Forest Carbon Partnership Facility (FCPF)

Carbon Fund

Emission Reductions Program Document (ER-PD)

Emission Reductions Program in Sangha and Likouala, Republic of Congo

Date of Submission of the advanced draft ER-PD: October 27, 2016

Executive Summary

Snapshot

Program Goal:	To implement the Republic of Congo's low-carbon development vision by demonstrating the feasibility of alternative development approaches at scale to reduce greenhouse gas emissions, enhance sustainable landscape management, improve and diversify local livelihoods, and conserve biodiversity.
Jurisdiction:	Sangha and Likouala Departments
Total Area:	12.4 million ha
Forest Area:	11.7 million ha (94%)
Duration:	The program has a long-term perspective of 20 years with an ERPA period of 5 years (2017 – 2022)
CO_2 Reductions:	11,093,204 million tCO_2 through 2022
Budget:	US$114 million in up-front investment finance and a potential of results-based payments for 11,093,204 million tCO2 over 5 years

Context and Ambition

The Republic of Congo is home to 22.4 million hectares of the Congo Basin forest, the world's second-largest swath of tropical rainforest. With a low historical rate of deforestation—0.052% per annum between 2000 and 2012—and forests covering 69% of the land area, it is a typical example of a High Forest Cover and Low Deforestation (HLFD) country. Keeping deforestation rates low in HFLD countries is one of the main strategies in the forest and land use sector to deliver on the Paris Agreement's goals to limit temperature increase to well below 2°C and to pursue efforts to limit increase to 1.5°C above pre-industrial levels.

The Government has demonstrated its commitment to a low-carbon development agenda including the land use sector by pursuing REDD+ since 2008. It submitted its Emission Reductions Program Idea Note (ER-PIN) in 2012, and is now submitting its advanced draft Emission Reductions Program Document (ER-PD) after an 18-months design period. The large-scale jurisdictional Emission Reductions Program (ER-P) in Sangha and Likouala has been developed together with partners drawn from among local communities and Indigenous Peoples (LCIP), departmental and national government authorities, the private sector, and international donors.

In September 2015, the Republic of Congo submitted its Intended Nationally Determined Contribution (INDC) to the United Nations Framework Convention on Climate Change (UNFCCC), presenting forests and REDD+ as a main contribution to global mitigation efforts. The Government has finalized its draft National REDD+ Strategy in July 2016, which sets out the strategic options for achieving its vision of pursuing low-carbon development pathways. The ER-Program for Sangha and Likouala is fully in line with the National REDD+ Strategy.

Nevertheless, the Republic of Congo is at a crossroads: Accelerated development during the recent period of high oil prices led to major infrastructure projects that opened up previously remote forest areas to economic activity. The recent dramatic drop in oil prices has lent urgency to the Government's drive to diversify its economy away from its overwhelming dependence on hydrocarbons. This represents a potential threat to the forest stock, as agriculture, forestry, and mining are among the key alternative sectors identified for development. At the same time, the Government has also identified REDD+ as an opportunity for economic diversification. The ER-Program thus yields an important opportunity to demonstrate the feasibility of innovative approaches to economic development that minimize impacts on forests. The ER-Program thus represents a unique opportunity for influencing the development trajectory of the country.

This program aims at implementing REDD+ as model for sustainable development in the program area, which covers 12.4 million hectares, 11.7 million hectares of which are forests. With the ER-Program area representing 59% of the national forest area, it is ambitious and will be among the first in Africa to test REDD+ at large scale. The objective of the program is to reduce 11,093,204 million tCO2 over five years by 2022, enhance sustainable landscape management, improve and diversify local livelihoods, and conserve biodiversity. The program is designed to aggregate and coordinate various sources of funding, including the Forest Investment Program (FIP), the Central African Forest Initiative (CAFI), the Global Environment Facility (GEF), the International Development Association (IDA), French Development Agency (AFD), the UK Department for International Development (DIFD), the African development Bank (AfDB) as well as private companies and investors.

The design phase of the ER-Program involved consultations and information sharing at local, departmental, and national levels with LCIP, civil society, local, departmental and national governments, and the private sector.

One of the program's main strengths is the well-established public-private partnership between the Government and CIB-OLAM. The company has been contracted by the Ministry of Agriculture and Ministry of Forest Economy, Sustainable Development and Environment (MEFDDE) to rehabilitate the cocoa market in the Republic of Congo by harnessing OLAM's strategic market position in the global cocoa sector. The ER-Program will contribute significantly to the Government's objective to promote a sustainable cocoa sector. The public-private partnership is a strong anchor for the ER-Program to build on and to increase climate and development benefits. Its ambition is to scale up significantly the existing successful cooperation and promote further the beginning of a revived cocoa sector in the country. This includes for CIB-OLAM to buy and export the cocoa produced sustainably in the ER-Program Area.

Drivers and underlying causes of deforestation and forest degradation

Then main direct drivers of deforestation and forest degradation in the program area are logging exploitation, agro-industrial production (palm oil), slash-and-burn agriculture and mining as an emerging driver. Underlying causes of deforestation include weak governance, lack of policy coordination and land use planning, poverty and insufficient enabling conditions for sustainable economic activities, population growth and infrastructure development.

Intervention Strategy and Program Activities

The intervention strategy is a combination of sectoral and enabling activities to address both direct drivers of deforestation and forest degradation as well as underlying causes. The sectoral activities consist of four main intervention areas:

First, the program will address degradation in forest concession areas by engaging forest concessionaires in reduced impact logging and forest protection (set aside areas), and promoting forest certification (FSC).

Second, the program aims at reducing emissions from deforestation i) in palm oil concessions by avoiding the conversion of forests with high conservation value (HCV) through contractual agreements and the promotion of certification under the Roundtable for Sustainable Palm Oil (RSPO) standard), and ii) in mining concessions through reduced impact planning of mine sites and supporting infrastructure.

Third, the program will work with communities to improve their livelihoods and provide alternative sources of income by i) promoting the production of cocoa by smallholders through agroforestry systems in degraded forests in CDZ in forest concessions, ii) promoting smallholder outgrower schemes for palm oil on deforested areas within oil palm concessions, and (iii) introducing conservation agriculture (cassava, maize) to increase agricultural productivity and crop diversification in degraded areas of CDZ.

Fourth, the program includes measures to improve the management of existing protected areas through improved protected area management and alternative income generating activities for communities (as listed above).

Finally, the enabling activities of the program target:

- Improved governance, e.g. through capacity building of program partners and synergies with the Forest Law Enforcement, Governance and Trade (FLEGT) process;
- Strengthened land use planning at national and local levels;
- Improved livelihoods through value chain development for agricultural products, e.g. for cocoa and palm oil.

Crucially, the ER-Program uses climate finance to set the development path of a new and rapidly growing commodity sector on a sustainable track by supporting forest-friendly approaches to cocoa cultivation. Involvement of the private sector is a key feature of this ER-Program, which intends to use carbon finance to leverage broader investments in the cocoa sector. The proof of concept that the ER-Program provides hence can have an impact well beyond its accounting area.

Reference Emissions Level

The Reference Level (REL) includes GHG emissions and removals from two REDD+ activities, deforestation and degradation, which represent respectively 64% and 36%% of total forest-related emissions in the Reference Period (2003-2012), for total average annual emissions of 10,854,290 tCO2/year.

Since 2012, there has been a marked acceleration of deforestation and degradation trends. As a result, and as an HFLD country, Congo will request an adjustment of its REL. In the 2017-2027 period, this would be 8,692,401 tCO2/year based on the modeled adjustment of the RL in Chapter

8.4; this number is over the maximum amount allowed by the Carbon Fund of 0.1% of total carbon stocks, and thus was capped at 6,730,348 tCO_2e.

Benefit-Sharing

The ER-Program will provide a variety of incentives and benefits for the different stakeholders involved. The ERPD describes preliminary arrangements for the distribution of revenues from emission reduction payments, including preliminary principles, definitions and the operational process for the sharing of monetary and non-monetary benefits, to the extent they have been developed. The Republic of Congo is developing a Benefit Sharing Plan to ensure the clear, equitable, effective, efficient, and transparent distribution of costs and benefits incurred by the different stakeholders involved or affected by the ER-Program.

The benefit sharing will employ a mix of performance- and non-performance based approaches:

- *Based on carbon performance:* The distribution of benefits will be based on carbon performance as either an amount of carbon not emitted or sequestered compared to the reference level, or based on proxies, such as an area (in hectare) of protected forest land. This approach will be applied, for instance, for communities where ER or proxies are directly measurable/attributable to beneficiaries.
- *Not based on carbon performance:* For some key stakeholders it is generally not possible or too costly to measure and attribute carbon performance. For example, LCIPs as well as government institutions receive benefits without measurement and without approximation of their carbon performance, in recognition of their specific contributions, legal claims, and/or the ER-Program's impact on their holdings, responsibilities, livelihoods, or other.

