocks in tree plantations in Ghana, IPCC AFOLU Vol. 4 default values from table 4.8 reflecting aboveground biomass in forest plantations were applied. Values for 'Africa broadleaf >20 years' for three ecological zones in the GCFRP Accounting Area (tropical rain forest, tropical moist deciduous forest, and tropical dry forest) were averaged to get 173.3 t d.m. ha^{-1}, which was converted to t C/ha by applying a factor of 0.47 to get 81 t C/ha. The belowground biomass value was then generated by applying a root-to-shoot ratio of 0.24 for tropical/subtropical moist forest/plantations >125 Mg ha^{-1} (Mokany et al.2006), to get 20 t C/ha. The total aboveground biomass in non-teak broadleaf species was thus estimated to be the sum of below and above-ground biomass stocks: 101 t C/ha.
A removal factor in t CO2 ha^{-1} was calculated by applying the molecular weight ratio of carbon dioxide to carbon, of 44/12 to get 370 t CO_2/ha. To derive annual removals over the lifetime of the plantation, the removal factor was divided by the typical rotation length of 40 years for indigenous species in Ghana, to get a final removal factor of 9 t CO_2 ha^{-1} yr^{-1}.
The values and sources used to estimate for both removal factors are summarized below:

Species		Value	Unit	Source
Teak	AGB & BGB	98	Mg C ha^{-1}	Adu-Bredu S., et al. 2008
	Final RF	14	t CO_2 ha^{-1} yr^{-1}.	
Non-teak broadleaf	AGB	173	t d.m. ha^{-1}	IPCC AFOLU Vol. 4 table 4.8 above-ground biomass in forest plantations.
		81	Mg C ha^{-1}	
	BGB	20	Mg C ha^{-1}	Mokany et al.2006
		101		
	Final RF	9	t CO_2 ha^{-1} yr^{-1}.	

Activity Data

For on-reserve plantations, the NFPDP had tabular records of planting activity for all years in the historical reference period except 2014. For that year, the average rate of on-reserve planting from 2010-2013 was applied, as it was determined this time period was more representative of 2014 activity due to the fact that many plantation programmes (MTS, CFMP, GPDP, and Model) ceased in 2009. For MTS, CFMP, GPDP, and Model programmes, the total area planted in the GCFRP ACCOUNTING AREA forest reserves up to 2009 was divided across the years the programme was in operation.

Off-reserve plantations under the NFPDP began in 2010 and continued through 2014. However, only data for 2010-2012 were available. Thus the average area planted during those was applied for 2013-2014.

The calculated activity data, as well as the applied failure rates and dates of NFPDP programmes are summarized below.

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[133] Adu-Bredu S., et al. (2008). Carbon Stock under Four Land-Use Systems in Three Varied Ecological Zones in Ghana. Proceedings of the Open Science Conference on Africa and Carbon Cycle: the CarboAfrica project, Accra, Ghana, 25-27 November 2008. Available at http://www.fao.org/3/a-I2240.pdf

GCFRP ACTIVITY DATA FOR ENHANCEMENTS									
	OFF RESERVE		ON RESERVE						
Year	Off-reserve planted area (ha)	Survival Rate	GPDP planted area (ha)	MTS planted area (ha)	CFMP planted area (ha)	Model planted area (ha)	Expanded Program	Survival Rate
2005	0	0	948	2429	303	0	0	55%
2006	0	0	948	2429	303	0	0	55%
2007	0	0	948	2429	303	7	0	55%
2008	0	0	948	2429	303	7	0	55%
2009	0	0	948	2429	303	7	0	55%
2010	1615	62%	0	0	0	0	1304	75%
2011	219	57%	0	0	0	0	2843	75%
2012	67	64%	0	0	0	0	2849	75%
2013	634	61%	0	0	0	0	1692	100%
2014	634	61%	0	0	0	0	1743	100%

On-Reserve Success Rates:
2001-2009: Derived from the reported failure rate of 44.9% (Source: SURVEY AND MAPPING OF GOVERNMENT PLANTATION SITES ESTABLISHED BETWEEN 2004 TO 2009 IN SOME FOREST RESERVES OF GHANA)
2010-2015: Derived from the average survival rate reported (Source: NFPDP dataset '2013 Final Verification Nationwide'. .) As actual estimates for rates of survival per forest reserve were available in this dataset for the year 2013, those rates were applied to activity data for 2013.
2014: Activity data for 2014 reflects the average rates accounting for survival from 2010-2013.

Off-Reserve Success Rates:
2010-2012: The off-reserve survival rates are the averages of the individual small holder plantations within the GCFRP for a particular year as reported in the handing over notes of the NFPDP by Ecotech and Zoil Services limited
2013-2014: Reflects the averaged survival rate from 2010-2012

NFPDP Programmes	Dates of Operation	Years
GPDP	2004-2009	6
MTS	2002-2009	8
CFMP	2005-2009	5
Model	2007-2009	3

Legal Timber Harvesting

The calculations of total emissions from logging are a result of a multiplication of total emission factor (TEF) (in t $CO2.m^{-3}$) by the activity data (m^3 extracted) for each year.

Activity Data

Ghana has timber extracted data for the entire historical period 2005-2014. These data present the total volumes of timber extracted annually by species and by administrative unit (region and locality) based on the Tree Information Forms (TIFs). This data is summed annually across administrative units to calculate total volumes by areas of interest, including the GCFRP Accounting Area (GCFRP ACCOUNTING AREA).

Emission Factors

The three components of the logging emission factor were calculated using the methods in Pearson et al. (2014) and using field measurements taken by the Ghana Forestry Commission following the standard operating procedures in Annex D. This method accounts separately for three emission sources that occur as a result of logging:

4. emissions from the subsequent milling, processing, use and disposal of the felled timber-tree,
5. emissions from incidental damage caused by the timber-tree fall and cutting of the log in the forest, and
6. emissions from infrastructure associated with removing the timber out of the forest (e.g. skid trails, logging decks and logging roads).

All emissions sources are associated with the volume of timber extracted (e.g. m^3) to allow for simple application of timber harvesting statistics. As such, the total emission factor from selective logging is estimated as the sum of three factors:

$$TEF = ELE + LDF + LIF$$

Where:

TEF	Total emission factor ($tCO2.m^{-3}$)
ELE	Emissions from extracted log ($tCO2.m^{-3}$)
LDF	Logging damage factor ($tCO2.m^{-3}$)
LIF	Logging infrastructure factor (t $CO2.m^{-3}$)

A committed emissions approach is employed in the calculations to simplify the carbon accounting process. This means that all emissions are accounted in the year of the logging event.

To estimate ELE, an average wood density (in g cm-3) weighted by the volume extracted of each species from the activity data is calculated, so that the average wood density (and therefore ELE) would reflect the species most harvested in Ghana. The applied wood density of 0.39 t/m^3 was calculated as the weighted mean of harvested species from the database of legally harvested trees between 2005 and

2014. The chainsaw milling efficiency applied is 50% as identified by the Forestry Commission and through literature revue (Hansen et al, 2012). The ELE reflects the proportion of carbon dioxide still sequestered in harvested wood products 100 years after initial harvest (considered to be permanently sequestered). A half-life of 30 years and a decay rate of 0.023 are applied as given in Table 12.2 in IPCC 2006[134].

Estimate for LDF are based on the measurements taken from the field work conducted by Ghana FC in May 2016, using the SOPs in annex D.
For skid trails it was assumed that creation of trails would avoid trees with a diameter greater than 20cm at breast height. The proportion of forest biomass represented by trees less than 20cm was calculated from the dataset of Napier and Kongsager (2011).[135] Across ten plots these trees represented 12% of the forest biomass (95% CI = 4.8%). This proportion was applied to the carbon stock derived from the FPP inventory dataset.
From measurement of 164 skid trails by the Ghana Forestry Commission in May 2016, the mean width was 4.6m (95% CI = 0.64m). For five skid trails the associated extraction volume was determined, and through integration with trail length a skid trail emission factor was derived.
For logging roads, the mean width was calculated from 11 roads measured by the Ghana Forestry Commission in May 2016 (5.3m +/- 0.65; mean +/- 95% CI). A per length of road emission was calculated from this width and the carbon stock from the FPP inventory dataset. However, no volumes could be paired with emission per length of road. This correlation instead had to rely on the study of Medjibe et al (2013) from Gabon.[136] Medjibe et al determined road construction of 1 m per cubic meter of log extracted.
For logging decks volume correlations were similarly unavailable. The Medjibe et al study determined logging decks represent 1.6 square meters of area per cubic meter of log extracted. This paired with FPP inventory data produced a decks emission factor.

Illegal Timber Harvest
The calculations of total emissions from illegal logging will mirror those used for legal logging with the multiplication of total emission factor (TEF) (in tCO2 m^{-3}) by the activity data (m^3 extracted).
Activity Data
Yearly activity data on the amount of timber harvested illegally in Ghana are not available. However, a number of studies have been conducted that provide estimates on the amount of illegal timber harvest. We will use the estimates from of one of these studies - 'Revisiting Illegal Logging and the Size of the Domestic Timber Market (Hansen et al. 2012).[137]Hansen estimated illegal logged timber at 4.1 million m^3 per year.

Emission Factor

[134] IPCC (2006) Guidelines for national greenhouse gas inventories. Volume 4: Agriculture, Forestry, and Other Land Use. http://www.ipcc-nggip.iges.or.jp/public/2006gl/vol4.html
[135]Napier, J. and Kongsager R. (2011). The breakeven price of REDD-credits: a case study from Kade, Ghana. Master Thesis, Technical University of Denmark.
[136]Medjibe, V.P., Putz, F.E., Romero, C. (2013) Certified and uncertified logging concessions compared in Gabon: Changes in stand structure, tree species, and biomass. Environmental Management. DOI 10.1007/s00267-012-0006-4
[137]Hansen, C.P., L. Damnyag, B.D. Obiri and K. Carlsen 2012. Revisiting illegal logging and the size of the domestic timber market: the case of Ghana International Forestry Review Vol.14(1), 2012 39

The emission factor for illegal timber harvest follow the same methodology as for legal timber harvest. The measurements taken in the field in May 2016 by the Forestry Commission were used to estimate TEF for illegal as well as legal timber harvest. As for legal logging a committed emissions approach is taken.

The extracted log emissions (ELE) were calculated with the following assumptions:

- The species harvested reflect the same species distribution as species legally harvested in Ghana;
- The logs are chainsaw milled in the forest;
- The resulting products are solidwood products.

Based on the findings of Hansen et al. (2012) the chainsaw milling efficiency applied is 27%. The applied wood density of 0.39 t/m^3 was calculated as the weighted mean of harvested species from the database of legally harvested trees between 2005 and 2014. The ELE reflects the proportion of carbon dioxide still sequestered in harvested wood products 100 years after initial harvest (considered to be permanently sequestered). A half-life of 30 years and a decay rate of 0.023 are applied as given in Table 12.2 in IPCC 2006[138].

Based on an understanding of illegal timber practices by the Forestry Commission, LDF is assumed to be identical to the factor used for legal timber harvesting.
LIF is assumed to be nullified as illegal timber harvested either use infrastructure created by legal timber harvesting practices.

Degradation from Fire

Total emissions from forest fire calculated using Equation 2.27 from IPCC (2006)[139]:

$$L_{fire} = A * M_B * C_f * G_{ef} * 10^{-3}$$

Where:

L_{fire}= amount of greenhouse gas emissions from fire, tonnes of each GHG
A = area burnt, ha
M_B= mass of fuel available for combustion tonnes ha-1
C_f= combustion factor, dimensionless
G_{ef}= emission factor, g kg^{-1} dry matter burnt

Activity Data

The activity data represents the total area burnt during the reference period. The MODIS Burned Area Product was used, which gives monthly totals of burned area at the 500m scale across the globe. The following steps were taken to process this data for the reference period:

- Clip the global dataset to the GCFRP ACCOUNTING AREA.
- Combine the monthly burned area pixels to create yearly burned area maps, from 2005-2014 (2000 was not included to maintain a 15-year reference level).
- Divide burned area between areas of forest remaining forest between 2005 - 2014 and areas of deforestation, both according to Ghana's national land cover maps. Burned area on all other land cover types was discarded. This was done to differentiate between forest fires that result in degradation and fires that result in deforestation, since deforestation fires will be accounted for separately.

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[138] IPCC (2006) Guidelines for national greenhouse gas inventories. Volume 4: Agriculture, Forestry, and Other Land Use. http://www.ipcc-nggip.iges.or.jp/public/2006gl/vol4.html
[139] IPCC (2006) Guidelines for national greenhouse gas inventories. Volume 4: Agriculture, Forestry, and Other Land Use. http://www.ipcc-nggip.iges.or.jp/public/2006gl/vol4.html

The high-resolution analysis (described in Annex 8) was used to determine the percentage of fires, mapped as deforestation fires, were actually fires occurring on agricultural tree plantations transitioning to non-plantation non-forest lands. A proportion of deforestation fires were removed from deforestation accounting corresponding to this percentage. The high-resolution analysis was also used to determine the proportion of fires, mapped as degradation fires, were actually on areas of: 1) agricultural tree plantations remaining plantations (and thus neither degradation nor deforestation fires), and 2) forest transitioning to agricultural tree plantations (and thus being deforestation fires). A proportion of deforestation fires were removed for degradation accounting corresponding to the percentages of these areas (and a proportion was added to the deforestation accounting).

Emission Factors

There are three parameters that make up the emission factor: the biomass available for combustion (M_B), the combustion factor (C_f), and the emission factor (G_{ef}).

Biomass available for combustion: The biomass available for combustion refers to all the biomass in the forest that is subject to burning by fire. Generally, only part of the overall biomass in the forest is subject to burning. The carbon pools that are subject to burning depend on the fire regime in the area; if surface fires are common, generally only the pools close to the forest floor are included (litter, deadwood, shrubs, grasses, small trees, and topsoil organic carbon). If canopy fires are common, a greater proportion of the larger trees may be available for combustion as well.

For this reference level, it was assumed that all forest biomass was subject to burning. This assumption was made due to the nature of the activity data from the MODIS burned area product. The burned area product generally detects only larger fires, given that it is a satellite product viewing primarily the forest canopy, has a spatial resolution of 500m. Therefore, fires must kill relatively large sections of the canopy in order to be detected by MODIS, and it is assumed that if the canopy is being burned, the understory biomass is also subject to burning.

For areas that burned in multiple years, a reduced biomass available for burning value was used, which was equal to the original biomass multiplied by the combustion factor and by the number times the area had burned. For example, if an area burned for the second time in specific year, the original biomass was multiplied by the combustion factor and by 2.

Combustion factors: Combustion factors refer to the fraction of M_B that is actually combusted during fire. C_f depends largely on climate and ecosystem, since combustion will be more complete under dry, hot conditions. Defaults from IPCC[140] were used since country-level data was not available.

Emission Factors

Emission factors in Equation 2.27 refer to the amount of each GHG that is emitted when a certain amount of dry matter is burned. The reference level accounts for the major GHGs emitted during biomass burning, which are CO_2, N_2O, and CH_4. Since these emission factors are fairly constant across forest types, IPCC (2006) defaults from Table 2.5 were used for G_{ef}.

[140] Factors from Table 2.6 of IPCC (2006)

Annex 8: Methods For Development Of Landuse Maps

Ghana generated four land use maps. The 2000 and 2010 maps were developed under Ghana's FPP, while the 2013 and 2015 maps were developed under the ERP. The rest of this sub-section describes the process used to develop these maps.

Development of 2015 Map

The 2015 land use map for the Emission Reduction Programme area was developed following Ghana's Standard Operating Procedure (SOP 003)[141] for acquisition of satellite data and generation of activity data and SOP 004 on the stratification of forest lands. The method used generally involved the review of existing maps, field data collection, image processing and classification, accuracy assessment of the maps and generation of the final land use maps.

Review of existing maps

The review of existing maps was conducted on existing land use maps developed under the Forest Preservation Programme (FPP) (1990, 2000 and 2010), a land use map (2000) developed by the RMSC for the multi-resource inventory completed, as well as a land use map produced by Ghana's Centre for Remote Sensing and Geographic Information System (CERSGIS) for the year 2000 were reviewed. The review was done to ensure consistency of the methods and comparability of the final output maps. It was meant to study the land use categorization of the previous maps to guide the production of current maps. Furthermore, analogue topographical maps were converted to digital maps to extract settlement and roads to guide the collection of field data for image classification and analysis.