The beneficiary groups of the program include i) local communities and Indigenous Peoples, ii) private concessionaires in the forestry and palm oil sectors, iii) the government. Benefit sharing will be executed through a contractual architecture with the different participants involved in the program activities.

Implementation and Monitoring Arrangements

The Government of the Republic of Congo, through the Ministry of Finance, will be the signatory of the ER-PA. The Ministry of Planning will play an important role in policy coordination, while technical leadership of the REDD+ process lays with the MEFDDE.

At the national level, the National REDD+ Committee (CONA-REDD), the highest inter-ministerial and cross-sectoral governance body, will provide oversight and strategic direction for the ER-Program. The National REDD+ Coordination (CN-REDD), an operational unit under MEFDDE responsible for the day-to-day management and implementation of REDD+, will, among others, serve as a technical secretariat for CONA-REDD and assess the alignment of the ER-Program implementation plan with the national REDD+ strategy.

The ER-Program will be managed and administered on a day-to-day basis by a REDD+ Management Entity (RME), which will be in charge of the operational and financial management. The RME will be responsible for carbon and safeguards monitoring and reporting for the program by using the national Safeguards Information System and the Measuring, Reporting and Verification (MRV) system. The latter will be run by the MEFDDE/ National Forest Management Inventory Center (CNIAF).

Social and Environmental Risk Management

The intervention strategy was developed in alignment with the draft National REDD+ Strategy and takes into account the recommendations of the draft Strategic Environmental and Social Assessment (SESA). The Environment and Social Management Framework (ESMF) and five sub-frameworks (pesticides management framework, cultural heritage management framework, Indigenous Peoples planning framework, process framework and resettlement policy framework) are currently under development, and will be brought to bear on the final ER-PD. Furthermore, the Republic of Congo has defined its Principles, Criteria and Indicators for social and environmental aspects of REDD+ (PCI REDD+), which are in compliance with the Cancun Safeguards and World Bank Operational Policies. The ER-Program will apply the safeguards instruments developed at national level (SESA, ESMF, PCI-REDD). A program-specific risk analysis and mitigation strategy is under development in conjunction with the ongoing SESA consultations and ESMF development.

In line with the institutional arrangements designed for the ER-Program, the RME will be responsible for guiding and ensuring compliance with safeguard requirements. That includes for the RME to assist implementers, such as concessionaires, NGOs and communities, in conducting environmental and social impact assessments and developing specific safeguard plans if required. Data collection on safeguards implementation will be conducted by the implementing partners. The RME will be responsible for compiling and analyzing the data and preparing annual safeguards monitoring to be assessed and reviewed by CONA-REDD, and conducting field missions for verification purposes together with LCIPs and civil society representatives.

To manage potential complaints and conflicts, a Feedback Grievance and Redress Mechanism (FGRM) is being designed. Its implementation will be the responsibility of the RME and the implementing agencies. From mid-2016 onwards, the FGRM will be tested and the national REDD+ registry will provide a transparent platform for filing complaints and monitoring their handling.

TABLE OF CONTENTS

TABLE OF TABLES

TABLE OF FIGURES

TABLE OF BOXES

LIST OF ACRONYMS

AFD	French Development Agencies (*Agence Française de Développement*)
ATO	African Timber Organization
CACO-REDD	REDD+ Concertation Platform (*Cadre de Concertation REDD+ société civile et populations autochtones*)
CAFI	Central Africa Forest Initiative
CDZ	Community Development Zones (*Séries de Développement Communautaire*)
CEFDHAC	Conference on the Ecosystems of Dense rainforests of Central Africa
CNIAF	National Forest Inventory and Management Center (*Centre National d'Inventaire et d'Aménagement Forestier*)
CN-REDD	National REDD Coordination (*Coordination Nationale REDD*)
CODEPA-REDD	Departmental REDD Committee (*Comité Départemental REDD*)
COMIFAC	Commission of Central African Forests (*Commission des Forêts d'Afrique Centrale*)
ConAg	Conservation Agriculture
CONA-REDD	National REDD Committee (*Comité National REDD*)
COP	Conference of the Parties
CSL	Conventional Selective Logging
EDD	Environment and Sustainable Development (*Environnement et Développement Durable)*
EFI	European Forest Institute
EIA	Environmental Impact Assessment
ER-P	Emissions Reduction Program
ER-PA	Emissions Reduction Payment Agreement
ER-PD	Emissions Reduction Program Document
ESMF	Environmental and Social Management Framework
FAO	Food and Agriculture Organization
FC	Forest Code
FCPF	Forest Carbon Partnership Facility
FEDP	Forest Economy Development Project of the World Bank
FGRM	Feedback and Grievances Redress Mechanism
FIP	Forest Investment Program
FLEGT	Forest Law Enforcement, Governance and Trade (FLEGT) Initiative
FSC	Forest Stewardship Council
GEF	Global Environment Facility
GHG	Greenhouse gas
Grmining	Green Mining
HCV	High Conservation Value
HFLD	High Forest Cover and Historically Low Deforestation
IDA	International Development Association
INDC	Intended Nationally Determined Contribution

IPCC	Intergovernmental Panel on Climate Change
ITTO	International Tropical Timber Organization
IUCN	International Union for Conservation of Nature
LCIP	Local Communities and Indigenous Peoples
LtPF	Logged to Protected Forest
MEFDDE	Ministry of Forest Economy, Sustainable Development and Environment (*Ministère de l'Economie Forestière, du Développement Durable et de l'Environnement*)
MRV	Monitoring, Report, Verification
MTR	Mid Term Review
NDA	Non Disclosure Agreement
NDP	National Development Plan
OCFSA	Conservation Organization of African wildlife (*Organisation pour la Conservation de la Faune Sauvage en Afrique*)
OSFAC	Monitoring of Forests in Central Africa (*Observatoire Satellital des Forêts d'Afrique Centrale*)
PA	Protected Areas
PACEBCo	Ecosystem Conservation Program in the Congo Basin
PCI	Principles, Criteria and Indicators
PDSA	Agriculture Development Plan (*Plan de Développement du Secteur Agricole)*
PFBC	Partnership for the forests of the Congo Basin
PRONAR	National Afforestation an Reforestation Program (*Programme National d'Afforestation et de Reforestation*)
RENAPAC	Network of Protected Areas of Central Africa (Réseau National des Populations Autochtones du Congo)
REDD+	Reduce Emissions from Deforestation and Degradation
REL	Reference Emissions Level
RIFFEAC	Network of forestry and environmental training institutions in Central Africa (*Réseau des Institutions de la Formation Forestière et Environnementale en Afrique Centrale*)
RIL	Reduced Impact Logging
RME	REDD+ Management Entity
RSPO	Roundtable for Sustainable Palm Oil
SESA	Strategic Environmental and Social Assessment
RoC	Republic of Congo
SFM	Sustainable Forest Management
SHAgCocoa	Small Holders Agroforestry Cocoa
SHAgPalm	Small Holders Agroforestry Palm
SNR	National Reforestation Service (*Service National de Reboisement*)
SIS	Safeguards Information System (*Système d'Information sur les Sauvegardes*)
TAP	Technical advisory panel
TFA	Tropical Forest Alliance
UFA	Forest Management Unit (*Unité Forestière d'Aménagement*)

UNDP	United Nation Development Program
UNEP	United Nation Environment Program
UNFCCC	United Nation Framework Convention on Climate Change
VCS	Verified Carbon Standard
VPA	Voluntary Partnership Agreement (VPA) under FLEGT
WCS	Wildlife Conservation Society
WRI	World Resource Institute
WWF	World Wildlife Fund

1 ENTITIES RESPONSIBLE FOR THE MANAGEMENT AND IMPLEMENTATION OF THE PROPOSED ER-PROGRAM

1.1 ER-Program entity that is expected to sign the emissions reduction payment agreement (ER-PA) with the FCPF

Name of entity	Ministry of Finance, Budget and Public Portfolio
Type and description of organization	Central government ministry, which is the legal ER-Program entity, and which as such can authorize another organization to administer and manage the ER-Program.
Main contact person	M. Calixte Nganongo
Title	Minister of State
Address	Croisement Avenue de l'Indépendance et Avenue Foch Brazzaville - Brazzaville
Telephone	+242 066688634
Email	cg.minfin@gmail.com

1.2 Organization(s) responsible for managing the proposed ER-Program

Same entity as ER-Program Entity identified in 1.1 above?	No
If no, please provide details of the organizations(s) that will be managing the proposed ER-Program	
Name of organization	REDD+ Management Entity, under the control and supervision of CONA-REDD
Type and description of organization	The REDD+ Management Entity will be selected through an international call for tender organized by MEFDDE (subject to government procurement rules). It will be responsible for the day-to-day management of the program including) inventory and reference level activities, benefit-sharing related works, administrative and financial management, strategic and other technical coordination, coordination of stakeholder outreach and the grievance redress mechanisms, as well as marketing of the program.
Organizational or contractual relation between the organization and the ER-Program Entity identified in 1.1 above	The REDD+ Management Entity (REM) will be selected through an international call for tender organized by MEFDDE (subject to government procurement rules). The RME to be staffed with international and domestic experts. Its mandate (and power of attorney to negotiate REDD+ Participation Agreements on behalf of the government) will be broad.
Main contact person	Georges Claver Boundzanga
Title	National REDD+ Coordinator
Email	bouzgege@yahoo.fr

1.3 Partner agencies and organizations involved in the ER-Program

Governmental agencies

Name of the partner	Name of the contact person telephone number and email address	Core capacities and role within the ER-Program
NATIONAL GOVERNMENTAL AGENCIES		
National REDD+ Committee (CONAREDD)	**Macaire NZOMONO,** President Advisor regarding Sustainable Development and Environment E-mail: mackzom@yahoo.fr	CONAREDD is the inter-ministerial and multi-stakeholder high-level committee responsible for national REDD+ development. Members : Ministries of Forest Economy, Sustainable Development and Environment, Planning, Agriculture and Livestock, Environment and Tourism, Mines and Geology, Land Use Planning and Infrastructure, Land tenure, Finance, Scientific Research, Energy and Hydrocarbons, Health; Civil Society, Indigenous Peoples, Private Sector.
National REDD+ Coordination (CN-REDD)	**Georges Claver BOUNDZANGA** National REDD+ Coordinator E-mail: bouzgege@yahoo.fr	As a division of the Ministry of Forest Economy Sustainable Development and Environment, coordinates the REDD+ process in the Republic of the Congo and the design phase of the ER-Program Sangha-Likouala, informs and consults stakeholders on the progress and development of the program.
Ministry of Planning	**Ingrid Olga EBOUKA BABAKAS** Minister of Planning	Facilitates and promotes intersectoral policy decision-making and dialogue to guarantee the success of REDD+.
Ministry of Forest Economy, Sustainable Development and Environment (MEFDDE)	**Rosalie MATONDO** Minister E-mail: rosalie_mat@yahoo.fr	Ensures Government's engagement in the implementation of REDD+, oversee CN-REDD, sign contracts related to REDD+
Ministry of Agriculture and Livestock	**Henri DJOMBO** Minister E-mail: henridjombo@yahoo.fr	Facilitate and implement the agriculture components of the ER-Program
Ministry of Mining and Geology	**Pierre OBA** Minister E-mail: kate_ketty03@yahoo.fr	Facilitate and implement the mining components of the ER-Program
National Center for Inventory and Management of Forest and Fauna Resources	**Jean-Claude BANZOUZI** CNIAF Director E-mail : mfumu1962@gmail.com	Responsible for the National Greenhouse Gas Inventory, National Forest Inventory, and the National Forest Monitoring System (NFMS).
National Afforestation and Reforestation Program (PRONAR)	**Pierre TATY** PRONAR Coordinator, E-mail: pierretaty@yahoo.fr	Coordinates reforestation activities, attracts technical and financial partners to support multi stakeholder activities, supports ER-Program activities related to reforestation and agroforestry.

Name of the partner	Name of the contact person telephone number and email address	Core capacities and role within the ER-Program
National Reforestation Service (SNR)	**M. DEMBI** Director Tel: +242055370788	Government service in charge of technical advice on reforestation. Will support agroforestry activities.
Centre for Non-Timber Forest Products (CVPFNL)	**M. ADOUA** Director Tel: +242055553296 / +242066612396	Government service that will support non-timber forest product management for local communities and Indigenous Peoples.
DEPARTEMENTAL GOVERNMENTAL AGENCIES		
Departmental REDD Committee (CODEPA REDD) Sangha	**Jean Lu MABIALA-TCHIBINDA** President of CODEPA-REDD Sangha E-mail: mabialatchibinda@yahoo.fr	Entity in charge of the design and implementation of REDD+ policies and strategy, as well as of decision-making, at the departmental level. Representatives from the department, the departmental divisions of central ministries, and local and Indigenous peoples.
CODEPA REDD Likouala	**Lucien MANISSE** President of CODEPA-REDD Likouala E-mail: mass.sagervie@yahoo.fr	Entity in charge of the design and implementation of REDD+ policies and strategy, as well as of decision-making, at the departmental level. Representatives from the department, the departmental divisions of central ministries, and local and Indigenous Peoples.

Civil Society

Name of the partner	Name of the contact person telephone number and email address	Core capacities and role within the ER-Program
CACO-REDD	**Firmin EMANA** President of CACO-REDD, E-mail: emanafirmin01@gmail.com	Civil society and Indigenous Peoples' platform responsible for coordinating NGOs involved in the REDD+ process. Plays a core role in consultation processes and monitors broader REDD+ efforts.
RENAPAC	**Parfait DIHOUKAMBA** President of RENAPAC, E-mail: pdihoukamba@yahoo.fr	Indigenous People Platform responsible for coordinating NGOs involved in the REDD+ process. Plays a core role in consultation processes and monitors broader REDD+ efforts.
Wildlife Conservation Society (WCS)	**Tim RAYDEN** Responsible for REDD+ program E-mail: trayden@wcs.org	International NGO involved in the management of protected areas, in particular Nouabalé-Ndoki National Park, Lac Télé Community Reserve, and active in wildlife management in several forest concessions. Potential implementer of program activities. .
WWF	**Pauwel DE WACHTER** pdewachter@wwf.panda.org	Supports responsible mining, agriculture and biodiversity conservation programs in the ER-Program area. Potential implementer of program activities.
Independent REDD Observer	TBD	Currently in planning phase, would provide independent oversight over REDD+, contingent upon financing.

Private Sector

Name of the partner	Name of the contact person telephone number and email address	Core capacities and role within the ER-Program
LOGGING CONCESSIONNAIRES		
Congolaise Industrielle des Bois (CIB) - OLAM	**Christian SCHWARTZ** General Director E-mail: christian.schwarz@olamnet com	Forest and agribusiness company with 5 forest concessions (Kabo, Pokola, Loundougou-Toukoulaka, Enyellé, Pikounda) in the program area. Program design and implementation partner, Pikounda Nord REDD+ project holder approved by VCS. Potential implementer of program activities.
OLAM International Ltd (OLAM)	**Darshan RAIYANI** Wood sector Vice President E-mail: darshan@olamnet.com	.
Danzer Group (IFO)	**Dieter HAAG** General Director E-mail: haag@ifo-congo.com Brazzaville : ifobzv@ifo-congo.com	Forest company with 1 concession in the ER-Program area, FSC-certified. Potential implementer of program activities.
Industrial Society Forest of Congo, (SIFCO)	**Zaid IBRAHIM** E-mail: zaidbrahim@gmail.com sifcochantier@gmail.com	Forest company with 1 concession (Tala Tala) in the ER-Program area. Potential implementer of program activities.
Société d'explotiation Forestière Yuan Dong (SEFYD)	**Henry HE** No 1, av. de Hangda , Place siecle de Dragon, bâtiment C807, Quartier XIHU, Hangzhou, Chine E-mail: operation@yd-timber.com	Forest company with 2 concessions (Jua Ikie and Karagoua) in the ER-Program area. Potential implementer of program activities.
Company Tanry Congo (STC)	**Séraphin BIKOUMOU** Management Cell	Forest company with 1 concession () in the ER-Program area. Potential implementer of program activities.
Likouala Timber	**Raphael BETITO** Contrôleur Général Email: betito.raphael@likouala.com	Forest company with 2 concessions (Missa and Bétou) in the ER-Program area. Potential implementer of program activities.
Rougier	**Paul Emmanuel HUET** CSR, Marketing, Communication Director E-mail: HUET@rougier.fr	Forest company with 1 concession (Mokabi) in the ER-Program area. Potential implementer of program activities.
PALM OIL COMPANIES		
ECOOIL	**Jean-Christophe MATOUALA,** Responsible for Village Oil palm E-mail : matoujc@yahoo.fr	Palm oil company with a concession in Sangha.that is planning to implement RSPO certification for its concessions and to develop village oil palm around its concessions. Potential implementer of program activities.