Image acquisition and pre-processing

Satellite images from Landsat 7 Enhance Thematic Mapper (ETM+) and Landsat 8 Operational Land Imager (OLI) were used for the production of the 2015 land use maps (Eight Landsat 8 and one Landsat 7.) The images were downloaded from the United States Geological Survey (USGS) Global Visualization Viewer (GLOVIS) website following the guidelines outlined in the Standard Operating Procedure (SOP 003). Landsat 7 images are made up of 9 bands and Landsat 8, 11 bands. Images of both satellites have a spatial resolution of 30 meters and temporal resolution of 16 days. The Landsat images come in tiles. Each tile is identified by its path and row number which is unique. Seventeen tiles ranging from path 192 row 056 to path 196 row 053 were used for this work (192 and 056, 193 and 053, 193 and 054, 193 and 055, 193 and 056, 194 and 052, 194 and 053, 194 and 054, 194 and 055, 194 and 056, 194 and 057, 195 and 052, 195 and 053, 195 and 054, 195 and 055, 195 and 056, 196 and 053). The images were stacked using 5, 4. 3 band combination.

To ensure that high quality images were used for this work, images with very little or no cloud cover were selected. Image scenes with cloud cover more than 5% were replaced with satellite images from previous or subsequent years depending on the quality and not exceeding one year interval. For areas with low cloud cover which still mask the land cover at the point and had the tendency of affecting the accuracy of the classification, Google earth software was used to identify the land cover masked by the cloud. The coordinates of the point where the cloud occurred were picked and converted to a KML fie this was loaded onto Google earth using the image of the year.

[141] The link to this SOP is in Annex 9, which provides links to a drop box with the SOPs.

Layer stack

The bands were stacked together using the layer stack tool in ERDAS Imagine 2010 to form a composite image for each tile. For Landsat 7 images, bands 1 (Blue), 2 (Green), 3 (Red) and 4 (infrared) were stacked together and for Landsat 8 images, bands 2(Blue), 3 (Green), 4 (Red) and 5 (infrared) were used. The composite images were displayed in infrared false colour combination in ERDAS Imagine for the classification. With this combination, vegetation appears in shades of red, urban areas are cyan blue, grass vary from dark to light green, and clouds are white or light cyan. Cropland (annuals) appears as light green with perennials having similar reflectance to that of natural forest.

Gap filling

Images from Landsat 7 with scan lines caused by malfunctioning of the sensor were corrected. This was done by using the focal analysis tool in ERDAS Imagine 2010 to fill in the gaps created by these scan lines.

Haze correction

The effect of haze was corrected using the dark subtract tool in ENVI 5.1. The composite images were loaded and dark subtract tool was opened, the composite images were selected and the tool was ran. This tool identifies the lowest DN value in each band then subtracts it from the remaining DN values for each band. This operation improves the contrast in the images.

For each tile the Digital number was corrected to Exo-atmospheric reflectance to enhance easy interpretation of the satellite images.

Stratification

The forest estate of Ghana is very diverse in terms of species composition and ecological landscape, which is influenced by soil structure and rainfall regime. Consequently forest management in Ghana is structured to address the diversity of the forest resources within and across the ecological landscape (S0P3). For accurate classification there was the need to stratify the forest landscape to facilitate field data collection and increase the accuracy of the classification and precision of measurement. The study area was first stratified into forest and non-forest using Normalized Difference Vegetation Index (NDVI) – an index used to assess the health of the vegetation cover and as recommended in the SOP 004 (for Stratification). Pearson *et al*., (2005) also recommends stratifying the study area into homogenous units to enhance sampling accuracy and capture more variability. Areas with high vegetation cover have high values as areas with low or no vegetation cover have low values.

To perform the NDVI, the stacked images were converted to Top of the Atmosphere (TOA) i.e. conversion from DN values to reflectance using Radiometric calibration tool. The output map was used to ran the NDVI using the NDVI tool under the spectral toolbox in ENVI 5.1.The NDVI values were used to classify each tile into forest and non-forest NDVI values which range from -0.1 to 0.1 with pixels having values greater than 0.3 classified as forest and those with values less than 0.3 classified as non-forest. Pixels classified as forest were extracted using the raster function editor in ArcGIS 10.3 to produce a forest map for each tile.

The forest map was further stratified using the NDVI values and forest canopy data taken at the field using the densitometer to close and open canopy forest. The densitometer is used to measure the amount of light that penetrate the forest floor through the forest canopy. The instrument was used to pick amount of light penetration values from open and close forest in the field. The data was used to calibrate the forest map. NDVI values from 0.3 - 0.5 were classified as open canopy of closure 15 – 60%. NDVI values ranging from 0.6 – 1% were classified as closed forest with canopy and cover of 60% and above.

The forest reserve shapefiles of Ghana were overlaid on the forest map. Pixels that fell within the forest reserve shapefile were classified as closed for those that fell outside as open forest. This is because most of the closed forests in Ghana are confined to the forest reserves with small patches falling outside the forest reserves. Pixels that fell within the shapefile with NDVI values less than 0.5 were classified as open forest and those with NDVI values greater than 0.5 and fell outside the shapefile were also classified as closed forest. However, these were in small patches.

The ecological zone and the administrative (region and district) shapefiles of Ghana were also overlaid on the forest map. This was done to know the distribution of both close and open forest within the different ecological zones and the various regions and districts. The output map showed the stratified landscape of the distribution of forest, non-forest and closed and open forest across the ecological and political landscape of Ghana. This map served as the preliminary map for field data collection.

Unsupervised Image classification

Having adequate knowledge of the study area, unsupervised classification was run on each tile to generate a thematic landuse map. This was done using the isodata unsupervised classification algorithm in ERDAS Imagine 2010 to classify each tile into 50 – 70 classes. The classes were merged together to form 8 – 10 classes based on the similarities in reflectance from original image and field knowledge. The ecological zones and political/administrative shapefiles were overlaid on the output to check the distribution of these classes across the ecological zones and the political districts and regions. The two maps (forest non-forest map and unsupervised classified map) were used as preliminary maps to design the field data collection.

A fish net tool in ArcGIS was used to generate random points with predetermined coordinates on the land use map. These points were to guide and ensure that all landuse representation within the ecological zones as well as within forest and non-forest areas was covered.

Field Data Collection (Training data set): The field data collection was preceded by one day intensive training for team members on the type of data, quantity and how to collect. The logistics and the general planning of the field work was thoroughly discussed during the training. The landscape was divided into two zones, namely; the ERPD (high forest zone) and the savannah and the coastal zones.

In order of importance the field data collection was started in the ERPD zone which include five regions namely: Ashanti, Western, southern part of Brong Ahafo, part of Eastern and Central regions. Five teams were formed for data collection with each team made up of 4 persons. Each team leader had a background in GIS and remote sensing, and was tasked to collate and transmit data via internet where available to the head of GIS at the close of the day's session. He was also tasked to collect all the field sheets used and submit them to the head of the GIS unit after the field work. Each team was tasked to collect a minimum of 200 points which included the coordinates, description of the landuse at the point, the adjoining land use and photographs.

Data collected both in hard and electronic were submitted to the field work coordinator and head of the GIS unit for further processing. Out of 2000 data points collected 1000 was used to run the classification and the other 1000 was used to run the accuracy assessment. The 2000 data was numbered serially. The odd number points were used to run the classification and the even number points used as reference data for the accuracy assessment. This was repeated for the savanna and coastal zones.

Supervised Image Classification

Training data was used in conjunction with the Google Earth software to run supervised classification. The land use categorization was based on the previous work done by FPP, national circumstances and in conformity with the IPCC land use categorization. Field data collected was grouped according to the landuse types identified and subsequently used as training data set to run the classification. In all, eight (8) landuse types were identified, namely; open forest, close forest, water body, grassland, cropland, wetland, settlement/bareground and other lands. The images were classified tile by tile, and where the tiles cut across different ecological zones, were divided accordingly and classified. This was done to address the different reflectance of the same cover types within the ecological zones. The classification was done in ERDAS Imagine 2010. The polygon tool was used in training the pixels (signatures).During the training of pixels, each class (landuse) had subclasses. The purpose of the subclasses was to reduce the margin of error. After training the pixels the maximum likelihood algorithm was used in running the classification. This algorithm was used because it is able to incorporate the statistics of the training samples before assigning the land covers to each pixel. After the classification, the outputs were displayed in ArcGIS 10.3. The subclasses were merged together using the re-class tool. The reclassified maps were then filtered using the majority filter tool to remove the "salt-and-pepper appearance" and enhance the cartographic presentation after the image classification. After the filtering process, the outputs were mosaicked using the mosaic to new raster tool to form one image. The resultant image was passed through Clump and Eliminate tools in ERDAS Imagine to remove land use fragments less than 0.4 of a hectare. Some of the tiles extended beyond Ghana, the output from the Clump and Eliminate operation was subset using the boundary shapefile of Ghana. This ensured that only landuse that fall within the boundary of Ghana were used for the analysis. This subset operation was done using the clip tool under the data management toolbox in ArcGIS. The same boundary shapefile of Ghana was used to clip all the maps to ensure that the pixels were properly aligned.

The Eight (8) land-use classes identified are described in Table 63below.

Table 63: Landuse classes and description

LANDUSE	DESCRIPTION
Closed forest	Natural forest and tree plantations with canopy cover of more than 60%, spatial coverage of more than one hectare and tree height reaching at least 5m.
Open Forest	Natural forest and tree plantations of canopy cover reaching 15% - 60%, spatial area of one ha and tree height reaching at least 5m.
Cropland	Areas covered by annual crops such as maize, cassava, plantain, and cocoa yam. It also includes agricultural tree crops including cocoa, citrus, rubber, etc.
Grassland	Long stretches of grass cover and bushy fallows. Animal grazing occur in these areas. The grassland also occurs in wet and low lying areas and sometimes along riverine belts.
Settlement / Bare Surface	These are areas that have been populated with permanent residence or covered with scanty grass, exposed rocks and bare lands
Water	Stagnant water, lakes, rivers and streams
Other land	Gravel pits, mined areas etc.

Wetlands	Area permanently covered by water and vegetation found in low lying areas

Spatial Analysis to Identify Tree Crops in the GCFRP Accounting Area

Mapping detailed land cover classes such as unshaded cocoa and monoculture plantations requires higher quality imagery (i.e. imagery with limited atmospheric variability) because the differences between the spectral signatures of the classes can be subtle. We acquired Landsat data from the USGS (http://earthexplorer.usgs.gov/), with a focus on scenes with limited clouds and atmospheric contamination (i.e. haze). Our focus here was on the southern central portion of Ghana, tiles 194055 and 194056. Given our criteria for the highest quality imagery, we selected images from the dates 7 May 2002 (2002127) and 21 December 2015 (2015355).

The Landsat imagery from the USGS are provided as digital numbers (DN). These simplified measurements of radiance to surface reflectance were converted using open source Geospatial Image Processing System (GIPS) which is freely available at http://gipit.github.io/gips/. Within this system, atmospheric correction is performed with the 6S model (Vermote *et al*. 1997)[142]. Clouds and thick haze are masked with a modified version of the ACCA algorithm (Irish *et al*. 2006)[143].

Additionally, the image acquired in 2015 has missing data due to the Scanline Corrector Failure on Landsat 7 (Williams *et al*., 2006)[144]. No sufficiently cloud-free data was available in 1999, 2000, or 2001 for either Landsat 5 or 7 nor in 2015/16 from Landsat 8. Via the GIPS software, several vegetation indices generated. Vegetation indices listed in Table 15 are intended to isolate attributes of the land surface and minimize residual atmospheric and sun-sensor geometry effects. These indices were stacked to the two tiles (194055 and 194056) and merged into a single raster. This raster was used as input into our classification system.

Table 64: Landsat and PALSAR indices

NDVI	(NIR – Red) / (NIR + Red)
LSWI	(NIR – SWIR1) / (NIR + SWIR1)
SATVI	(SWIR1 – Red / (SWIR1 + Red + L)) * (1+L) - (SWIR2/2)
NDTI	(SWIR 1 – SWIR 2) / (SWIR 1 + SWIR 2)
Brightness	0.3561(Blue) + 0.3972(Green) + 0.3904(Red) + 0.6966(NIR) + 0.2286(SWIR 1) + 0.1596(SWIR2)
Greenness	-0.3344(Blue) + -0.3544(Green) + -0.4556(Red) + 0.6966(NIR) + -0.0242(SWIR 1) + -0.2630(SWIR2)
Wetness	0.2626(Blue) + 0.2141(Green) + 0.0926(Red) + 0.0656(NIR) + -0.7629(SWIR 1) + -0.5388(SWIR2)
MSI	SWIR 1 / NIR
RFDI	(HH – HV) / (HH + HV)

The 2015 maps were generated using SAR backscatter from PALSAR2, available as mosaics from the Japanese Space Agency (JAXA; http://www.eorc.jaxa.jp/ALOS/en/palsar_fnf/data/index.htm), in addition to the Landsat. The digital numbers provided in the mosaics to sigma nought backscatter were converted. In addition to the HH and HV polarizations, two indices HH/HV^2 and RFDI ((HH – HV)/ (HH +

142 Vermote, E. F., Tanré, D., Deuzé, J. L., Herman, M., & Morcette, J. J. (1997). Second simulation of the satellite signal in the solar spectrum, 6S: An overview. Geoscience and Remote Sensing, IEEE Transactions on, 35(3), 675-686.

143 Irish, R. R., Barker, J. L., Goward, S. N., & Arvidson, T. (2006). Characterization of the Landsat-7 ETM+ automated cloud-cover assessment (ACCA) algorithm. Photogrammetric Engineering & Remote Sensing, 72(10), 1179-1188.

144

HV)) were we generated. These observations were originally provided at the ~25 m spatial resolution, and data were re-projected to match the Landsat 30 m grid. Supervised classification approach was applied, meaning training or calibration data were used. Calibration data were collected from two primary sources. The team collected 75 observations, primarily of cocoa, in April 2016. These observations included digitized field boundaries of the observed areas. Additionally, polygons for cocoa, oil palm plantations, natural forest, citrus plantations, rubber plantations, settlement, water, grassland, and crop land (Figure 10) were digitized. These observations we created using high resolution imagery from 2015, as well as 1997-2003. In total, 554 polygons for calibration and validation of the 2015 maps and 268 polygons for the 2002 maps were used.

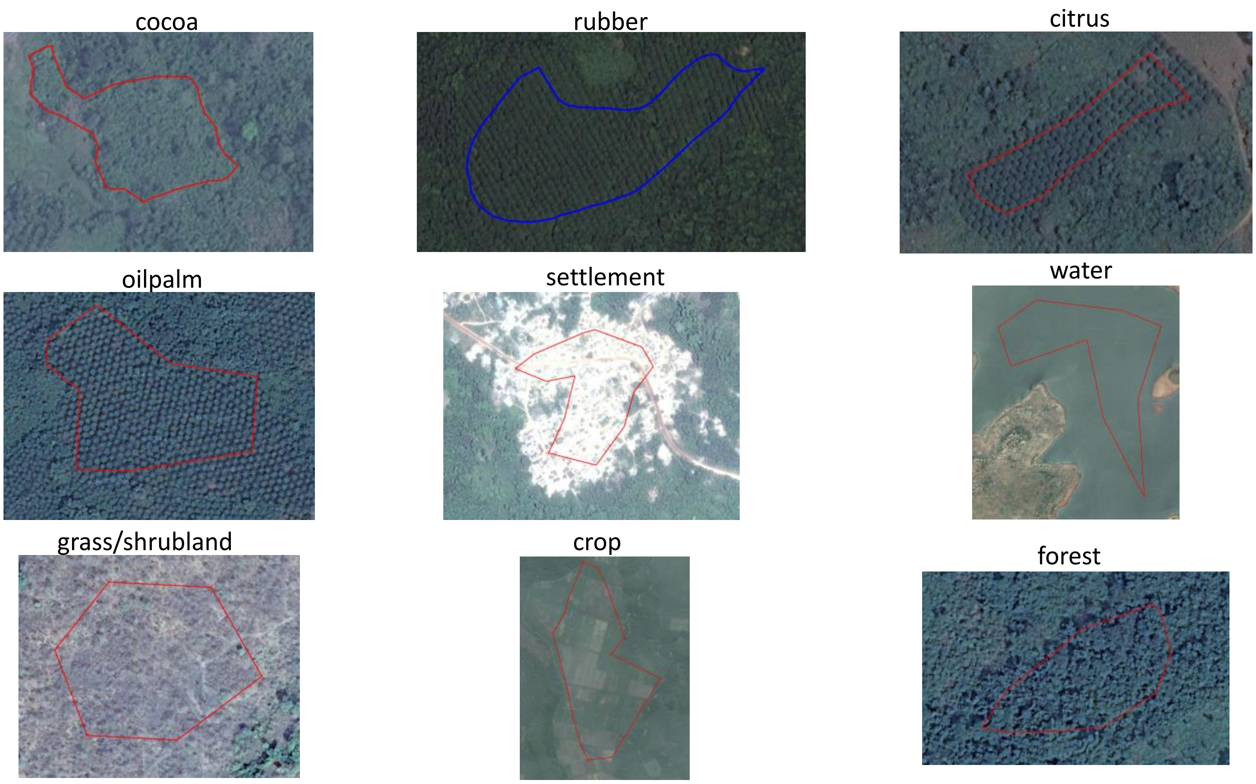

Figure 34: Example of calibration and validation polygons digitized using Google Earth Pro

For supervised classification, **G**eneral **A**utomated **R**emote **Se**nsing **C**lassification Tool (GARSeCT) was used to create maps. GARSeCT is a Random Forest classifier (SciKits-Learn python module) wrapped in python code to make remote sensing classification easier to perform. A Random Forest classifier falls under the general category of “Machine Learning” methods. It is an “Ensemble Learning” algorithm, meaning that several models are combined to solve a single prediction problem. In this case, each component model application is a Classification Decision Trees. A Decision Tree asks a series of binary questions which maximize the information about the response variable (class). It performs a “greedy search”, asking which one binary question will maximize the info about Y (the class)? Each root node produces two daughter nodes. At each daughter node, we repeat recursively. The advantages of using a decision tree classifier include ease of use, sensitivity to linear and non-linear relationships, provides information on feature importance, and generally avoids overfitting.

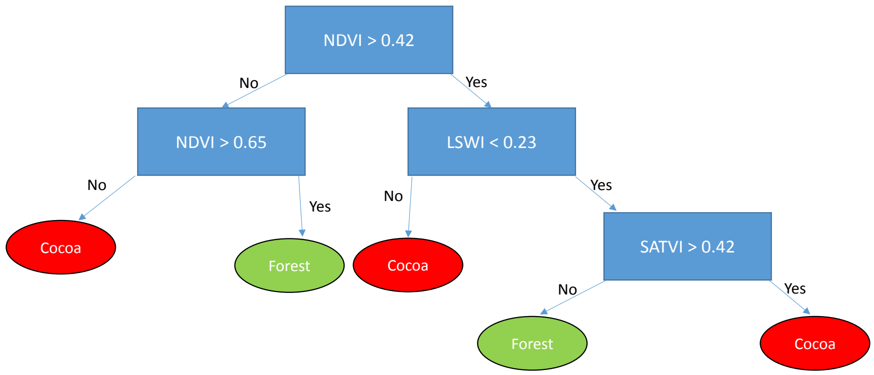

Figure 35: Example classification tree (for illustration only)

The stacks of processed raster data and digitized training data are provided as input to GARSeCT. Separate classifications were performed for 2002 and 2015. GARSeCT returns a classified map, cross-validation results, and maps of likelihood of class membership. GARSeCT was run using 100 trees. Each tree relies on a different subset of data for training, and therefore, can produce different classifications for each pixel, thereby "casting a vote" for class membership for each pixel. These "votes" are tallied and captured in the likelihood of class membership maps and the class with the most votes for each pixel is reported in the classification map.

Results

Consistently, it was found that tasseled cap (TC) wetness, SATVI, TC-brightness, and NDVI provided the most predictive power. In the 2015 classification, the four metrics derived from PALSAR provided the least predictive power. Results showed significant confusion between some classes, particularly the plantation classes. Specifically, oil palm (59%) and rubber (60%) showed low reliability or user's accuracy. The classification maps were post-processed to simplify the classifications to four classes: *cocoa*, *plantation* (from oil palm, rubber, and citrus), *forest*, and *other* (from settlement, water, grass, and crops). For 2015, out of sample user's accuracy was 74% for cocoa, 89% for plantation, 88% for forest, and 99% for other. For 2002, out of sample accuracy was lower: 68% for cocoa, 78% for plantation, 88% for forest, and 85% for other. The plantation area breakout was approximately 60% oil palm, 30% rubber, and 10% citrus. Classification maps were adjusted using the class likelihood maps to address concern of the over predicting cocoa and plantation at expense of forest. Forest threshold of 10% in 2002 and 20% in 2015 were set, meaning any pixel with a forest class likelihood over this threshold was classified as forest. Additionally, manual clean-up was done by digitizing areas of known error and correcting the classification. The final maps have lower validation accuracy (e.g. 69% and 65% reliability for cocoa and plantation respectively) more accurately reflect the land cover.

Discussion and next steps

The maps created here do not have a minimum unit size below the pixel resolution. It may be appropriate to eliminate plantations under a certain size and classify these as forest. Texture metrics, including standard deviation and spatial co-occurrence, were generated from a 90 x 90 meter moving window. These texture metrics as generated failed to improve the classification performance, most likely because the spatial scales of the features on the landscape (e.g. tree crops, roads) are often smaller than the 90 m scale offered by this texture analysis. The use of the 15 meter panchromatic band for measuring texture was therefore proposed as an improvement.

Via JAXA, quad pole fine beam PALSAR backscatter data at 10 m spatial resolution was acquired for a subset of southern Ghana. The additional spatial resolution and polarity are likely to produce more accurate classification results. Proposal to further explore the improvements provided by the inclusion of radar data was made. While this won’t help with reference levels, radar data is likely to play a large role in forest monitoring in the tropics in the years to come due to a proliferation of sensors and an insensitivity to cloud cover.

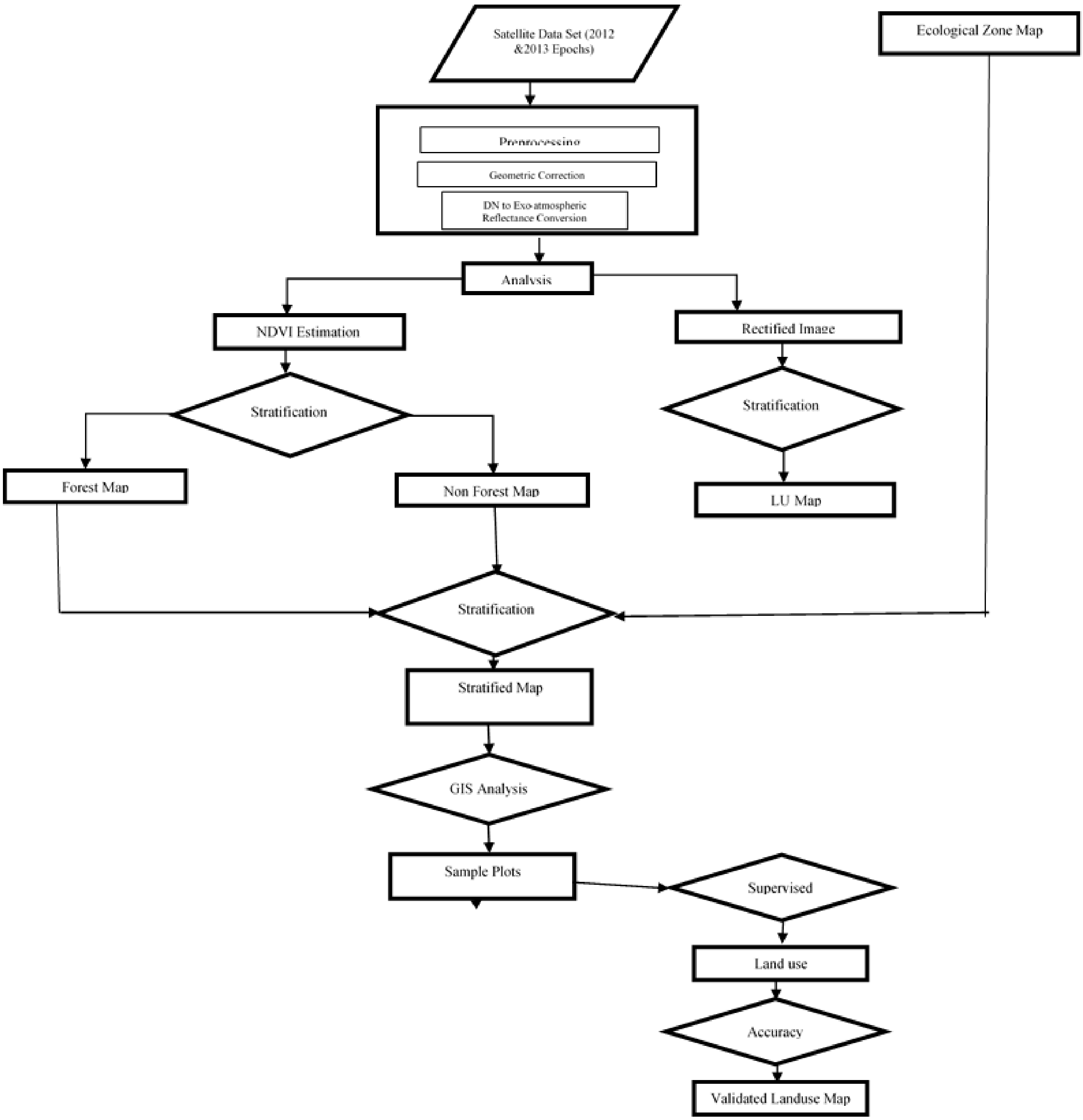

Figure 36: Flowchart indicating the procedure for the execution of the assignment

Accuracy Assessment of 2015 Land Use Map

The field data (1000 data points) of even numbers were used to construct the confusion Matrix which was used to assess the accuracy of the classification. The matrix uses statistical outputs, which can be used to check the quality of the classification results. The matrix compares on class-by-class based on the field data and the classification results. During the accuracy assessment, the overall accuracy as well as the Kappa statistic was also computed. For each landuse category the accuracy was assessed; the producer and user accuracy and overall accuracy for that landuse category were determined. A combine

accuracy of all the eight landuse classes were determined, the user and producer accuracies of all the landuse classes were determined and Kappa statistics calculated.
For the historical maps i.e. the 2013 and 2000 maps, the accuracy were calculated using collect Earth software which relies on Google earth search engine combined with archived field data.
Data points were generated randomly from the historical images. These points were uploaded on Google earth and the land cover determined. The coordinates and description of the landcover on the Google earth were used as field data. These were converted to KML files and displayed on the classified map. The descriptions of the points (from google earth) on the classified maps were taken as the reference data. The two data sets i.e. the data generated from the Collect Earth software and corresponding points on the classified map were used to construct the error matrix. The overall accuracy of the 2013 landuse map was 82.75% and the Kappa was 0.7739 and the 2000 landuse map was 81.7 % and the Kappa was 0.7644.

To establish the validity of this approach, the same method was used to assess the accuracy of the 2015 map which was found to be 81.46%. The accuracy generated from the real filed data for the 2015 was 80.1%. These two figures i.e. 80.1 from field data was compared to the 81.46 from Google earth. The two accuracies were comparable and for this reason the collect earth approach was adopted. The even numbered training data were used to assess the accuracy of the 2015 land use map by using Error / Confusion matrix (Table 16) and Kappa statistics. It yielded an overall accuracy of 80.1%. Water body yielded the highest accuracy because reflectance from water is very unique and does not confuse with other cover types. This was followed by close forest with a producer accuracy of 95% and user accuracy of 87.35. This was so because the close forest is confined to the gazzetted forest reserves which are very distinct on the image. However, significant confusion existed for the grassland, cropland and Open Forest categories. This confusion was minimized by the use of Google Earth. The number of the training data for such classes was significantly increased during the validation.

Table 65: Accuracy Assessment for 2015 Map

Class Name	Reference Total	Classified Total	Number Correct	Producers Accuracy	Users Accuracy	Kappa
Closed forest	80	87	76	0.95	0.8735	0.7346
Open Forest	331	263	255	0.7703	0.9696	0.8334
Water body	21	25	21	1	0.84	0.6936
Grassland	200	186	154	0.77	0.8279	0.7356
Settlement/Bare ground	90	142	84	0.933	0.5915	0.7394
Cropland	250	275	189	0.756	0.6872	0.7302
Wetland (Swampy)	19	15	15	0.7894	1	1
Other land	9	7	7	0.7778	1	1
Totals	**1000**	**1000**	**801**			
Overall Classification Accuracy = 80.1%						
Overall Kappa Statistics = 0.7644						

Production of the 2013 Land use Map

The **2013** land use map for the Emission Reduction Programme area was developed following the Standard Operating Procedure (SOP 003) for acquisition of satellite data and generation of activity data and Stratification of Forest Lands (SOP 004). The method used generally followed the same procedure as the 2015 land use map. However field data used here were historical field data and data generated from Google Earth.

Review of existing maps

Landuse maps developed under the Forest Preservation Programme (FPP) and the validated land use map for 2015 were the base maps for the development of the 2013 land use map. The end procedure was same for the 2015 land use map. That was done to ensure consistency of the method and comparability of the final output maps. It was meant to study the landuse categorization of the previous maps to guide the production of the current map.

Image Pre-processing

Nine (9) Landsat 7 were used to cover the study area (the high forest zone and northern part of the forest savanna transitional zone). This covered 5 ecological zones namely, Moist Evergreen, Wet Evergreen, moist semi deciduous, dry semi-deciduous upland ever green and transition zone of Ghana. The images were stacked using 4, 3, 1 band combination and subsequently geo-referenced and re-projected. Haze correction was done using haze reduction module in ERDAS imagine version 10. For each tile the Digital number were corrected to Exo-atmospheric reflectance to enhance easy interpretation of the satellite images.

Stratification

To facilitate field data collection and increase the accuracy of the classification and precision of measurement, the study area was first stratified into forest and non-forest using MODIS Enhanced Normalized Difference Vegetation Index (NDVI) and Standard Operating Procedure for Stratification (SOP 004). Pearson *et al.*, (2005) recommends stratifying the study area into homogenous unit. Three (3) levels of stratification were done. The first level was done by masking all the gazzetted forest reserves to form forest reserve and off forest reserve areas map. The second level was done using NDVI (band 3 and 4) to extract the images. The NDVI values were used to segregate forest and non-forest in the off reserve areas.

$$NDVI = \frac{Band4+Band3}{Band4-Band3} \text{ ....Equation 1}$$

The third level of stratification was done by overlaying the ecological zones of Ghana on the 2 maps i.e. forest reserve area and off reserve forest and non-forest map. The stratification ensured that all areas within the ecological zones, including off reserve areas and within the forest reserve were fairly represented in the data collection to improve on the accuracy of the classification as well as the land use change Matrix.

Unsupervised Image classification

Having in-depth knowledge of the study area, unsupervised classification was run on each tile generating a maximum of 36 land use categories. Google Earth software was used to select images of 2013 that were available and cloud free to generate random points with predetermined coordinates on the unsupervised classified map. These points were to guide and ensure that all land use representation within the ecological zones as well as within forest and non-forest areas were covered. The transitional land use map was use as input for field data collection.

Field Data Collection (Training data set)

As a historical map no real time field data collection was done. However historical field data archived and the field data generated by Google Earth were combined to generate the stratified maps. One thousand training data set were collected and divided into 2 sets, one set used to run the classification and the other set for accuracy assessment.

Supervised Image Classification

The training data set assisted by Google Earth was used to run supervised classification. The land use categorization was based on the previous work done by FPP, 2015 land use map, local content and in conformity with the IPCC land use categorization. Each of the 9 tiles was classified separately before they were mosaicked. This was done to avoid the alteration of the DN values which could potentially affect the accuracy of classification. The individual classified scenes for the various tiles were later mosaicked to obtain the 2013 land use map. A 3x3 majority filter was applied to the resultant mosaicked file to remove the “salt and pepper” effect associated with image classification. The resultant image was passed through Clump and Eliminate tools in ERDAS Imagine to remove land use fragments less than 0.4 of a hectare. The classification was based on the maximum likelihood classifier. Eight (8) land use classes were identified.

Accuracy Assessment of 2013 Land Use Map

The second set training data was used to assess the accuracy of the 2013 land use map by using Error / Confusion matrix. It yielded 82.75% overall accuracy. The validated land use map was overlaid with the stratified map and 400 points were randomly generated. These points were uploaded on the 2013 Google Earth images and the number of points which were correctly classified were counted. The percentage of these points represented an overall accuracy which was 82%. The accuracy assessment from this process is comparable to the accuracy generated from the matrix.