Name of the partner	Name of the contact person telephone number and email address	Core capacities and role within the ER-Program
MINING COMPANIES		
Congo Iron SA (Sundance Resource Group)	**Aimé Emmanuel YOKA** General Director Email: eyoka@congoiron.net	Mining company with 1 concession (Nabemba) in the ER-Program area. Potential implementer of program activities.

Funding partners and technical support

Name of the partner	Name of the contact person telephone number and email address	Core capacities and role within the ER-Program
Forest Carbon Partnership Fund (FCPF)	**Daniela GOEHLER** Country Focal Point for RoC E-mail : dgoehler@worldbank.org	Technical and financial support for the finalization of REDD+ readiness and for the design of the ER-Program including preparation of the ER-PD.
World Bank	**Julian LEE** Environment and Natural Resources Specialist E-mail : jlee7@worldbank.org	Technical and financial support for the finalization of REDD+ readiness and for the design of the ER-Program including preparation of the ER-PD and synergies with other initiatives such as the Forest and Economic Diversification Project , Global Environment Facility, Forest Investment Program, and Central African Forest Initiative.
Terra Global Capital / Geoecomap	**Leslie DURSCHINGER** 220 Montgomery Street, Suite 608 San Francisco, CA 94104 E-mail : Leslie.durschiner@terraglobalcapital.com	Technical Service Provider and main contributor of the ER-PD.
FAO	**Saya MABA** FAO E-mail : marius.sayamaba@fao.org	FAO is providing technical and financial support for the national MRV.
UNDP	**Jean Félix ISSANG** UNDP E-mail : jean-felix.issang@undp.org	UNDP is preparing a project that includes a protected area management component in the ER-Program area. They are also supporting REDD+ with their support to the Green Climate Fund initiative.
COMIFAC	**Martin TADOUM** Executive secretary E-mail: mtadoum@comifac.org	Supports REDD+ project implementation in the Republic of Congo
Congo Basin Forest Partnership (CBFP)	**Clotilde NGOMBA** Coordinator c.ngomba@afdb.org	Financial support to CNIAF to design and implement the National Forest Inventory and

Name of the partner	Name of the contact person telephone number and email address	Core capacities and role within the ER-Program
		participate in the design of the National Land Use Plan (PNAT).
Agence Française de Développement (AFD)	**Christophe DUCASTEL** Agriculture, rural and biodiversity development department ; Sustainable development department, E-mail: ducastel@afd.fr	Technical and financial support for the implementation some of ER-Program activities, including shade cocoa.
European Forest Institute (EFI)	**Alessandro TREVISAN** E-mail: alessandro.trevisan@efi.int	Technical and financial support for REDD+ readiness, including support for the Benefits Sharing Plan, REDD+ Universities, etc.
United States Forest Service / USAID	**Isaac MOUSSA,** Country Director usfs.congo@gmail.com	Technical and financial support through partner NGOs to support implementation of REDD+..
World Resources Institute (WRI)	**Djoan Bonfils,** Regional technical assistant E-mail: djoan.bonfils@wri.org	Technical support in participatory activities of land use planning, including the design of the new National Land Use Plan (PNAT).
National School of Agronomy and Forestry (SCSTA) / University Marien Ngouabi	**Patrice AKOUANGO** Directeur E-mail: fulakril@yahoo.fr	Technical support for REDD+ implementation process, in the Republic of the Congo as this school trains new young elites in forest management and agriculture sectors.
Institut de Recherche Forestière (IRFO)	**Jean de Dieu NZILA,** Directeur de l'Institut de Recherche Forestière	Technical support for REDD+ implementation process in RoC.

2 STRATEGIC CONTEXT AND RATIONALE FOR THE ER-PROGRAM

2.1 Current Status of the Readiness Package and Summary of Additional Achievements of Readiness Activities in the Country

The Republic of Congo conducted a participatory self-assessment process regarding progress on REDD+ readiness between May and July 2016. As a result, out of the 34 criteria of the Readiness Package Assessment Framework, national stakeholders rated 12 criteria as significantly progressed (green), 16 as satisfactorily progressed (yellow) and six as moderately progressed where more efforts are required (orange). As summary of the Readiness-Package assessment is provided in Table 1. As part of the assessment process, the country has prepared a work program[1] to further advance remaining readiness activities and operationalize the main REDD+ tools.

The Republic of Congo presented its Readiness-Package 22nd FCPF Participants Committee Meeting (PC22), held on 26-28 September in Accra, Ghana. The FCPF Participants Committee endorsed it and emphasized the importance of the work program to complete the readiness work[2].

Table 1. Summary of Progress according to the Readiness Package (August 2016)

No.	Criteria	Evaluation
1	Accountability and transparency	
2	Operating mandate and budget	
3	Multisector coordination mechanisms and cross-sector collaboration	
4	Technical supervision capacity	
5	Funds management capacity	
6	Feedback and grievance redress mechanism	
7	Participation and engagement of key stakeholders	
8	Consultation processes	
9	Information sharing and accessibility of information	
10	Implementation and public disclosure of consultation outcomes	
11	Assessment and analysis	
12	Prioritization of direct and indirect drivers/ barriers to forest carbon stock enhancement	
13	Links between drivers/barriers and REDD+ activities	
14	Action plans to address natural resource rights, land tenure, governance	

[1] https://www.forestcarbonpartnership.org/sites/fcp/files/2016/Sep/R-Package%20work%20plan_1.pdf

[2] https://www.forestcarbonpartnership.org/sites/fcp/files/2016/Sep/Final%20Resolution%203%20Endorsement%20of%20RoC%27s%20Readiness%20Package.pdf

No.	Criteria	Evaluation
15	Implications for forest law and policy	
16	Selection and prioritization of REDD+ strategy options	
17	Feasibility assessment	
18	Implications of strategy options on existing sectoral policies	
19	Adoption and implementation of legislation/regulations	
20	Guidelines for implementation	
21	Benefit-sharing mechanism	
22	National REDD+ registry and system monitoring REDD+ activities	
23	Analysis of social and environmental safeguard issues	
24	REDD+ strategy design with respect to impacts	
25	Environmental and social management framework	
26	Demonstration of methodology	
27	Use of historical data and adjustment for national circumstances	
28	Technical feasibility of the methodological approach, and consistency with UNFCCC/IPCC guidance and guidelines	
29	Documentation of monitoring approach	
30	Demonstration of early system implementation	
31	Institutional arrangements and capacities	
32	Identification of relevant non-carbon aspects, and social and environmental issues	
33	Monitoring, reporting and information sharing	
34	Institutional arrangements and capacities	

(Source: Republic of Congo R-Package)

2.2 Ambition and strategic rationale for the ER-Program

The Republic of Congo has the third largest area of tropical rainforests in Africa and is an important player to address deforestation in the Congo Basin, covering around 12% of the Congo Basin massif. The 22.4 million hectares of the country's forests represent 65% of the national territory, out of which 80% are exploitable. According to FAO, the average national deforestation rate is 0.052% in the 2000-2012 period. The country can therefore be classified as a country with high forest cover and historically low deforestation (HFLD). With 2.5 million hectares of forest concessions under certification by the Forest Stewardship Council (FSC), the Republic of Congo has the largest area of FSC certified forest in Africa.

The country has been engaging in the REDD+ process since 2008 and has developed a REDD+ program for result-based payments in the Departments of Sangha and Likouala to deliver significant climate impact, critical development benefits and a strong public-private partnership for unique learning in the FCPF Carbon Fund. It follows a multi-sectoral approach and is aligned with all four pillars of the validated draft of National REDD+ Strategy, namely building governance capacities, sustainable forest management, improvement of agricultural systems and rationalization of the production and utilization of fuelwood. The program area includes 17 forest concessions including Community Development Zones (CDZ), two agro-industrial and one mining concession, three national parks and one community reserve. Among those are the Nouabalé-Ndoki National Park (NNNP), which constitutes a portion of the Sangha Trinational World Heritage Site (TNS) - the single most biologically intact landscape in the Congo Basin - and the Lac Tele Community Reserve in Likouala - the world's largest swamp forest and second largest wetland area.

Specifically, the Emission Reductions Program in Sangha and Likouala aims at implementing REDD+ as model for sustainable development in line with the "Congo Vision 2025" in Northern Congo. The ER-Program covers an area of 12.4 million hectares, out of which 11.7 million hectares are forests. With the program's forest area representing almost 60% of the national forest area, it is ambitious and will be among the first in Africa to test REDD+ at large scale. The objective of the program is to reduce 10.5 million tCO_2eq from REDD+ activities over five years (2017-2022), enhance sustainable landscape management, improve and diversify local livelihoods and conserve biodiversity.