Table 66: Accuracy Assessment for 2013 Map

Class Name	Reference Totals	Classified Totals	Number Correct	Producers Accuracy	Users Accuracy	Kappa
Close forest	54	55	51	94.44%	92.73%	0.9159
Open Forest	146	148	129	88.36%	87.16%	0.7978
Water	20	20	20	100.00%	100.00%	1
Grass	67	73	53	79.10%	72.60%	0.6709
Settlement	15	8	8	53.33%	100.00%	1
Cropland	88	90	65	73.86%	72.22%	0.6439
Wetland	2	2	2	100.00%	100.00%	1
Otherland	8	4	3	37.50%	75.00%	0.7449
Totals	**400**	**400**	**331**			
Overall Classification Accuracy = 82.75%						
Overall Kappa Statistics = 0.7739						

Development of 2000 and 2010 Land Use Map

For the assessment of Wall-to-Wall Land Use Change using LULUCF Classes, satellite imageries of medium (2000) and high (2010) resolution were procured. The Land Use classes were defined as per IPCC guidelines, which have six classes including Forest Land. In addition, to facilitate stratification, the Forest Land was divided into two classes, employing Crown Cover (CC) threshold: a) Dense forest (> 60%); and b) Open forest (<60%). For analysis, Erdas Imagine Software was used. All datasets were maintained with the same projection system, UTM Zone 30.

Geometric Correction

The satellite data was pre-processed for Geometric correction and then converted to Exoatmospheric (or top-of-atmosphere, TOA) Reflectance. Then, after estimating Normalized Difference Vegetation Index (NDVI), LU classification was carried out

Preparation of Satellite Data:

For 2000 epoch Land Use (LU) analysis, Landsat (TM/ETM+) with spatial resolution 30m was used. Similarly, for 2010 epoch LU, ALOS AVNIR-2 with spatial resolution 10m was used, which was supplemented by DMC satellite data (spatial resolution 22m) for the area where ALOS AVNIR-2 was lacking. Details of data to be included in these epochs are presented below:

2000 Epoch: Landsat Enhanced Thematic Mapper plus (ETM+) images (spatial resolution 30m) of 2000-2001 were used for LU classification for 2000 Epoch. All 16 scenes is in Table 18 below.

2010 Epoch: For the LU classification of 2010 epoch, the archived ALOS AVNIR-2 (Advanced Visible and Near Infrared Radiometer type 2) images with spatial resolution 10m[145] of 2009–2011 were used. 79

Table 67: List of Landsat ETM+ used for 2000 Epoch Land Use Classification

SN	Landsat Scene Identifier	Path/Row	Date Acquired	Cloud Cover (%)
1	LE71920562001094EDC00	P192/R056	2001/4/4	0.4
2	LE71930532000339EDC00	P193/R053	2000/12/4	0.0
3	LE71930542000339EDC00	P193/R054	2000/12/4	0.0
4	LE71930552000339EDC00	P193/R055	2000/12/4	3.4
5	LE71930562000035EDC00	P193/R056	2000/2/4	0.0
6	LE71940522000314EDC00	P194/R052	2000/11/9	0.2
7	LE71940532000314EDC00	P194/R053	2000/11/9	0.0
8	LE71940542001012EDC00	P194/R054	2001/1/12	0.0
9	LE71940552000074EDC00	P194/R055	2000/3/14	6.8
10	LE71940562001092EDC00	P194/R056	2001/4/2	5.1
11	LE71940572000138EDC00	P194/R057	2000/5/17	10.0
12	LE71950522000305EDC00	P195/R052	2000/10/31	0.1
13	LE71950532000353EDC00	P195/R053	2000/12/18	0.0
14	LE71950542001051EDC00	P195/R054	2001/2/20	0.0
15	LE71950552000033EDC00	P195/R055	2000/2/2	0.0
16	LE71950562000033EDC00	P195/R056	2000/2/2	0.0

[145] https://auig.eoc.jaxa.jp/auigs/top/TOP1000Logout.do

AVNIR-2 scenes were analyzed, refer to Figure 13 for their location

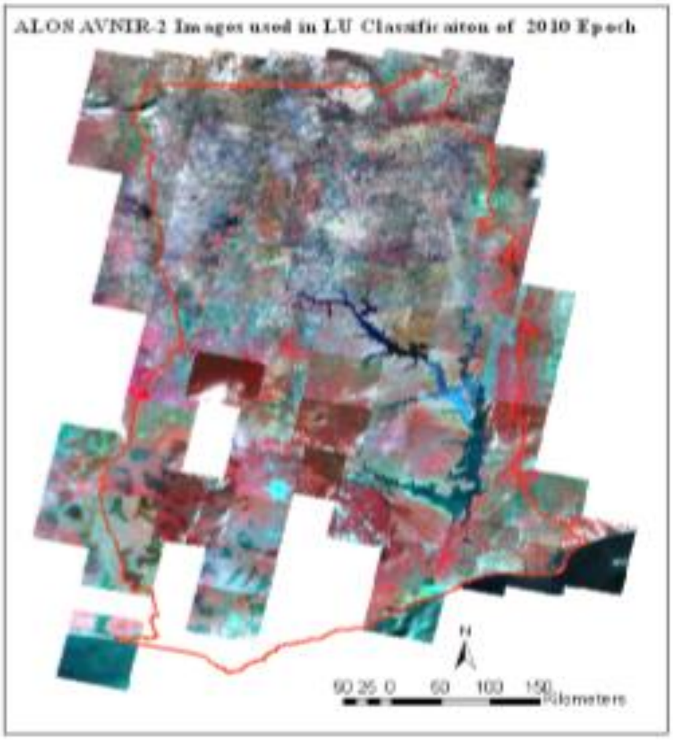

Figure 37: ALOS AVNIR-2 Images used in LU Classification of 2010 Epoch

Some of areas were not covered by the available archived ALOS AVNIR-2 images. For such areas, Disaster Monitoring Constellation (DMC) images[146] were included in the analysis, which also helped in discarding the cloud area in ALOS AVNIR-2.

[146] (http://www.dmcii.com/products.htm)

Figure 14 Analyzed 3 DMC Scenes

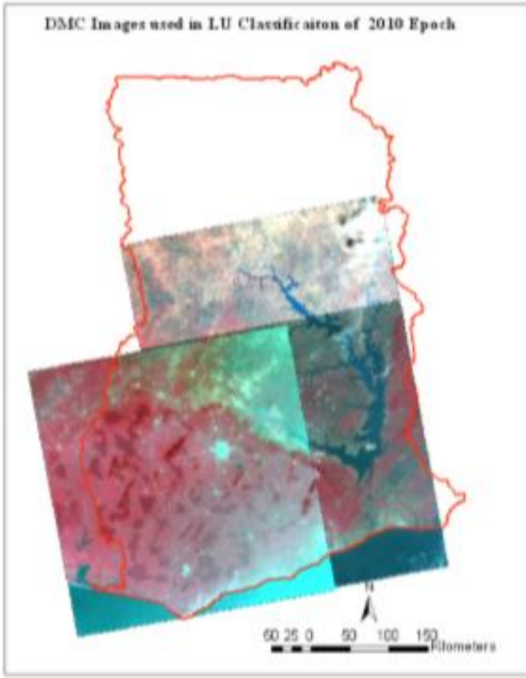

Figure 38: DMC Images used in LU Classification of the 2010 Epoch

3 DMC scenes were used as shown in Table 69

Table 68: 3 DMC Scenes used

SN	Image Name	Acquisition Date
1	U2000982_000000_015499_p	19/01/2011
2	U20009a0_000000_015499_p	22/01/2011
3	U20009a0_015000_030499_p	22/01/2011

The processing level of procured satellite data of 3 epochs is provided in Table 70 below.

Table 69: Processing Level, and Product Format of Procured Satellite Data

SN	Epoch	Satellite Data		Production Information
1	2000	LANDSAT (ETM+)		Multispectral: Bands 1 to 5 and Processing Level: L1T; Product F
2	2010	ALOS AVNIR2		Multispectral: (4 bands) with 10r Level: 1B1; Product Format: CEO
3		DM		Multispectral: 3bands with 22m Level: L1T; Product Format: Geo

To get better geo-metric corrected images including the removal of inter-scene location discrepancy, all the images were ortho-rectified employing Shuttle Radar Topography Mission (SRTM) Digital Elevation

Model (DEM). For Ground Control Points (GCPs), the features such as road crossing and road river crossing were used from the existing Topographic maps so acquired from Survey of Ghana (SOG).

Preparation of DEM and Reference Dataset

Downloading and compiling SRTM DEM: SRTM DEM (spatial resolution 90m) was downloaded from Web site[147]. It was re-projected to the projection, UTM, Zone 30 with spheroid and Datum WGS84. The SRTM DEM covering whole Ghana is presented below in figure 15.

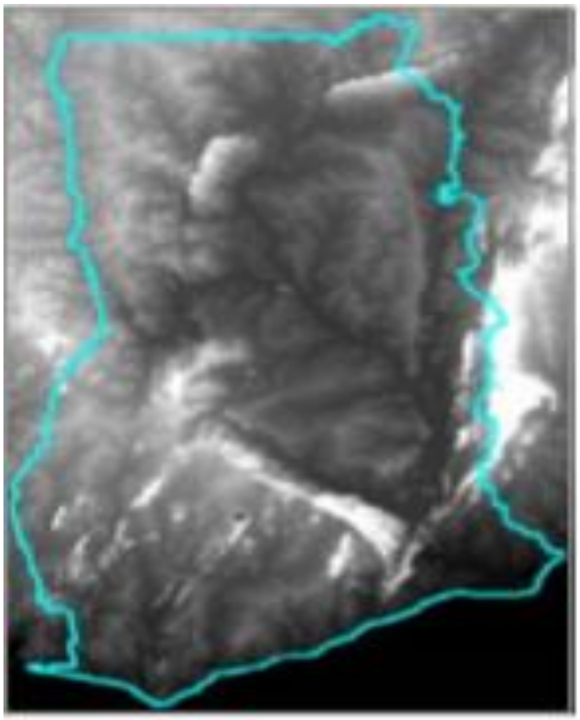

Figure 39: SRTM DEM spatial resolution downloaded

Preparing the Reference Data for GCPs

For ortho-rectification the reference datasets were required to collect GCPs. For this, the existing road and river GIS data were used. However, with limited number of such GCPs from exiting GIS data, wherever necessary additional GCPs were collected from the existing ortho-rectified Landsat images available at Webpage; http://glcf.umiacs.umd.edu/. To avoid discrepancy between existing GIS data and existing ortho-rectified Landsat images, multi-dated Landsat images were downloaded and compared with GIS data especially for road crossing which were found relatively stable. And, the Landsat image which was found having less discrepancy was selected as reference image. The list of those reference images are presented below in Table 71.

Table 70: List of used Reference Landsat Image for GCPs

[147] http://srtm.csi.cgiar.org/SELECTION/inputCoord.asp

	Landsat scene (Path/Row)	Date
1	P192R056	2001/4/4
2	P193R053	2000/12/4
3	P193R054	2000/12/4
4	P193R055	2001/12/7
5	P193R056	2000/2/4
6	P194R052	1999/11/7
7	P194R053	1999/11/7
8	P194R054	2000/5/17
9	P194R055	2002/3/20
10	P194R056	2002/1/15
11	P194R057	2002/1/15
12	P195R052	2001/7/14
13	P195R053	2000/6/9
14	P195R054	2000/2/2
15	P195R055	2000/2/2
16	P195R056	2000/2/2

Ortho-rectification of Satellite Data

The procured ALOS AVNIR-2 satellite images were not rectified. On the other hand, most of Landsat images were rectified; however some scenes had greater level of discrepancy. Similarly, all 3 scenes of DMC were found to be re-rectified in order to locationally match with ALOS AVNIR-2 scenes. Thus, to achieve images with better locational accuracy, ortho-rectification was carried out employing the above compiled SRTM DEM for height source and GCPs from reference datasets.

Ortho-rectification of AVNIR-2: In Erdas Imagine Software, 'ALOS RPC model' was used. In,

a. Is an ALOS AVNIR-2 scene before ortho-rectification; and
b. Is after ortho-rectification.

Ortho-rectification of Landsat: This was carried out using 'Landsat Model' of Erdas Imagine Software. Step by step detail of procedure is included in Manual 1.

Ortho-rectification of DMC: This was carried out with 'Projective Transformation Model' of Erdas Imagine Software.

Cloud and Shadow Removal

After extracting the cloud and shadow area in the ortho-rectified images, such area in the classified images was replaced with the classified result of other dated image. In the ortho-rectified image, cloud and shadow was replaced while creating mosaicked image for whole Ghana.

Converting DN to Radiance and then to TOA Reflectance

The reflectance value of an object is considered as relatively more consistence compared to Digital Number (DN). With this essence, DN value of pixels was converted to Radiance and then to Exoatmospheric (or top-of-atmosphere, TOA) Reflectance prior to start analysis for LU classification. The conversion of DN to radiance and then to TOA Reflectance was carried out using the equation mentioned in "Landsat 7 Science Data Users Handbook-Data Products".

i. **Conversion of DN to Radiance:** The general equation for DN to Radiance is as follows:

$$L\lambda = Grescale * QCAL + Brescale$$

Where,

λL = Spectral Radiance at the sensor's aperture (W/m2/sr/µm)

Grescale = Rescaled gain

QCAL = Digital Number (DN)

Brescale = Rescaled bias

ii. **Conversion of Radiance to TOA Reflectance:** Following equation was used to convert radiance to TOA reflectance:

$$\rho_p = \frac{\pi . L_\lambda . d^2}{ESUN_\lambda . \cos\theta_s}$$

Where,

ρ_p = Unitless planetary reflectance

$L\lambda$ = Spectral radiance at the sensor's aperture

d = Earth-Sun distance in astronomical units from nautical handbook

ESUN λ = Mean solar Exoatmospheric irradiances

θ s= Solar zenith angle in degrees

Analysis

Normalized Difference Vegetation Index (NDVI) was estimated using the following equation,

$$NDVI = \frac{(NIR - Red)}{(NIR + Red)}$$

Where, NIR: Near Infra-Red band and Red: Red band

Included Land Use (LU) Classes for 3 Epochs

With respect to Land Use classes, the following six (6) broad classes were included based on the UNFCCC Good Practice Guide (GPG 2003) and the Guidelines for Agriculture, Land Use and Forestry (GL-AFOLU 2006): 1. Forest Land; 2. Cropland; 3. Grassland; 4. Wetlands; 5. Settlements; and 6. Other Land

These six classes were used as they are:

- Reasonably consistent with the IPCC Guidelines
- Robust as a basis for carbon estimation
- Reasonably mappable by remote sensing methods
- Complete in that all land areas should be represented in one

The definition of these classes is as follows:

1) Forest Land (2000): This includes all land with woody vegetation consistent with thresholds used to define Forest Land in the national greenhouse gas inventory. It also includes systems with a vegetation structure that currently fall below, but in situ could potentially reach the proposed national values used by to define the Forest Land category in Ghana as follows:

- Minimum Mapping Unit (MMU) is 1.0ha
- Minimum crown cover is 15%
- Potential to reach minimum height at maturity (in situ) as 5m

2) Cropland (1000): This includes crop land (currently cropped or in fallow), including rice fields, and agro-forestry systems where the vegetation structure falls below the thresholds used for the Forest Land category. This includes land where over 50% of any defined area is used for agriculture.

3) Grassland (3000, 4000): This includes rangelands and pasture lands that are not considered Cropland. It also includes herbs and brushes that fall below the threshold values used in the Forest Land category such as the other wooded land following the FAO definition in Ghana:

- CC < 15% and > 10%, height > 5m, MMU > 0.5ha
- CC 5% - 10%, height > 5m, MMU > 0.5ha
- Shrubs, bushes and trees CC > 10%, Height < 5m, MMU > 0.5ha

4) Wetlands (7000, 8000): These include areas of peat extraction and land that is covered or saturated by water for all or part of the year (e.g., peat lands) and that does not fall into the forest land, cropland, grassland or settlements categories. It also includes reservoirs as a managed sub-division and natural rivers and lakes as unmanaged sub-divisions.

5) Settlements (5000): These include all developed land, including transportation infrastructure and human settlements of any size, unless they are already included under other categories.

6) Other Land (6000): This category includes bare soil, rock, ice, and all land areas that do not fall into any of the other five categories.

Moreover, as part of dataset preparation for creation of baseline forest resource map, Forest land was divided into two classes based on Crown Cover (CC) threshold; Closed (Dense) forest (> 60%) and Open forest (<60%). Also water body such as river and reservoir was initially separated from other wetlands. Thus, altogether 8 LU classes were considered during classification, which was finally compiled to above 6 LU classes.

Collection of Interpretation Keys

The interpretation keys for some model locations with respect to all included LU classes were collected by conducting the Ground Truthing (GT) survey using the satellite image of 2010 epoch. In all, 5 teams were formed to conduct GT survey covering the entire country, each one comprised of 4 members; a team leader, a data recorder, a labour, and a driver. As part of planning, the possible candidate sites and plan route were selected by displaying the images into computer and overlaying the road network and settlement datasets. During the GT survey, along with collecting the coordinates, existing Land Use class, and others, photo was taken to all 4 directions in order to have better understanding of the LU of surroundings. Altogether, interpretation keys were conducted for about 1,057 sites spreading across the whole country (Figure 16).

Figure 40: Distribution of points for Interpretation Keys

Image Classification

Employing the threshold to NDVI, each image of 2010 epoch was first classified grossly into three groups:

i. Vegetation A (with higher NDVI values),
ii. Vegetation B (with middle range of NDVI), and
iii. Non-vegetation (with lower NDVI values).

Comparison of NDVI values with the displayed ortho-rectified image helped in deciding about the NDVI threshold for each image scene. After dividing the whole scene into above three gross groups, the ortho image was masked and separately run for unsupervised classification (ISODATA Clustering) for 20 classes, which were recoded to the classes in order to get the draft LU result of 2010. During both steps; deciding for NDVI threshold, and recoding for classes, the information of collected interpretation keys was used. Dividing the image into above three groups, helped in getting higher degree of accuracy for Forest land as most of dense forest was generally found included in 'Vegetation A' group. And, conversely 'Non-vegetation' area rarely included Forest land. Majority of Settlements areas were created by manual digitization. The cloud and shadow area was replaced by getting the classified LU result of the alternate dated image. The draft LU classification result of 2000 and 1990 epoch images were carried out adopting the same procedure.

Ground Verification

Considering time and resource constraint, Ground Verification (GV) was carried out on sampled locations. This was further modified by accessibility was impossible. Taking the draft LU classification result of 2010 epoch, GV was carried out for 2,213 locations. The distribution of those locations is presented as blue dots in Figure 17 below. During the GV survey, along with verifying the resulted LU class with the existing one, photo was taken to all 4 directions, similar to as taken during GT survey.

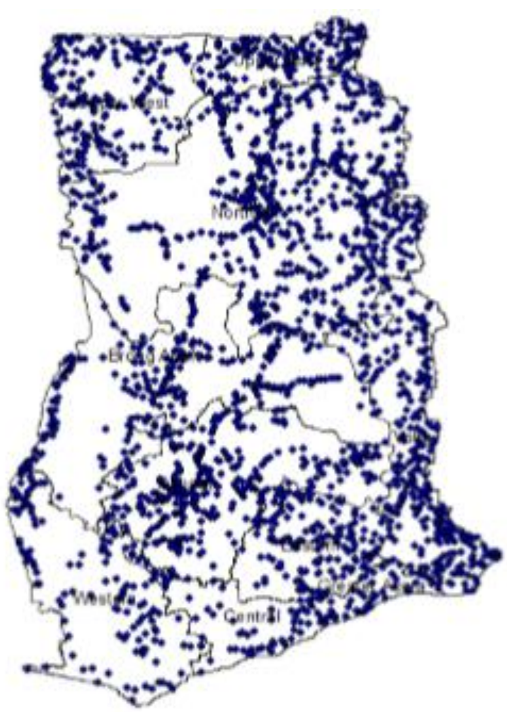

Figure 41: Locations of Conducted Ground Verification Survey

Editing and Finalising the LU Classification

i) Editing Draft LU Classification: Mis-classification errors in the draft LU classified images were grouped into two classes: localized and generalized, depending on their magnitude or level of spread. Isolated errors within a scene were described as local errors while similar error that cut across the repeated locations in the scene were classified under general errors. In order to edit a draft classified LU scene, its corresponding ortho-rectified image and GV point shapefiles, and Google Earth image and field pictures were employed. All these editing were done using Erdas Imagine 2011 Software.

For localized mis-classification errors editing, the Area of Interest (AOI) was delineated covering the area and then it was replaced with the appropriate class. For generalized editing, the preliminary classified result of the scene; that is, the unsupervised classification with 20 classes, was checked and then appropriate class was assigned by recoding for the class representing the mis-classification. This corrected class area was then overlaid on to the previous image result to achieve updated one. Editing was carried out first to 2010 epoch LU result followed that by 2000.

ii) Finalizing the LU Classification: This involved mainly the edge matching among the neighbouring scenes and then mosaicking them to create single dataset. Edge matching was carried out by editing mis-matches at the edges with the neighbourhood scenes by creating AOI and then assigning the matching LU class. During this, the ortho-rectified image was always displayed side by side to assign appropriate LU class. After edge matching the individual edited scenes were mosaicked using the Mosiac Pro tool in Erdas and subsequently subsetted using the boundary of Ghana. Lastly, the resultant LU imagery were recorded to six (6) LU classes.

All epochs (2010 and 2000,) final LU classification map was achieved adopting this procedure. The main challenge was to ensure high quality of the classification result for the base year, 2010. Thus, more time and effort was dedicated in producing the 2010 LU map which was then used as base for producing the 2000 LU maps

Accuracy Assessment of Classification Result

Accuracy Assessment was performed employing the result of above 2,213 GV points distributed throughout Ghana and thus it was carried out only for 2010 LU epoch LU classification result (that is, at spatial resolution 10m). This was performed using the Classifier tool of Erdas Imagine. The procedures involved following steps:

- Clicking the ‘Erdas’ - ‘Supervised’ – ‘Accuracy Assessment’ to display dialog box.
- From the dialog box, the final 2010 classified image was browsed and the viewer with the displayed classified image linked.
- Then, using the “User-defined points” under Edit menu the field verification points was imported displaying its X – Y coordinates in the table.
- For the corresponding point, the classified reference code associated with the Land Use (LU) classes (during image classification) was entered in the “Reference” column.
- The accuracy report was created by clicking ‘Report’ – ‘Accuracy Report’. The generated report was generated as an Error Matrix in form of text file and it had the overall accuracy, user’s and producer’s accuracy,

Table 71: Accuracy Assessment Result of LU Map of 2010

Ref. data / Classified data	Forestland	Cropland	Grassland	Settlements	Wetlands	Other Land	Classified Total	User Accuracy (%)
Forestland	520	48	39	0	0	0	**607**	**85.67**
Cropland	57	493	48	1	0	2	**601**	**82.03**
Grassland	55	44	384	0	0	9	**492**	**78.05**
Settlements	17	13	12	283	1	5	**331**	**85.50**
Wetlands	0	0	1	0	152	0	**153**	**99.35**
Other Land	2	0	3	0	0	24	**29**	**82.76**
Reference Total	**651**	**598**	**487**	**284**	**153**	**40**	**2213**	**-**
Producer Accuracy (%)	**79.88**	**82.44**	**78.85**	**99.65**	**99.35**	**60.00**	**-**	**83.87**

Land Use Change Detection Analysis

From the LU Map of 2 epochs, Land Use Change was carried out to quantify the land cover changes that have taken place, providing information (in the form of change map) on what class changes to what (the from – to conversions information). For this, the LU thematic image of two epochs was pre-requisite in assessing the changes that has taken place within that interval. The Matrix Union tool under thematic toolbar (of Erdas Imagine 2011) was employed in assessing the changes that have taken place within the epochs 2000 – 2010.

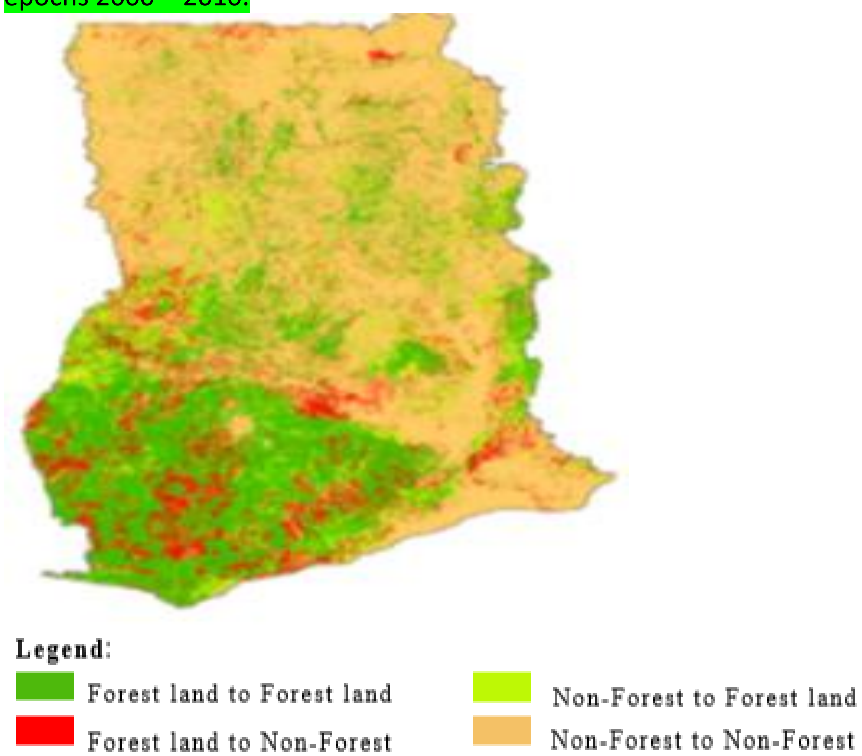

Figure 42: Erdas Imagine 2011

Table 72: Land Use Conversion Matrix 2000 -2010

2010 / 2000	Forest Land	Cropland	Grassland	Settlements	Wetlands	Other Land	Total LU Area in 2000 (Ha)
Forest Land	6,700,952.2	1,233,155.0	927,424.7	20,711.7	12,022.8	17,159.2	**8,911,425.6**
Cropland	812,670.3	1,791,822.5	1,209,277.7	44,173.2	27,978.2	18,649.7	**3,904,571.6**
Grassland	1,655,716.6	2,174,157.3	5,908,042.4	72,840.4	74,491.7	69,092.3	**9,954,340.7**
Settlements	3.6	0.5	1.4	203,838.8	0.0	0.0	**203,844.2**
Other Lands	4,803.8	3,786.8	22,997.3	2,168.6	758,167.7	754.7	**792,678.8**
Wetlands	20,990.2	18,526.5	105,659.0	1,315.6	6,123.5	4,068.2	**156,683.0**
Total LU area in 2010 (Ha)	**9,195,136.6**	**5,221,448.5**	**8,173,402.6**	**345,048.3**	**878,783.9**	**109,724.1**	**23,923,543.9**
Net LU Change (Ha)	***283,711.0***	***1,316,876.9***	***-1,780,938.1***	***141,204.1***	***86,105.1***	***-46,958.9***	

Annex 9: Logging Measurement SOP to Update Logging Emission Factors

Standard Operating Procedures for Estimation of Carbon Stock Damage from Selective Logging in Ghana

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Contents

Introduction and How to Use this Document

The active and important role vegetation and soil play in the global carbon cycle and global climate change is now internationally recognized. Vegetation and soil can act as both a net source and a net sink of greenhouse gas (GHG), depending on how the land is managed. Alterations in land use management techniques that result in changes to net GHG emissions are now a significant component to the regulatory and voluntary actions taking place globally to combat climate change.

The purpose of this document is to provide standard field measurement approaches to assist in quantifying the amount of carbon stored within the various organic pools found within a landscape. The methods presented in each Standard Operating Procedure (SOP) have been developed over time by foresters and ecologists to accurately and efficiently estimate carbon stocks.

The SOPs are grouped by purpose. The first set of SOPs are general and can be used for many field measurement goals. A set of SOPs are also presented on the measurement of all the carbon pools. These can be used to estimate the standing stock of a carbon pool within a stratum. Another set of SOPs are presented to estimate the emissions resulting from selective logging. Various SOPs are also presented on estimating canopy cover. These SOPs should only be used when the purpose of data collection is known.

This manual *does not* specify guidance on stratification, sampling design, sampling intensity, the spatial distribution of sampling points, pool measurement selection, or the methods needed to transform field measurement data into carbon stock estimates. Therefore, additional guidance is required prior to any field data collection.

The SOPs present a *generic* approach that will be appropriate for most land cover types, ecosystems, and locations. However, all the field measurement methods presented in this document may require adaptation for the specific ecosystem, land cover, and vegetation type in the location where sampling will take place.

The SOP manual is also *not specific* to any regulatory or voluntary market standard such as the Clean Development Mechanism (CDM), Climate Action Reserve (CAR), American Carbon Registry (ACR), Verified Carbon Standard (VCS), CarbonFix, or PlanVivo.

Therefore, it is imperative that methods presented here are adapted into a specific SOP manual, developed for a specific field measurement campaign. The particular adaptations required should be conducted by a forester or ecologist with detailed knowledge in field carbon stock measurement and in the particular carbon market regulatory requirements.

In addition, the SOPs should not be conducted without receiving extensive field training in the measurement methods performed by a qualified forester or ecologist.

It is expected that this manual will be updated overtime as the carbon market changes and as terrestrial carbon science evolves. Therefore, it is recommended that prior to use, users visit Winrock

International's website to determine if a more recent version is available at www.winrock.org/ecosystems.

SOP Field safety

No matter what activities are engaged in or where they are carried out, *safety is the first priority* and all precautions must be well thought out in advance and then strictly adhered to. Planned field activities must remain flexible and allow for adjustments in response to on-the-ground assessments of hazards and safety conditions. Accordingly, field personnel must be vigilant and always avoid unnecessary risks. Field crew members in particular must be well prepared. It is recommended that personnel engaging in field activities hold general first aid training and if possible training in CPR.

The following guidelines will apply to all field-based activities:

- Mandatory buddy system. Field crews will include no less than two people who must be directly accompanying each other for the entire duration of field work. Ideally field crews should include a minimum of three people; in case of an accident resulting in injury one person may leave to seek help while another person stays with the injured crew member.
- For each day in the field, specific location and scheduling information must be logged in advance with a point person who can be reached at any time during the anticipated duration of field work. While in the field, crews should check in with their designated point person once per day.
- Each independent crew must carry a radio, satellite phone or cell phone provided by the institution. Crews should make sure to check batteries each time before entering the field.
- Trip planning will include identification of the nearest medical facility and specific directions to reach that facility. When in areas with poisonous snakes, advance communication should be made to verify that appropriate antivenins are available. Where applicable, hunting regulations should be checked with local state agencies prior to field work.
- Personnel will carry personal and institutional insurance cards with them at all times. As well, personnel will carry identification and, if possible, institutional business cards at all times.
- Field crews will carry a first aid kit with them at all times. First aid kits should contain Epinephrin/Adrenalin or an antihistamine for allergic reactions (e.g. bee/wasp stings). Sun block and insect repellent should be carried in the field.
- Where poisonous snakes are common, snake chaps are recommended. In the event of snake bite, the victim should be taken immediately to a medical facility. Conventional "snake bite kits" (e.g. suction cups, razors) have been proven ineffective or even harmful and should not be used.
- Basic field clothing should be appropriate for the range of field conditions likely to be encountered. This will include: sturdy boots with good ankle support or rubber boots, long sleeves and pants, rain gear, and gloves. Blaze orange (vest or hat) is recommended when and where hunting may be taking place. Where necessary, to avoid extended contact with plant oils, ticks, and/or chiggers, a change of clothes should be made at the end of each day in the field and field clothes should not be reworn without first laundering.
- Ensure personnel stay sufficiently hydrated and carry enough clean water for the intended activity. Carry iodine tablets or other water purification tablets in case there is a need to use water from an unpurified source.

- Heightened caution should be given while operating any motor vehicle, particularly on backcountry roads where conditions are unreliable and rights-of-way are often not designated or adhered to. ATVs should always be operated at low speeds (<15 mph).
- Some plots may be too hazardous to sample. Situations include: plot center on a slope too steep to safely collect data (i.e., >100% slope or on a cliff); presence of bees; volcanic activity; illegal activities; etc. When hazardous situations arise, a discussion should be conducted among the team members to assess the situation.

SOP Quality Assurance/Quality Control

Those responsible for aspects of data collection and analysis should be fully trained in all aspects of the field data collection and data analyses. Standard operating procedures should be followed rigidly to ensure accurate measurement and re-measurement. It is highly recommended that a verification document be produced and filed with the field measurement and calculation documents that show that QA/QC steps have been followed.

Quality Assurance

Data collection in field:

During all data collection in the field, the crew member responsible for recording must repeat all measurements called by the crew member conducting the measurement. This is to ensure the measurement call was acknowledged and that proper number is recorded on the data sheet. In addition, all data sheets should include a 'Data recorded by' field with the name of the crew member responsible for recording data. If any confusion exists, the transcribers will know which crew member to contact. After data is collected at each plot and before the crew leaves the plot, the crew leader shall double check to make sure that all data are correctly and completely filled. The crew leader must ensure the data recorded matches with field conditions, for instance, by verifying the number of trees recorded.

Data sheet checks:

At the end of each day all data sheets must be checked by team leaders to ensure that all the relevant information was collected. If for some reason there is some information that seems odd or is missing, mistakes can be corrected the following day. Once this is verified and potential mistakes checked, corrected data sheets shall be handed over to the person responsible for their safe keeping while the crew is still in the field. Data sheets shall be stored in a dry and safe place while in the field. After data sheets have been validated by crew leaders, the data entry process can commence.