Then main direct drivers of deforestation and forest degradation in the program area are logging exploitation, agro-industrial production (palm oil), slash-and-burn agriculture and mining as an emerging driver. Underlying causes of deforestation include weak governance, lack of policy coordination and land use planning, poverty and insufficient enabling conditions for sustainable economic activities, population growth and infrastructure development. The intervention strategy is therefore a combination of sectoral and enabling activities to address both direct drivers of deforestation and forest degradation as well as underlying causes. The sectoral activities consist of four main intervention areas:

First, the program will address degradation in forest concession areas by engaging forest concessionaires in reduced impact logging and forest protection (set aside areas), and promoting forest certification (FSC). It should be noted that some forest concessionaires (CIB-OLAM, IFO) are already engaged in sustainable forest management (SFM). The program's contribution for those concessionaires is to strengthen SFM practices through REDD+ incentives. Concessionaires, who are not yet pursuing forest certification will be encouraged to do so.

Second, the program aims at reducing emissions from deforestation i) in palm oil concessions by avoiding the conversion of forests with high conservation value (HCV) through contractual agreements and the promotion of certification under the Roundtable for Sustainable Palm Oil (RSPO) standard), and ii) in mining concessions through reduced impact planning of mine sites and supporting infrastructure.

Third, the program will work with communities to improve their livelihoods and provide alternative sources of income by i) promoting the production of cocoa by smallholders through agroforestry systems in degraded forests in CDZ in forest concessions, ii) promoting smallholder outgrower schemes for palm oil on deforested areas within oil palm concessions, and (iii) introducing conservation agriculture (cassava, maize) to increase agricultural productivity and crop diversification in degraded areas of CDZ.

Fourth, the program includes measures to improve the management of existing protected areas through improved protected area management and alternative income generating activities for communities (as listed above).

Finally, the enabling activities of the program target:

- Improved governance, e.g. through capacity building of program partners and synergies with the Forest Law Enforcement, Governance and Trade (FLEGT) process;
- Strengthened land use planning at national and local levels;
- Improved livelihoods through value chain development for agricultural products, e.g. for cocoa and palm oil.

One of the program's main strengths is the well-established public-private partnership between the Government of the Republic of Congo and CIB-OLAM. The company has been contracted by the MEFDDE to rehabilitate the cocoa market in the Republic of Congo by harnessing OLAM's strategic market position in the global cocoa sector.

Olam International, based in Singapore, is a leading agribusiness operating in 65 countries and involved with commodities including cocoa, coffee, cashew, rice and cotton. In 2011, Olam acquired Congolaise Industrielle des Bois (CIB), the largest logging company in the country. Today, they operate five forest management concessions (2.1 million hectares) in the Sangha and Likouala departments. Three of these concessions are Forest Stewardship Council (FSC) certified (1.3 million hectares). CIB-OLAM currently employs over 939 workers.

Box 1. OLAM INTERNATIONAL

The ER-Program will contribute significantly to the Government's objective to promote a sustainable cocoa sector. The country began exporting cocoa in 1950. In 1977, its production rate was 2,500 tons, but this rapidly fell to 841 tons in 1986. Up to 1992, the Government's policy and strategy regarding cocoa was to give priority to the development of state enterprises and parastatal offices to the detriment of rural agriculture. These public structures, made possible due to oil income, intervened significantly in marketing and supplying inputs. Agricultural research and training services were virtually non-existent and rural infrastructure, especially roads, were inadequate. By the early 1990s, a decline in oil prices led to significant budgetary restrictions. As a result, state farms were dismantled, agricultural organizations restructured, and state monopolies abolished in the early 1990s. With no buyers for crops, farmers ceased to maintain their cocoa plantations. Now only low quantities are still produced, mainly in Sangha Department (700 to 1,000 tons/year), and sold to Cameroonian traders.

Since 2012, the Republic of Congo has partnered with CIB-OLAM to implement, support and relaunch the cocoa sector in the country through a long-term project that will: (i) implement productive orchards, (ii) support research and development to improve agronomic practices and (iii) promote a durable and sustainable cocoa sector. This partnership is a strong anchor for the ER-Program to build on and to increase climate and development benefits.

The project started with CIB-OLAM providing support to 707 small producers, prefunding small farmers' cocoa production and providing fertilizers. Jointly with the Government, CIB-OLAM gave micro-credit loans to 400 small producers and provided them with agricultural tools. CIB-OLAM also rebuilt the three "Office Café Cocoa" shops in the Sangha Department, provided technical support and trained 500 small producers to manage cocoa plantations. It also recruited and trained a dedicated team of 17 people to provide the "proof of concept" for the commercialization of cocoa that meets international quality standards: An amount of 418 tons between 2012 and

2015 of cocoa was declared nationally and exported from Pointe Noire to Amsterdam. The ambition of the ER-Program is to scale up significantly the existing successful cooperation and promote further the beginning of a revived cocoa sector in the country. This includes for CIB-OLAM to buy and export the cocoa produced sustainably in the ER-Program Area.

Finally, the program is designed to combine different sources of investment funding in a programmatic approach, such as the Forest Investment Program (FIP), the World Bank's International Development Association (IDA), the Global Environment Facility (GEF), the French Development Cooperation (AFD), and the Central African Forest Initiative (CAFI), as well as to leverage private funding to ensure a long-term sustainable land use model.

2.3 Political Commitment

The Republic of Congo is committed to addressing deforestation in the context of a green economy pathway that includes REDD+. The country has submitted an Intended Nationally Determined Contribution (INDC), where REDD+ figures as one of the national priorities to reduce greenhouse gas (GHG) emissions. Forests feature as one strategic area to diversify the country's economy in the context of the "Congo Vision 2025": REDD+ is seen as a tool for sustainable development and a pillar of a green economy. In particular, the National Development Plan 2012-2016 identifies REDD+ as a priority to protect the environment, to fight against global warming and to promote sustainable development at the same time. It also figures in the Strategy Document for Growth, Employment, and Reduction of Poverty (DSCER-P 2012-2016). The country is currently preparing the development of the 2nd NDP, potentially with support from the World Bank. The validated draft of National REDD+ Strategy positions REDD+ at the interface of the county's Agriculture Vision 2035, sustainable development vision 2030 and new forest policy of 2014.

In November 2015, the Republic of Congo signed the CAFI Joint Declaration. This confirms the country's commitment to develop a National REDD+ Investment Framework to implement the National REDD+ Strategy, including national reforms and multi-sectoral programs aimed at transformational change to address the drivers of deforestation and forest degradation. Activities under the National REDD+ Investment Framework will improve the enabling conditions for the ER-Program. In particular, the National REDD+ Investment Framework will include the implementation of a National Land Use Plan (NLUP) under the leadership of the Ministry of Land Use Planning. Law No. 43-2014 of 10 October 2014 on land use planning and territorial development provides the legal framework and guidelines for territorial planning under a sustainable development paradigm.

In order to ensure high-level commitment and cross-sectoral coordination, the inter-ministerial, participatory National REDD+ Commission (CONA-REDD) is leading the REDD+ process. It has been operational since November 2015 and includes representatives from the presidency, various ministries[3] , legislators, as well as nine from civil society, six from Indigenous Peoples' organizations, and three form the private sector. CONA-REDD provides political oversight and

[3] Forest Economy, Sustainable Development and Environment; Tourism; Agriculture and Livestock; Mines and Geology; Energy and Hydrocarbons; Planning and Integration; Finance; Territorial Administration; Land and Public Domain; Health and Population; Scientific Research

strategic orientation for all REDD+ efforts in Republic of Congo, including the ER-Program. In order to strengthen CONA-REDD further, it is foreseen to restructure it into two chambers: one at ministerial level for high-level ownership and policy coordination and one at technical level.

As regards the cocoa sector, the Government of the Republic of Congo approved a domestic budget allocation of FCFA 33 billion (USD54 million) for the implementation of the National Development Plan (NDP) 2014-2018 in the cocoa sector, which targets to plant 23,000 hectares of cocoa in six departments. A feasibility study is currently underway (a first draft is available) led by the Ministry of Agriculture and with support from France to increase the ambition of the cocoa plantation target. A national conference on cocoa is planned in November 2016 to discuss the results of the study and the integration of revised targets. CIB-OLAM is the main partner to implement the NDP for the cocoa sector, which is integral part of the ER-Program activities in Sangha and Likouala.

While the country pursues the diversification of its national economy from agriculture, it is committed to sustainable forest management and minimizing the risks of deforestation associated with agricultural production at the same time.

The country's strategy is to i) regenerate old cocoa plantations, including almost 5,000 hectares in the program area, and ii) to establish cocoa plantations on crop land, agricultural wastelands and degraded forests. The allocation of land for cocoa production will be guided through i) the broader land use planning process at national level as part of the implementation of the National REDD+ Investment Framework through CAFI and other sources and ii) the development of simplified management plans in CDZ as part of the Forest Economy Development Project (FEDP) of the World Bank. The ER-Program is a unique opportunity for the Republic of Congo to demonstrate how incentives for forest protection through carbon revenues and sustainable cocoa production can be developed in harmony in the context of a green economy pathway.