Field data collection Hot Checks:

After the training of field crews has been completed, observations of each field crew and each crew member should be made. A lead coordinator shall observe each field crew member during data collection of a field plot to verify measurement processes and correct any errors in techniques. It is recommended that the crew chiefs switch to a different crew to ensure data collection procedures are consistent across all field crews. Any errors or misunderstandings should be explained and corrected. These types of checks should be repeated throughout the field measurement campaign to make sure incorrect measurement techniques have not started to take place.

Data Entry checks:

To ensure that data is entered correctly, the person entering data (whether during fieldwork or after a return to the office) will recheck all of the data entered and compare it with the original hard copy data sheet before entering another sheet. It is advised that field crew leaders either enter the data, or participate in the data entry process. Crew leaders have a good understanding of the field sites visited, and can provide insightful assistance regarding potential unusual situations identified in data sheets.

Communication between all personnel involved in measuring and analyzing data should be used to resolve any apparent anomalies before final analysis of the monitoring data can be completed. If there are any problems with the plot data (that cannot be resolved), the plot should not be used in the analysis.

Quality Control

Field measurement error estimation

A second type of field check is used to quantify the amount of error due to field measurement techniques. To implement this type of check, a complete re-measurement of a number of plots by people other than the original field crews is performed. This auditing crew should be experienced in forest measurement and highly attentive to detail. One gap per concession should be randomly or systematically chosen to be re-measured. Field crews taking measurements should not be aware of which gaps will be re-measured whenever possible.

After re-measurement, data analysis is conducted and biomass estimates are compared with estimates from the original data. Any errors discovered could be expressed as a percentage of all plots that have been rechecked to provide an estimate of the measurement error.

For all the verified plots:

$$\text{Measurement Error (\%)} = \left| \frac{(\text{t C/ha of measured plot} - \text{t C/ha of remeasured plot})}{\text{t C/ha of remeasured plot}} \text{ x } 100 \right|$$

This error level will be included in the carbon stock reporting.

Data Entry quality control check:

After all data has been entered into computer file(s), a random check shall be conducted. Sheets shall be selected randomly for re-checks and compared with data entered. Ten percent of all data sheets shall be checked for consistency and accuracy in data entry. Other techniques such as data sorting and verification of resulting estimates shall be employed to ensure data entered properly corresponds to field sites visited. Personnel experienced in data entry and analysis will be able to identify errors especially oddly large or small numbers. Errors can be reduced if the entered data is reviewed using expert judgment and, if necessary, through comparison with independent data.

Framework for estimation of carbon stock damage from selective logging

Selective logging is the harvesting of a proportion of the trees in a stand or forest. Selective logging may be used to manage even or uneven-aged stands with the goal of protecting forest soils, maintaining or improving wildlife habitat, increasing site productivity, or improving tree species diversity. There will be auxiliary damage to the forest carbon stock during selective logging; from broken branches on remaining trees to the creation of new roads and the clearing of areas for logging decks. The calculation of forest carbon stock damage from selective logging involves the use of several SOPs.

Estimation of carbon stock damage from selective logging involves the following SOPs:

1 LOCATING FELLED TREES
2 CARBON STOCK DAMAGE DUE TO TREE FELLING
3 AREA OF CANOPY OPENING
4 CROWN AREA FROM THE GROUND
5 CARBON STOCK DAMAGE DUE TO LOGGING EXTRACTION

Locating felled trees

Field Equipment:
GPS receiver

Locating felled trees in a dense forest is not always an easy job. It is best to have a person familiar with the logging process in the area to act as a guide. If a guide is not available it is best to start at a logging deck and systematically walk all skid trails radiating out from the logging deck. One systematic method is to use the clockwise method, start with a skid trail at the north or nearest to the northern direction from the center of the logging deck. Next proceed with the next closest skid trail in a clockwise direction. Look for signs of felled trees such as stumps, broken or bent branches in the standing trees, or canopy openings.

Carbon stock damage due to tree felling

Field Equipment:
Flagging
GPS receiver
DBH tapes
DME or other distance measuring equipment
Machete or knife
Permanent marking pen
Compass
Large diameter calipers
Laboratory Equipment:
Drying oven
Laboratory scale

This SOP describes the methodology for estimating the biomass remaining in the forest that has been selectively logged. The concept underlying these methods is based on the “Gain-Loss” method described by the IPCC (2006). Measurements in the “Logging Plots” should be conducted soon after the tree is felled (within approximately 3 months).

Estimating carbon emissions due to selective logging practices consists of an investigative activity, where field technicians must take accurate measurements. Amongst the measurements taken in the field, **DBH** and **dimensions of the removed log** are especially **important**. These measurements must be accurate and reflect the real conditions in the field. It is not always possible to measure DBH because part of the bole where one would measure it (see ‘Measuring Trees’) is removed. Thus, when DBH measurement is not possible, other measurements must be used to extrapolate to DBH.

Measurements on felled tree:

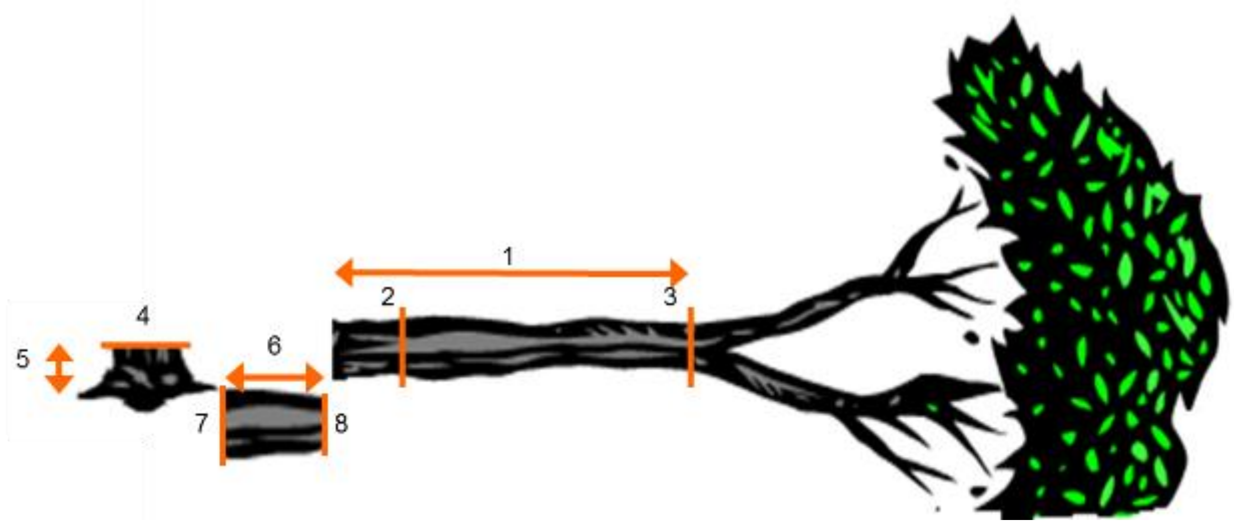
1. Locate stump and crown of logged tree. Be sure to verify that the crown is from the selected stump by determining the angle of the tree fall, species and distance from stump. Search the surrounding area for other potential stumps.
2. Measurements on the stump of the tree (should be taken with calipers):
    a. Measure the height of the remaining stump (H_{Stump}).
        i. If stump is taller than 1.3m and not buttressed, measure DBH.
    b. Measure the diameter (*d*) at the top of the stump (d_S). This measurement is very important as measurement of DBH is often not possible.
        i. If the tree is not buttressed, measure the diameter as in a tree (wrapping the tape around the stump).
        ii. If the tree is buttressed, measure the height of the buttress ($H_{Buttress}$) and the diameter at the top of the buttress, which can be either top of the stump or top of a piece that was cut from bottom of the log. Measure diameter of buttressed tree using a watch and taking three measurements total: 12-to 6, 2 to 8, 4 to 10,where 12 o’clock always points due north when diameter measurement is

horizontal, or upward to the sky when diameter is vertical (i.e. piece lying on the ground). The average of these three measurements will be the diameter of the stump (d_S)

3. If a section(s) of the bole of the tree is cut and left in the forest (i.e. will not be removed), measure the length (l_{Piece}) and the diameters at the bottom ($d_{Piece-B}$) and top of the piece ($d_{Piece-T}$). If piece is buttressed, measure diameter using a watch and taking three measurements total: 12-to 6, 2 to 8, 4 to 10, where 12 o'clock always points due north when diameter measurement is horizontal, or upward to the sky when diameter is vertical (i.e. piece lying on the ground).
4. Measure the diameter at the top cut where the log was removed (d_T).If diameter of top of the tree is irregular, measure diameter using a watch and taking three measurements total: 12-to 6, 2 to 8, 4 to 10, where 12 o'clock always points upward to the sky.
5. Measure the length of the log (l_{Log}). The length of the log is the distance between the edge of the stump and the top cut as shown in figure below. This distance can often be the distance between the top of the piece and the bottom of the crown left in the forest. This measurement is crucial and requires high level of accuracy, even though it may require some judgment.

   Important:

   a. If tree has not yet been removed, field crew must assess location where bole will be cut at the bottom (if lower portion of bole will not be taken as a log) and at the top (at the base of the crown), and then measure this distance, which represents the length of the log. Expert knowledge will be necessary to accurately ascertain where the cuts will occur – this should be attained by having team members who have previously participated in tree harvests.
   b. If tree has moved during or after felling (i.e. slid due to slope, dragged with skidder to facilitate consecutive cuts, etc), field crew must assess the distance it moved (i.e. distance from stump or top of the piece to bottom of the log) to accurately measure the length of the log. The distance the felled tree has moved can be often identified by saw-dust vestiges in the forest floor indicating wood cutting, dragging marks from the bole scrapping the forest floor, dragging markings from skidder or skidder-cable on the forest floor, etc.
6. Measure the avoidable merchantable waste in the main stem after bole branches off, from the top cut to the minimum diameter accepted by the mill. Measure the length (l_{AMW}) and the top diameter of this piece (d_{AMW-T}).



Measurements required in a logging plot.

Where:

1. Length of the log (l_{Log})
2. DBH
3. Diameter at the top cut (d_{Top})
4. Diameter of the stump (D_{Stump}) (and diameter of bottom of the log if no piece present – d_{Bottom})
5. Height of the stump (H_{Stump})
6. Length of the piece (l_{Piece})
7. Diameter of the bottom of the piece ($d_{Piece\text{-}B}$)
8. Diameter of the top of the piece ($d_{Piece\text{-}T}$)(and diameter of bottom of the log – d_{Bottom})

Different scenarios may be faced by field crews when implementing the "Logging Plots". Thus a diagram outlining the different possibilities and providing the appropriate measurements to conduct under such circumstances is provided below.

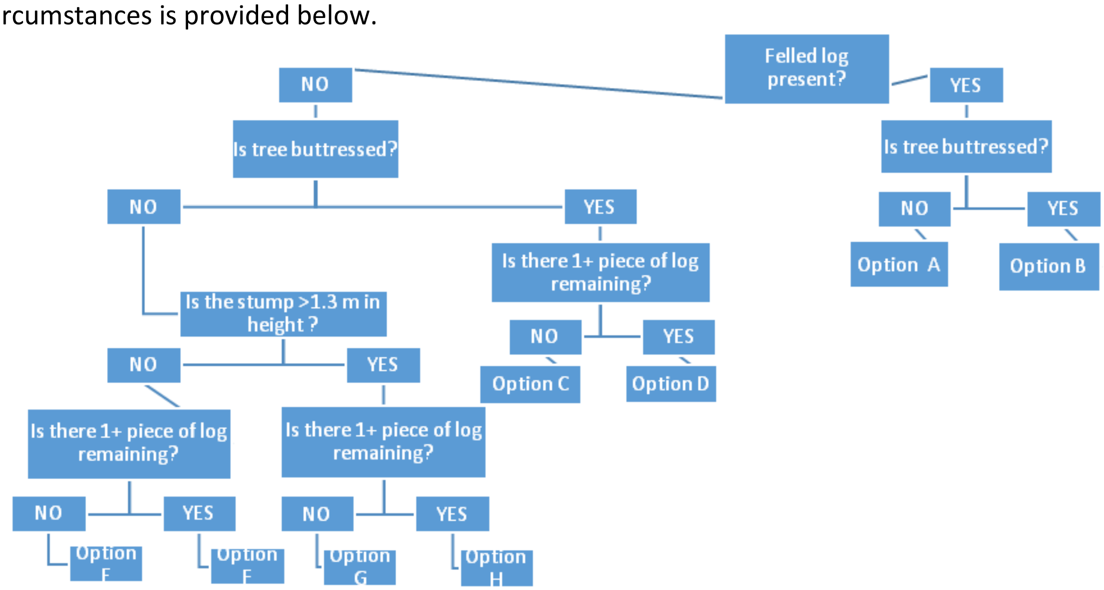


Figure 43: Diagram of different possibilities faced by field crew.

Below are the measurement field crew should take from felled tree under the different circumstances encountered in the field.

Option A

Take measurements: 1, 2, 3, 4, 5,

Option B

Take measurements: 1, 2, 3, 4, 5, and, if possible, measure the height of the buttress ($H_{Buttress}$).

Option C

Take measurements: 1, 4, 5, Also estimate the length of the log (3) and, if possible, measure the height of the buttress ($H_{Buttress}$).

Option D

Take measurements: 1, 4, 5, 6, 7, 8. Also estimate the length of the log (3) and, if possible, measure the height of the buttress ($H_{Buttress}$).

Option E

Take measurements: 1, 4, 5. Also estimate the length of the log (3).

Option F

Take measurements: 1, 4, 5, 6, 7, 8. Also estimate the length of the log (3) and, if possible, measure the DBH (2) in piece of log.

Option G

Take measurements: 1, 2, 4, 5. Also estimate the length of the log (3) and, if possible, measure DBH (2).

Option H

Take measurements: 1, 2, 4, 5, 6, 7, 8. Also estimate the length of the log (3), if possible, measure DBH (2).

Incidental damage measurements:

When a timber tree is felled, it incidentally damages the residual stand in two main ways: 1) by knocking down, uprooting or breaking other trees and 2) breaking off large branches of surviving trees. Measurements of incidental damage should be conducted as follow:

1. Walk along the area where timber tree fell in a clockwise direction starting from the stump, and identify all trees significantly damaged and branches broken off due felling the timber tree.
    a. Measure the DBH (≥10 cm) and note the species of all trees that are either uprooted or are snapped 1m or less above ground. Follow good practices outlined in 'SOP for Measurements of Trees' for measuring DBH. Do not measure any pre-existing dead trees.
        i. Classify the damaged trees into the following classes:
            1. Uprooted, lying on ground (G)
            2. Crown snapped off (S)

        Note: Bent or leaning trees are conservatively assumed to not be dead and will survive.
    b. Measure diameter of all significant braches (base diameter ≥10 cm) that have been damaged by felling the timber tree:

    Note: It is very important that any large branches on the forest floor be clearly identified as originating from a surviving tree and not from an already measured damaged tree to prevent double counting. Efforts must also be taken to ensure branches were snapped during tree fall and do not represent down dead wood predating the harvest. Such branches should be sound, and have evidence of being relatively recently fallen (e.g. presence of leaves, twigs, complete bark, etc.).

Area of canopy opening

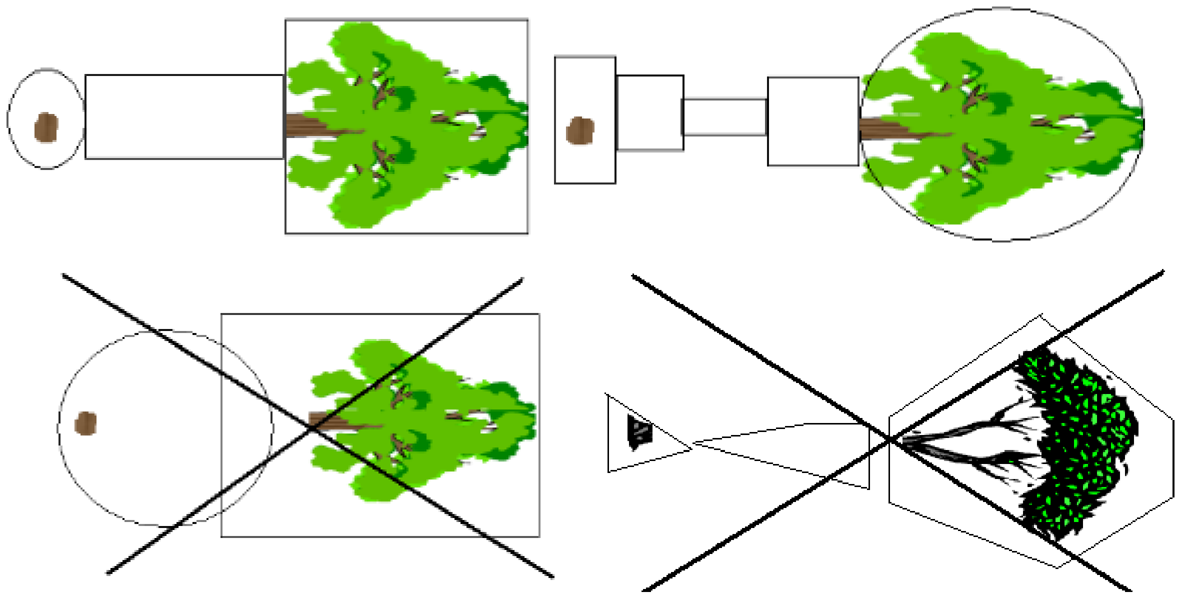
Field Equipment:

GPS receiver

Laser Range Finder

This SOP is used to estimate the area of canopy opening created when a tree is selectively logged in a forest. This method will be most accurate if done relatively soon after the tree is cut. This will most often be done in conjunction with 'SOP Carbon stock damage due to tree felling'.

1. Locate stump and crown of logged tree. Be sure to verify that the crown is from the selected stump by determining the angle of the tree fall, species and distance from stump. Search the surrounding area for other potential stumps.
2. Walk around the entire gap, locating every section of gap formed. Mentally divide the gap into different *non-overlapping* ovals or rectangles. Shapes must either be either: oval, circle, rectangle or square. There must be direct vertical penetration of light to the forest floor to qualify as gap. They cannot be complex shapes unless detailed angles are taken). Draw shapes onto data sheet.
3. Measure and record the length and width or diameter of the appropriate shape. **Remember** – to measure the area of an oval one must measure diameter of major axis *and* minor axis.



Carbon stock damage due to log extraction

Field Equipment:
GPS receiver
Laser Range Finder or Measuring tape

This SOP describes the methods used to estimate the carbon damages from the construction infrastructure used to remove logs out of the forest, such as: skid trails, new haul roads, and logging decks. The methods will be most accurate if done soon after the tree is cut. This will most often be done in conjunction with 'SOP Carbon stock damage due to tree felling'.

Assumptions

In this SOP, skid trail is a pathway travelled by ground skidding equipment while moving trees or logs to a landing. A skid trail differs from a skid road in that the ground surface is mainly untouched by the blades of earth moving machines. A logging deck is the centralized location where logs are gathered, delimbed and cut to length if necessary, and loaded on to log trucks for transport. A road is used by log trucks to take logs from the logging deck and ends at a pre-existing road or highway.

Skid trails:

In areas where skid trails are wide and completely cleared of vegetation:

1. Measure width of all skid trails at various random locations (at least 20 measurements per skid trail)
2. Measure DBH and species of all trees along the side of the skid trails that are clearly damaged (snapped or uprooted) due to skid trails construction.
3. Use tracking feature of the GPS to track entire length of skid trails.
   a. Collect waypoints at beginning and end of skid trail.
4. Calculate the area of skid trails by multiplying the average width by the total length
5. Multiply area of skid trails by carbon stock of stratum where skid trail is constructed. Note: This carbon stock impacted by skid trails is often smaller the total forest carbon stocks as skidder do not kill all trees to haul logs out of the forest, especially the trees with large DBH (e.g. DBH>50cm).
6. Divide result from 4 by cubic volume extracted from the gaps associated with the measured skid trail
7. Average across the skid trails measured in the concession

Skid trail in Guyana

Skid trail in Brazil

In areas where skid trails are narrow paths into the forest with live vegetation on the ground:

1. Measure the DBH and species of all trees clearly damaged (snapped or uprooted) due to skid trails construction.
2. Use tracking feature of the GPS to track entire length of skid trails.
   a. Collect waypoints at beginning and end of skid trail.
3. Divide result from 2 by cubic volume extracted from the gaps associated with the given skid trail.
4. Average across the skid trails measured in the concession

<u>Logging decks:</u>

1. Measure at least 20 logging decks per concession by breaking down the area of the logging deck into simple geometric shapes (square, rectangle or circle). Draw sketch of the shape of entire logging deck in datasheet. Measure the sides/diameters of all shapes imagined, and record measurements in respective place (i.e. aside of drawn geometric shape) on the datasheet.
2. Multiply area of deck by carbon stock of stratum where deck is constructed.


Logging deck in Guyana

Roads

To calculate the impact of logging roads aerial imagery can be used to correlate area of roads with a measured stock for unlogged forest per unit area. If aerial imagery is not available:

1. Measure width of all haul roads at various random locations
2. If length of haul roads are not reported. Use tracking feature of the GPS to track entire length of roads. Otherwise, use reported length of logging roads.
    a. Collect waypoints at beginning and end of haul road.
3. Calculate the area of roads by multiplying the average width by the total length.
4. Multiply area of road by the carbon stock of stratum where road is constructed.
5. Divide result from 4 by cubic volume extracted in the area where the roads are found for that year.


Logging road in Guyana

TIMBER TREE MEASUREMENTS Date________________________
Plot ID #:___________________Location: _________________ Coordinate System:
Crew chief: ___________________ Data recorded by: ___________________ # people in crew: __________
Start Time: _________________End time: __________________Total Time: _____________minutes
Camera Number: ______________ Photo Number(s):________________
Forest type
Additional notes describing plot area:

Timber Tree 1
Species: _______________ GPS Accuracy: _____ (m)
GPS Coordinarte: E: ____________N: ____________

Timber Tree 2
Species: _________________ GPS Accuracy: _____ (m)
GPS Coordinarte: E: ____________N: ____________

	Tree Buttressed:	☐ Yes ☐ Not				Tree Buttressed:	☐ Yes ☐ Not	
	Height of the buttress ($H_{Buttress}$)	______	(cm)			Height of the buttress ($H_{Buttress}$)	______	(cm)
	Diameter of stump top (d_S):	______	(cm)			Diameter of stump top (d_S):	______	(cm)
	Height of the stump (H_S):	______	(cm)			Height of the stump (H_S):	______	(cm)
	DBH(dbh):	______	(cm)			DBH(dbh):	______	(cm)
Log Section 1:	diam. bottom ($d_{Piece-B}$):	______	(cm)		Log Section1:	diam. bottom ($d_{Piece-B}$):	______	(cm)
	diam. top($d_{Piece-T}$):	______	(cm)			diam. top($d_{Piece-T}$):	______	(cm)
	length (l_{Piece}):	______	(cm)			length (l_{Piece}):	______	(cm)
Log Section 2:	diam. bottom ($d_{Piece-B}$):	______	(cm)		Log Section 2:	diam. bottom ($d_{Piece-B}$):	______	(cm)
	diam. top($d_{Piece-T}$):	______	(cm)			diam. top($d_{Piece-T}$):	______	(cm)
	length (l_{Piece}):	______	(cm)			length (l_{Piece}):	______	(cm)
	Length of Log (l_{Log}):	______	(m)			Length of Log (l_{Log}):	______	(m)
	Log:	☐ Present ☐ Absent				Log:	☐ Present ☐ Absent	
	Diameter at top cut (d_T):	______	(cm)			Diameter at top cut (d_T):	______	(cm)
	Length of avoid. merchant waste (l_{AMW})	______	(m)			Length of avoid. merchant waste (l_{AMW})	______	(m)
	Diam. top of avoid. merchant waste(d_{AMW-T})	______				Diam. top of avoid. merchant waste(d_{AMW-T})	______	

Sketch of Canopy Gap: Canopy Opening Dimensions: ______________________________

DAMAGED TREES MEASUREMENTS

Damage type: (S) snapped, (U) uprooted, or (B) branch (if larger than 10 cm in diameter)

Species	DBH	Type	Species	DBH	Type	Species	DBH	Type	Branches	D1	D2	Length

SKID TRAIL DATA SHEET

Skid Trail ID: _________________ Location: _________________ Date: ______/_______/_______

Crew Chief: _________________ Coordinate System:

Skid Trail Widths: (m)

Fatally Damaged trees: (S) snapped, (U) uprooted

Species	DBH	Type	Species	DBH	Type	Species	DBH	Type	Species	DBH	Type

Skid Trail ID: _________________ Location: _________________ Date: ______/_______/_______

Crew Chief: _________________ Coordinate System:

Skid Trail Widths: (m)

Fatally Damaged trees: (S) snapped, (U) uprooted

Species	DBH	Type	Species	DBH	Type	Species	DBH	Type	Species	DBH	Type

Skid Trail ID: _________________ Location: _________________ Date: ______/_______/_______

Crew Chief: _________________ Coordinate System:

Skid Trail Widths: (m)

Fatally Damaged trees: (S) snapped, (U) uprooted

Species	**DBH**	**Type**	**Species**	**DBH**	**Type**	**Species**	**DBH**	**Type**	**Species**	**DBH**	**Type**

LOGGINGDECK DATA SHEET

Date: _________/________/_________

Logging Deck ID: ________________________ Location: ______________________

Polygon ID: _______________ (Using polygon feature of GPS) **OR**

Coordinate. System: GPS Waypoint E: _________________ N:_________________

Logging Deck Dimensions: ______________________Sketch of Logging Deck:

Logging Deck ID: ________________________ Location: ______________________

Polygon ID: _______________ (Using polygon feature of GPS) **OR**

Coordinate. System: GPS Waypoint E: _________________ N:_________________

Logging Deck Dimensions: ______________________Sketch of Logging Deck:

Logging Deck ID: ________________________ Location: ______________________

Polygon ID: _______________ (Using polygon feature of GPS) **OR**

Coordinate. System: GPS Waypoint E: _________________ N:_________________

Logging Deck Dimensions: ______________________Sketch of Logging Deck:

Logging Deck ID: ________________________ Location: ______________________

Polygon ID: _______________ (Using polygon feature of GPS) **OR**

Coordinate. System: **WGS84** GPS Waypoint E: _________________ N: __________________

Logging Deck Dimensions: ______________________Sketch of Logging Deck:

Logging Deck ID: ________________________ Location: ______________________

Polygon ID: _______________ (Using polygon feature of GPS) **OR**

Coordinate. System: GPS Waypoint E: _________________ N:_________________

Logging Deck Dimensions: ______________________Sketch of Logging Deck:

ROAD DATA SHEET

Road Track ID: _________________Location: _________________ Date: _____/_____/________
Road Type: ___________________Crew Chief: ___________________Coordinate System:
Road Width: (m)

Road Track ID: _________________Location: _________________ Date: _____/_____/________
Road Type: ___________________Crew Chief: ___________________ Coordinate System:
Road Width: (m)

Road Track ID: _________________Location: _________________ Date: _____/_____/________
Road Type: ___________________Crew Chief: ___________________ Coordinate System:
Road Width: (m)

Annex 10: Proposals for Stepwise Improvements

Deforestation

Activity data for deforestation will continue to be updated biannually to comply with UNFCCC-recommended reporting norms. Land cover maps will continue to rely on Landsat imagery, although future maps will use Landsat 8 imagery rather than Landsat 7. Images from other sources will be considered, especially radar-derived products such as PALSAR that avoid the issue of cloud cover, which is a common problem in Ghana. Pre-processing and classification will be standardized in the future to ensure greater compatibility between maps for more accurate change detection, and a standard country mask will be used to ensure accurate mapping along Ghana's borders. Research will be conducted on post-deforestation carbon stocks within Ghana to replace the literature-based stocks used in this reference level. This will allow for more accurate emission factors by better quantifying the growth of non-forest land cover types after deforestation events.

Carbon Stock Enhancement

A centralized, comprehensive database of carbon stock enhancements undertaken under the NFPDP would represent a stepwise improvement of measurement and monitoring for this activity. The database would maintain the following data carbon stock enhancement activities needed for accurate measuring and monitoring of this REDD+ activity under the ER programme:

- **Spatial data on annual area planted under NFPDP funding**. This would include shapefiles of planted area so
- **Verified area planted**
- **Species composition**
- **Estimates plantation survival rates**:
  - Data collected in field surveys to verify area planted and estimate survival rate (within the year planting occurred)
  - Ongoing performance of planted area through assessment of a sample of all on-reserve planted areas within the GCFRP ACCOUNTING AREA using Google Earth

Timber Harvesting

Legal Timber Harvesting

The main improvement necessary for legal timber harvest is to improve the logging infrastructure factor (LIF) estimate. This can be done by correlating the measurements taken in the fieldwork undertaken in May 2016 by the Forestry Commission with timber extracted for those specific location.

Illegal Timber Harvesting

Given the nature of this activity, it is difficult to gather comprehensive estimate of total timber extracted from illegal practices. However, it will be important to develop a systematic approach to assess the impact of this activity on the ER-Programmes' total emissions.

The AD used for the RL provides an estimate of timber volume for the year 2009 based on the methodology used by Hansen et al. 2012. While this estimate provides a useful proxy for the RL, the study has not been replicated to date.

The Forestry Commission has begun gathering data on illegal logged timber based on what rangers at the district level confiscate from illegal loggers. These data exist for 2013-2015 and so could be a source of data for monitoring illegal timber harvesting in the future. However, it should be noted that these data are based on what rangers are able to confiscate on forest reserves, thus represent only a portion of the actual illegally logged timber. Furthermore, at this stage, it is understood that these data remain incomplete, even within the forestry reserves.

Under the ER-Programme incentives should be provided to rangers and other stakeholders in the GCFRP ACCOUNTING AREA to encourage a significant increase in monitoring at the scale of HIAs, using the reporting methods developed by RMSC. These data can be aggregated at the FSD's District Manager level and reported back to RMSC.

The other option is to follow the methods outlined in Hansen et al 2012 and conduct a similar study, systematically to establish estimate every two years.

Woodfuel Collection

While the analysis of emissions from historic woodfuel collection generated for the development of the GCFRP ACCOUNTING AREA reference level represents what can be considered an IPCC Tier 2 approach (see Bailis et al. 2015[148]), there are opportunities for stepwise improvements to the emission estimates by integrating more spatially explicit or country-specific data inputs to the WISDOM model. Furthermore, the emissions estimated for the RL represent those for the year 2009, and thus updated data to apply to the WISDOM model will be necessary for tracking emissions during the MRV period.

The following suggestions for updating and improving WISDOM estimates for Ghana were developed in association with Rudi Drigo, the co-author of the WISDOM model. Stepwise improvements could be made both in the data applied to the WISDOM model, along with the development of in-country capacity for applying the model. Updates to estimated emissions from woodfuel use would be necessary for monitoring emissions from this activity under the ER-Programme for the GCFRP ACCOUNTING AREA, but would also likely be important if Ghana were to expand its REDD+ programme to the national level, given emissions from this activity are assumed to be more significant outside the GCFRP ACCOUNTING AREA.

The WISDOM model can be tailored to fit Ghana's needs in terms of geographic scope (ecoszones such as the GCFRP ACCOUNTING AREA or appropriate subdivisions within the ecozones), and consists of modules on demand, supply, integration and woodshed analysis. Each module requires different competencies and data sources and its contents are determined by the data available or, to a limited extent, by the data purposively collected to fill critical data gaps. Information of relevance to wood energy comes from multiple sources, ranging from census data to local pilot studies or survey data.

Demand:

Woodfuel demand is largely a function of population and population density, infrastructure, household energy supply needs, and access to woodsheds.As such, t*he following sources of data can support the estimation of woodfuel demand specifically for Ghana and its ecozones:*

- *Population census*
- *Spatial data on infrastructure (e.g., roads, gas pipelines)*
- *Topography*
- *Surveys of household energy needs and use*

Supply:

Woodfuel supply is a measure of both the existing biomass in woodsheds as well as their productivity. Productivity is an important consideration as it accounts for the ability of biomass stocks to regenerate once harvested for woodfuel use).

The following sources can contribute to the estimation of woodfuel supply in Ghana:

- Biomass Stocks (stocks could be tailored to match FPP data)
- Productivity (mean annual increment)

Integration

[148] http://www.nature.com/nclimate/journal/v5/n3/full/nclimate2491.html?message-global=remove

Use of spatial data to estimate the demand and supply balance of woodfuel, specific to the desired spatial resolution. This will identify areas of deficit, surplus, and can help plan for future scenarios.

Woodshed analysis

The analysis for the delineation of woodsheds in Ghana, i.e. supply zones of specific consumption sites requires additional analytical steps that may be summarized as:

- Mapping of potential “commercial” woodfuel supplies suitable for urban, peri-urban and rural markets.
- Definition of woodsheds, or woodfuel harvesting areas, based on the level of commercial and non-commercial demand, woodfuels production potentials and physical/economic accessibility parameters. Estimation of harvesting sustainability, of woodfuel-related fNRB values at subnational level and of woodfuel induce forest degradation rates.