It is furthermore important to note that the Government is currently discussing a commitment to orient the industrial oil palm sector towards savanna areas. The Government is stepping up action and has joined the Tropical Forest Alliance (TFA) on 2 July 2016 to engage in its Africa Palm Oil Initiative. Representatives from the Government (Ministry of Agriculture, National REDD+ Coordination), the private sector (Eco-Oil) and civil society (WRI) have been leading the TFA engagement. It should be noted that the development of the ER-Program has played an important role for the Government to better understand the TFA's work. Two large palm oil companies (Eco-Oil, ATAMA) are present in the program area.

It should also be noted that the Republic of Congo has been engaged in the FLEGT Initiative and signed a Voluntary Partnership Agreement (VPA) with the European Union on 17 May 2010, which was ratified on February 19, 2013. This effort is supported by the EU REDD Facility and an independent observer. In 2015, the country launched an information system for legality verification of timber and derivative products. The adoption of the new Forest Code, which is expected in the coming months, will support progress in the VPA FLEGT process to address illegal logging. This is an important synergy with the ER-Program's objectives.

The Republic of Congo has furthermore demonstrated political commitment to the ER-Program during the following events over the past in the past three years:

- March 2013: Presentation of an Early Idea Note at the 6th meeting of the FCPF Carbon Fund;

- April 2014: Presentation of the Emission Reduction Program Idea Note (ER-PIN) at the 9th meeting of the FCPF Carbon Fund;
- November 2015: CONA-REDD in its inaugural meeting confirmed the ER-Program as a priority;
- December 2015: Side event at the 21st Conference of the Parties (COP) of UNFCCC featuring the ER-Program with high-level participation from the Government, OLAM and the World Bank;
- February 2016: Consultation Workshop on the ER-Program with the participation of Rosalie Matondo, President advisor in Environment at that time but now Minister of MEFDDE.

Finally, the Departmental REDD+ Committees (CODEPA-REDD) in Sangha and Likouala have reiterated their commitment to the ER-Program and its prioritization in the context of sustainable development planning at departmental level during the CODEPA restructuring session in July 2015 and the CODEPA training session in August 2016 to communicate on the program.

3 ER-PROGRAM LOCATION

3.1 Accounting Area of the ER-Program

The accounting area of the ER-Program covers the northernmost part of Republic of Congo and is defined by the departments of Sangha and Likouala. The area extends across 12,371,743 ha, of which Sangha represents 5,784,837 ha and Likouala 6,586,906 ha. The department of Sangha has a *commune* (Ouesso) and five districts: Mokéko, Ngbala, Pikounda, Sembé and Souanké. The department of Likouala has seven districts: Liranga, Impfondo, Betou, Dongou, Enyellé, and Epena Bouanela.

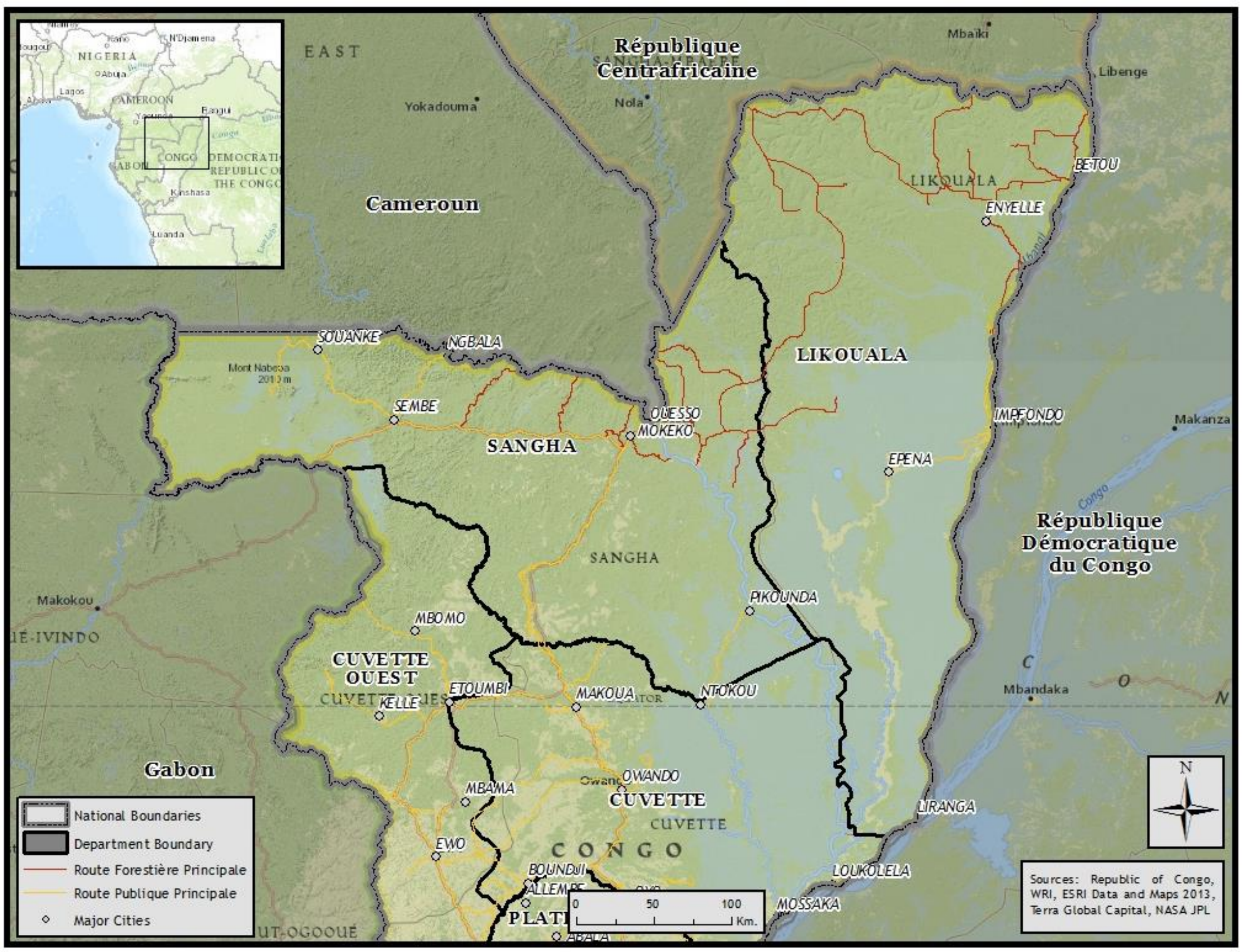

Figure 1. Political Map of the ER-Program Area

3.2 Environmental and Social Conditions in the Accounting Area of the ER-Program

Situated in the northern part of Congo, the program area is mostly home to relatively intact equatorial lowland rainforest of the Congo Basin, with a mostly closed canopy. The area was until recently relatively inaccessible by road, which has changed with the opening of the Brazzaville-Ouesso road, and is further changing with the surfacing of the Ouesso-Souanké road.

Vegetation types include: (i) Primary forest consisting of mixed forest land, which contains the Meliaceae and legumes, monodominant Limbali forest, widespread in Nouabalé-Ndoki National Park; (ii) semi-Deciduous Forest found commonly in Odzala-Kokoua National Park; (iii) secondary Forest (forest regrowth, young and old observable secondary forests along ancient roads logging and fallow land near the villages); (iv) riparian forest and seasonally flooded forest (with fairly low wood density); (v) wet meadows that constitute important animal habitat and Raphiales that cover a large area of Lake Tele, flooded and flooded savannahs and swampy grasslands which makes up the Other Wetlands class; and (vi) the bare/grasslands class which makes up grasslands, grasses and bare ground.

Undisturbed natural forests are primarily limited to the program zone's protected areas and the more remote areas of forest concessions, as well as to the extensive tracts of largely inaccessible forested wetlands.

Land Use and Land Cover

The ER-Program Area is divided into several specific land tenure and management strata to facilitate the accurate establishment of the RL + Adjustment, MRV as well as to support the results-based benefits sharing plan.

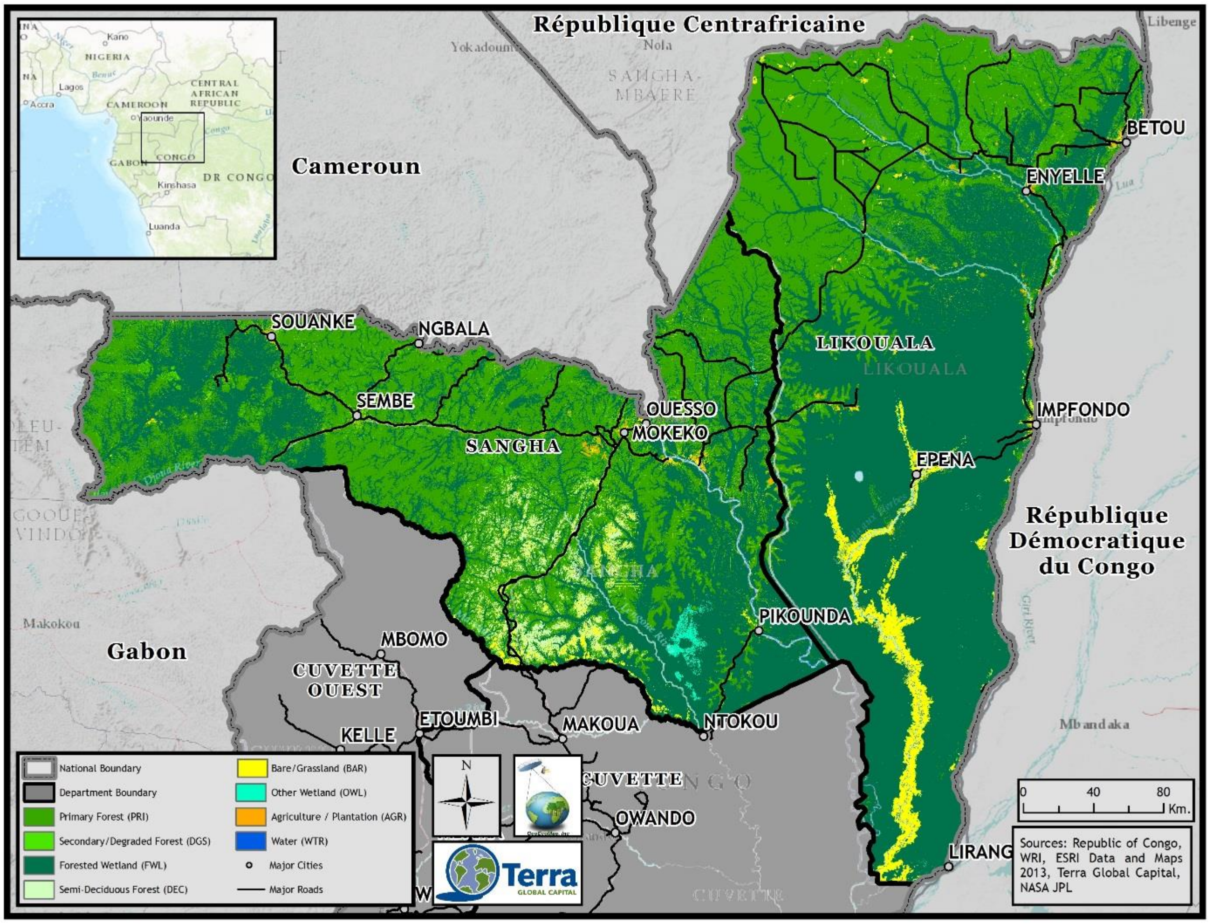

Figure 2. Land Cover in Likouala and Sangha

Table 2. Areas of Different Land-use/Land Cover Classes in ER-Program Area (2015)

Class ID	Land Cover Class	Hectares	Percent Cover
0	NoData	605	0.00%
1	Primary Forest	4,772,723	38.58%
2	Degraded/Secondary Forest	292,605	2.37%
3	Forested Wetlands	6,493,433	52.49%
4	Semi-Deciduous Forest	171,218	1.38%
5	Bare/Grasslands	416,007	3.36%
6	Other Wetlands	65,054	0.53%
7	Agriculture/Plantation	116,769	0.94%
8	Water	43,324	0.35%
Total	-	12,371,737	100%

Climate and Catastrophic Events

Northern Congo has an equatorial climate, with high rainfall (1,500-1,600 mm per year) and high humidity (85% on an annual average). Rainfall is concentrated in two rainy seasons (March-May and September-November), with dry seasons in between. Anecdotal evidence suggests these seasons have become less predictable according to latest observations. Average monthly temperatures vary slightly around 25°C, with a minimum in August (24.0°C) and a maximum in March (25.7°C) and low diurnal temperature variations (less than 10°C).

The dry season increases the risk of bush fires in grasslands bordering rivers. High winds during thunderstorms can destabilize stands and play an important role in ecosystem dynamics. The rainy season brings widespread flooding to low-lying areas watersheds.

Soils

The soils in the area are impoverished ferralitic and reworked lateritic soils, and the hydromorphic soils that occupy large tracts of flooded and riparian forests. The area's large waterlogged forests contain significant expanses of peat, with high organic matter content. Some areas have clay loam soil or sandy loam depending on the nature of the alluvium, and are highly acidic and low in fertility. This alluvial deposit is ongoing owing to flooding during the rainy season. Lateritic crusts are observed at the bottom of slopes near rivers.

Rare and Endangered Species and Habitat

The program zone boasts very rich biodiversity, which is home to nearly 300 species of birds and more than 60 species of mammals, including forest elephants, gorillas, chimpanzees, bongos, leopards and hippopotamuses. Poaching for ivory, trophies, and bushmeat threatens much major fauna. The area's rich biodiversity has led the Government to create four large protected areas: Nouabalé-Ndoki, Ntokou-Pikounda, and Odzala-Kokoua National Parks, and Lac Télé Community Reserve.

Overview of Stakeholders and Rights-Holders

The accounting area contains the following ethnic groups: Bakota, Bagandou, Bandjongo, Bandza, Bomassa, Bomitaba, Bondjos, Bondongo, Bakouélé, Bakas, Bondongo, Bonguili, Djiem, Enyelles, Gbaya, Mbenzélé, Mbati, Mboma, Moundjombo, Porn, Sango, Sangha-Sangha, Ka-aka, Lignelé, and Yasoua.

Formal law – which distinguishes forest land as either state-owned or private and assumes default ownership for the state (see chapter 4.4 below) – recognizes customary land holdings. For Indigenous Peoples, this is laid down in Article 31 of Act No 5: "The Indigenous Peoples have a collective and individual right to property… [to] lands and natural resources *that they occupy or use traditionally*" (italics added). The guarantee translates into an obligation for the government to demarcate areas that are reserved for local communities and those that can be given out under individual concessions. Concession holders must accept access and passage rights, and they have to set aside a portion of land for exclusive use by local communities.

The accounting area contains 17 forest concessions belonging to 12 firms or in some cases, do not yet have a concession holder (covering 7,233,257 ha, or 59% of the surface area), 13 mining exploration and research concessions belonging to 13 firms (including overlapping claims of forestry concessions), four national parks/reserves and 3,070,720 ha of unattributed areas. However, local communities consider the forest as their heritage. The people of northern Congo are animist belief for much of them, and consider certain areas of forests as sanctuaries. Concession management implies that communities face access restrictions. In the case of forest concessions with management plans, logging companies leave a portion of the concessions to forest communities, called Community Development Zones (CDZ).

Table 3. Land Tenure Classes within the ER-Program Area

Land Tenure Class	ID	Total Hectares	Hectares of Forest (2015)	% Forest Cover	% Total Area
Industrial Palm oil	1	232,410	203,411	88%	2%
Forest Concession - Production Areas	2	4,654,894	4,499,686	97%	38%
Protected Areas	3	1,835,356	1,714,706	93%	15%
Forest Concessions - Non Production Areas	4	2,578,363	2,489,705	97%	21%
Unattributed Areas *Not* in oil Palm & Forest Concessions	5	3,070,720	2,822,469	92%	25%
Total Area	-	12,371,743	11,729,979	95%	100%

Population Demographics and Growth

The area has an estimated population of 306,405 (2015), of which 109,`528 are located in Sangha and 196,877 in Likouala. Population density is very low, at about 2.5 people per km2.

Natural population growth of 2.86% and migration from both within and without Congo combine to increase the area's population.

Table 4. Historical and projected population growth

	2007	2010	2015	2020	2025	2035	2040
Sangha	85.738	94.159	109.528	126.619	145.475	188.496	212.583
Likouala	154.115	169.251	196.877	227.599	261.492	338.823	382.120
Total	**239.853**	**263.410**	**306.405**	**354.218**	**406.967**	**527.319**	**594.703**

Source: CNSEE, RGPH 2007 and World Population Prospects: Revision, DVD Edition

Livelihoods and Economic Activities

Agriculture is the dominant activity in most villages, the most common crop being cassava and some maize, though most communities rely on forest foods for household consumption. The limited area under cultivation (<0.5 ha per family) generally limits incomes within the ER-Program Area.