Forest fire

Although the MODIS burned area product will continue to be used in the short term, more accurate, higher-resolution alternative activity data sources will be researched for long term use. These could include a Landsat-based burned area product or higher-resolution data sources. This higher-resolution option would allow for more accurate detection of small degradation fires that likely go undetected by MODIS. Research will be performed to calibrate such burned area products to Ghana specifically instead of using global algorithms.

Research will also be conducted to provide more accurate, ecozone-level combustion factors to improve the emissions estimations from fire.

Annex 11: Estimates for Woodfuel Emissions by District

(Estimates are for the year 2009, but were extrapolated over the entire reference period.)

State	District	Non-renewable biomass	With Expansion Factor (1.32)	Emissions t CO2/yr
Ashanti	Adansi North	11025.76	14554.00	26,682
Ashanti	Adansi South	13931.45	18389.52	33,714
Ashanti	Ahafo Ano North	5435.39	7174.71	13,154
Ashanti	Ahafo Ano South	9795.94	12930.64	23,706
Ashanti	Amansie Central	10528.10	13897.10	25,478
Ashanti	Amansie East	6451.26	8515.67	15,612
Ashanti	Amansie West	8503.48	11224.59	20,578
Ashanti	Asante Akim South	6891.82	9097.20	16,678
Ashanti	Atwima Mponua	12807.44	16905.83	30,994
Ashanti	Atwima	8778.02	11586.98	21,243
Ashanti	Bosomtwe-Kwanwoma	9926.70	13103.24	24,023
Ashanti	Ejisu-Juabeng	9823.47	12966.98	23,773
Ashanti	Kumasi	72803.48	96100.59	176,184
Ashanti	Kwabre	23744.18	31342.31	57,461
Ashanti	Obuasi Municipal	5502.98	7263.93	13,317
Brong Ahafo	Asunafo North	3023.61	3991.16	7,317
Brong Ahafo	Asunafo South	2259.28	2982.24	5,467
Brong Ahafo	Asutifi	2896.93	3823.95	7,011
Brong Ahafo	Dormaa	5123.32	6762.78	12,398
Brong Ahafo	Tano North	1837.72	2425.79	4,447
Central	Asikuma Odoben Brakwa	6190.06	8170.88	14,980
Central	Assin North	6595.68	8706.30	15,962
Central	Assin South	7259.09	9582.00	17,567
Central	Lower Denkyira	9560.66	12620.07	23,137
Central	Upper Denkyira	6506.14	8588.10	15,745
Eastern	Atiwa	5501.38	7261.82	13,313
Eastern	Birim North	8343.08	11012.86	20,190
Eastern	Birim South	11585.25	15292.54	28,036
Eastern	East Akim	5623.79	7423.41	13,610
Eastern	Fanteakwa	5478.67	7231.84	13,258
Eastern	Kwabibirem	10795.99	14250.71	26,126
Eastern	Kwahu West	2597.61	3428.85	6,286
Eastern	West Akim	9264.63	12229.32	22,420
Western	Ahanta West	3483.03	4597.61	8,429
Western	Aowin-Suaman	4666.98	6160.41	11,294
Western	Bia	3336.68	4404.42	8,075
Western	Bibiani Anhwiaso Bekwai	3289.88	4342.64	7,962
Western	Jomoro	3900.48	5148.64	9,439

Western	Juabeso	4523.94	5971.60	10,948
Western	Mpohor Wassa East	6185.96	8165.46	14,970
Western	Nzema East	5617.29	7414.82	13,594
Western	Sefwi Wiawso	5913.20	7805.42	14,310
Western	Wasa Amenfi East	2572.61	3395.85	6,226
Western	Wasa Amenfi West	5363.01	7079.17	12,978
Western	Wassa West	7736.48	10212.15	18,722
TOTAL				**926,816**

Annex 12: Capacity Building

This annex includes capacity building conducted and planned to support the Forestry Commission in the assessment of emissions for the development of a reference level and MRV system.

Technical field training on estimating carbon emissions from selective logging.
Training Participants: RMSC, FSD, CCU and IUCN.
Training lead by AGS with support from Winrock
Resource Management Support Centre of the Forestry Commission, Kumasi April 2015
The objective of this training is to support the Ghana Forestry Commission in the measurements and data analysis necessary to estimate emissions from forest degradation and provide guidance on estimating historic emissions and reference level development.
Winrock conducted a training that focuses on estimating emissions from timber harvesting, while providing guidance on other sources of degradation. Winrock has designed an innovative, participatory and field based training programme on estimating emissions from selective logging.
The objectives of this training were to strengthen the capacity of the Ghana Forestry Commissions in the following topics:

- Field methods for estimating the carbon impacts of selective logging activities
- Overview of forest stratification
- Overview of geospatial data acquisition
- In class training on the development of emission factor from selective logging
- In class training on the Forest Carbon Partnership Facility (FCPF) REDD+ Decision Support Tool. Available here: http://redd-dst.ags.io/
- Working with Ghana to determine likely impacts of illegal timber harvesting and if necessary sampling methods to allow an extrapolation from legal logging totals to illegal logging totals

Two scientists from Winrock lead this training: Alexandre Grais and Gabriel Sidman, from April 13-17. The sections below outline the training agenda and provide some supporting information on the field measurements and class room training programme.

Training Agenda

Time	ACTIVITES	LOCATION
	Sunday, April 12	
	Winrock experts arrive in Accra	**Accra**
	Monday, April 13	
7h00 – 12h00	Travel to Kumasi	
1h00 – 1h45	Opening of the training (Mr. Bamfo)	Class room at Resource Management Support Centre of the Forestry Commission in Kumasi
1h45-2h00	Introductions, overview of training goals and objectives	
2h00 – 3h00	Hands on training on FCPF REDD+ DST, available here: http://redd-dst.ags.io/ and overview of the carbon impacts from selective logging and significance of fire and fuel wood in Ghana	
3h00 – 3h15	Coffee Break	
3h15 – 5h00	Overview of estimating annual emissions and Reference Level (SOP 011/SOP 001)	
	Tuesday, April 14	
8h30-9h30	Introduction to use of geospatial data for REDD+	Class room at Resource Management Support
9h30 – 10h30	Overview of Acquisition of RS Data and Generation of Spatial Activity Data (SOP 003)	

10h30-10h45	Coffee Break	Centre of the Forestry Commission in Kumasi
10h45-12h00	Stratification (SOP 003) Identifying natural forest vs cocoa plantation	
12h00-1h00	Lunch	
1h00-1h45	Activity Data for deforestation (SOP001)	
1h45-2h30	Emission Factors for deforestation (SOP001)	
2h30 – 3h00	Combining Emission factors and activity data to get historical emissions (SOP001)	
3h00 – 3h15	Coffee Break	
3h00 – 4h00	Overview of the carbon impacts from selective logging and discussion of significance of illegal logging in Ghana (SOP 008)	
4h00 – 5h00	Overview of Quality Assurance/Quality Control (QA/QC) methods for estimating carbon impacts from selective logging	
Wednesday, April 15		
5h00 – 8h30	Travel to logging plots in Asenayo Forest Reserve	**Asenayo Forest Reserve in the Nkawie Forest District Logging concession, field training**
8h030– 12h00	Establishment of logging plots in recently logged forest – first two plots will be demonstration with full team. For subsequent plots, we will split into two teams. Each plot should take roughly 30 min. Depending on distance between logging plots, we can cover 2 to 3 plots per hour.	
12h00-12h30	Lunch in the field	
12h30 – 5h00	Establishment of logging plots in recently logged forest. In the afternoon. Participants will lead measurements with oversight by Winrock trainers.	
5h00 – 7h00	Travel back to Kumasi	
Thursday, April 16		
08h30-10h00	Recap of measurements taken in the field Overview of calculations to estimate emissions from selective logging	Class room at Resource Management Support Centre of the Forestry Commission in Kumasi
10h00-10h15	Coffee Break	
10h15-12h00	Introduction and Hands-on training on data entry and analysis for estimation of carbon impacts from selective logging, QA/QC protocols,and calculation of field measurement error. Focus on extracted log emissions (ELE) (SOP 008)	
12h00-1h00	Lunch	
1h00-3h00	Discussion of and presentation on remote sensing analysis of logging infrastructure (SOP 008/SOP 003)	
3h00-3h15	Coffee Break	
3h15-5h00	Hands-on training on data entry and analysis for estimation of carbon impacts from selective logging, QA/QC protocols,and calculation of field measurement error Focus on logging infrastructure factor (LIF) (SOP 008)	
Friday, April 17		
08h30-10h00	Hands-on training on data entry and analysis for estimation of carbon impacts from selective logging, QA/QC protocols,and calculation of field measurement error Focus on logging damage factor (LDF) (SOP 008)	Class room at Resource Management Support Centre of the Forestry Commission in Kumasi
10h00-10h15	**Coffee Break**	
10h15-12h00	Discussion and development of sampling scheme for incorporation of illegal logging (SOP 004/008)	
12h-1h00	**Lunch**	
1h00-3h45	Combining logging factors with activity data to estimate emissions from logging (SOP 008/SOP001)	

3h45-4h00	Coffee Break	
4h00-5h00	Training Summary, final question and answer summary and training wrap up	
<u>Saturday, April 18 and Sunday April 19, 2014</u>		
Travel back to Accra		Accra

General Description

The change in carbon stocks between “before-logging” and “after-logging” scenarios is a result of the extraction of timber, the damage caused to residual trees as a result the logging activities, and the removal of trees due to the construction of roads, skid trails and logging decks.

Measurements will take place in logged blocks. If possible, the logged areas should be those that have been harvested recently (i.e., within the past few months) or, more preferably, those that are actively being harvested during the time of the site visit so that cut logs are still on site. <u>Non-destructive</u> measurements to be conducted in each logging gap will include:

- Measurements on the stump and crown of the harvested tree;
- Measurements of any pieces of the bole left behind on the forest floor;
- Measurements of the felled timber tree (if still on site);
- Measurements of any trees severely damaged as a result of logging operations;
- Measurements of the size of the canopy opening (gap);
- Dimensions of roads and skid trails;
- Area of any land-based logging decks

Relationships are then created between harvested volumes and:

- Emissions from felled tree and trees damaged during tree felling;
- Area and hence emissions from infrastructure for timber extraction;
- Legal and illegal timber.

Training on improved land cover mapping in Ghana for emissions from deforestation and degradation from fire - Identification of cocoa, oil palm & rubber plantations. Training on identifying degradation from fire.

Training Participants: GIS and remote sensing specialists.
Training lead by AGS with support from Winrock
RMSC Geospatial Lab, Kumasi July 11-13 2016

Day 1: Workshop. A series of presentations and discussion sessions regarding land cover mapping in Ghana with a broad FC stakeholder audience

9:00 AM –Opening remarks and introductions– CCU, Winrock

9:30 AM – Overview of Ghana’s National Forest Monitoring System and links with Carbon Fund and UNFCCC –Winrock

10:00 AM – Introduction to mapping tree crops and plantations with remote sensing – AGS*[Introduce some technical concepts and issues, but keep at a relatively high level for a general audience]*

Includes Why map tree crops and plantations? Benefits and challenges

11:00 AM – BREAK

11:15 AM – Strata used and emission factors associated with tree crops and plantations – Winrock

12:30 PM – LUNCH BREAK

1:15 PM – Steve and AGS team installs and tests any additional software

2:15 PM – Training begins in lab. Introductions
2:45 AM - Acquiring and preprocessing optical and radar remote sensing data[includes review of required data sets; introduction to websites for downloading data sets; conversion to reflectance and backscatter; cloud screening; quality assessment.]
4:45 PM – Questions and Discussion regarding acquiring and preprocessing
5:00 PM – END MEETING

Day 2: Training.

8:00 AM – Adjustments to software systems in lab, if necessary
9:30 AM – Review the collection and processing of field observations and digitizing using Google Earth Pro [includes requirements for sampling; screening for consistency and bad data; converting data into csv table format for use with RS observations]
11:00 AM – BREAK
11:15 AM – Introduction to supervised classification techniques using decision trees and random forest classifiers (GARSeCT)
12:30 PM – LUNCH BREAK
1:30 PM – Resume supervised classification techniques using decision trees and random forest classifiers
3:00 PM – BREAK
3:30 PM –Validation, revision, and uncertainty assessment
5:00 PM – END OF TRAINING DAY

Day 3: Training.

8:00 AM – Adjustments to software systems in lab, if necessary
9:00 AM –Work through an example from start to finish
10:30 AM – BREAK
10:45 AM – Continue working through example
12:00 PM – LUNCH BREAK
1:00 PM - Discussion/questions on AGS approach
1:30 PM – Introduction to using MODIS to identify forest degradation from fire. – Winrock
1:30 PM – Hands on exercise using GCFRP ACCOUNTING AREA layers to identify area of fire in GCFRP ACCOUNTING AREA for 2000, 2010 2012 and 2015, including differentiating between
3:00 PM – BREAK
3:15 PM – Hands on exercise continued to match with RL analysis
4:30 PM – Round table discussion on developing step by step SOPs to ensure quality control of data entry in the future and development of SOP outline.
5:30 PM – END OF TRAINING DAY

Training on reference level/MRV tool.

Training Participants: CCU, RMSC, FSD.

Training lead by Winrock

Resource Management Support Centre of the Forestry Commission in Kumasi, July 14-16, 2016

Day 1: Introduction to RL/MRV and deforestation emission estimates.

8:00 AM – Training overview and goals introduction. CCU and Winrock
8:30 AM – Overview of Ghana's National Forest Monitoring System and links with Carbon Fund and UNFCCC - This initial presentation will be designed to give participants an overview of the UNFCCC and Carbon Fund context for a REDD+ mechanism and an overview of in the inputs for the GCFRP ACCOUNTING AREA RL, key decisions made and an overview of which institutions will be responsible for which aspects of the MRV and what their roles will be. The purpose is to prepare participants for the presentation of more technical information, and to define key concepts and technical terms that will be used throughout the workshop
10:30 AM – BREAK

10:45 AM – Presentation on the data used and assumptions made to calculate emissions from deforestation for the GCFRP Accounting Area. Explanation of EF and AD calculations
12:00 PM – LUNCH BREAK
1:00 PM – Overview of the deforestation component of the reference level and MRV tool
1:30 PM - Hands on exercise using actual data to estimate emissions from deforestation for the reference level and for the monitoring period using excel based tool
3:00 PM – BREAK
3:15 PM – Hands on exercise continued to match with RL analysis
4:00 PM – Round table discussion on developing step by step SOPs to ensure quality control of data entry in the future and development of SOP outline.
5:00 PM – END OF TRAINING DAY

Day 2: Training. Degradation estimates.

8:00 AM – Overview of the different components of forest degradation included in the RL
8:30 AM – Presentation on the data used and assumptions made to calculate emissions from degradation from timber harvest (legal and illegal) for the GCFRP Accounting Area. Explanation of EF and AD calculations
10:00 AM – Overview of the legal and illegal timber harvest component of the reference level and MRV tool
10:30 AM – BREAK
10:45 AM – Hands on exercise using actual data to estimate emissions for degradation from timber harvest for the reference level and for the monitoring period using excel based tool
12:00 PM – LUNCH BREAK
1:00 PM - Presentation on degradation from fire and the data used and the assumptions made to estimate emissions
2:30 PM – Hands on exercise using actual data to estimate emissions for degradation from timber harvest for the reference level and for the monitoring period using excel based tool
3:00 PM – BREAK
3:15 PM – Hands on exercise continued to match with RL analysis
4:00 PM – Round table discussion on developing step by step SOPs to ensure quality control of data entry in the future and development of SOP outline.
5:00 PM – END OF TRAINING DAY

Day 3: Training. Enhancement of forest carbon stocks and degradation from fuelwood.

8:00 AM – Presentation on the data used and assumptions made to calculate removals from forest carbon stock enhancements for the GCFRP Accounting Area. Explanation of removal factors and AD calculations
10:00 AM – Overview of the enhancement component of the reference level and MRV tool
10:30 AM – BREAK
10:45 AM – Hands on exercise using actual data to estimate emissions for degradation from timber harvest for the reference level and for the monitoring period using excel based tool
12:00 PM – LUNCH BREAK
1:00 PM - Presentation on the WISDOM model used to estimate emissions from forest degradation from fuel wood.
2:00 PM – Discussion on data inputs needed for WISDOM model and use in MRV
3:00 PM – BREAK
3:15 PM – Round table discussion on developing step by step SOPs to ensure quality control of data entry in the future and development of SOP outline.
4:30 PM – Distribution of certificates of completion
5:00 PM – END OF TRAINING DA