The forestry industry is the major employer in the region. It has attracted significant numbers of people to the area through both direct and indirect employment. For example, Pokola has grown from 300 to 13,000 inhabitants since the arrival of *Congo Industrielle des Bois*, the largest forest company in the area.

Subsistence hunting (authorized by the Forest Code) and hunting for profit (prohibited by law) are common, with negative consequences for biodiversity, and animal populations appear to be rapidly declining. Bushmeat is the primary source of protein and a means of income for the communities in the area. Animal farming is rare, although fishing is common along watercourses and in swamp forests.

Gathering non-timber forest products (e.g. Marantaceae leaves, Gnetum, raffia, fruit) is common, and often practiced by women for household consumption and sale. Small-scale trade occurs in the markets of population centers. Other limited sources of income include carpentry, food processing (milling grain and cassava) and professions such as domestic servants, hairdressers, etc.

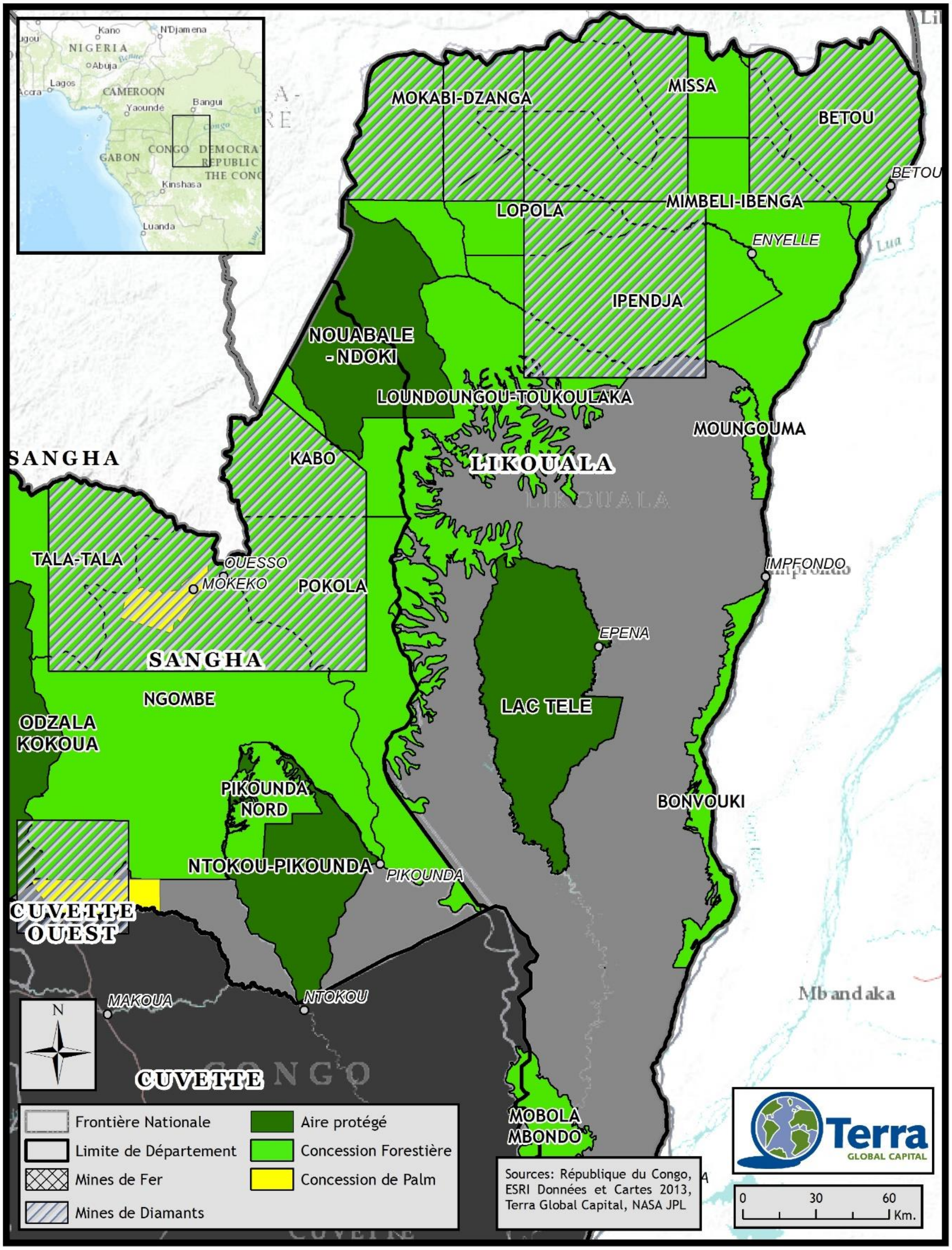

Figure 3. Land tenure and Land-Use in Likouala District

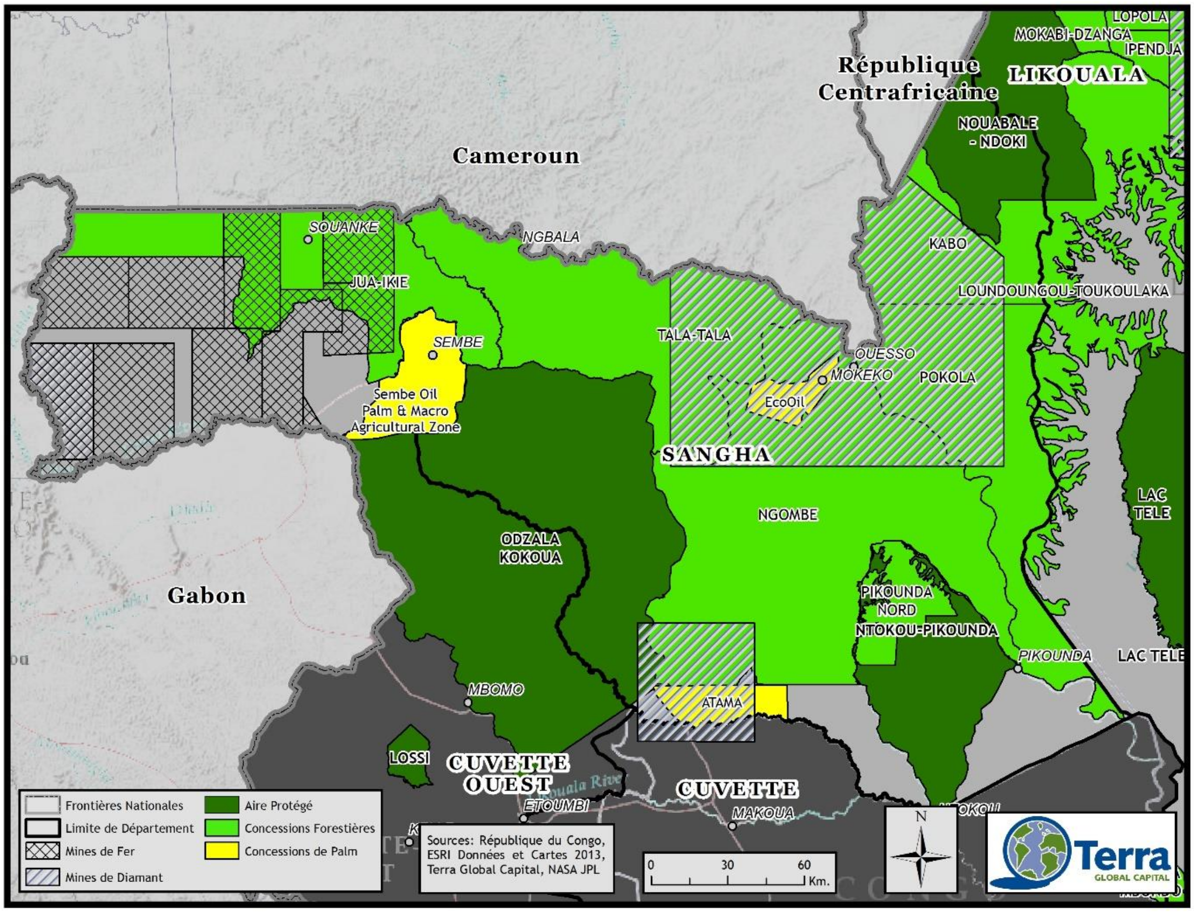

Figure 4. Land Tenure and Land-Use in Sangha District

4 DESCRIPTION OF ACTIONS AND INTERVENTIONS TO BE IMPLEMENTED UNDER THE PROPOSED ER-PROGRAM

4.1 Analysis of Causes and Drivers of Deforestation and Forest Degradation as well as Existing Activities Leading to Reversal and Increasing Carbon Stocks

The analysis of drivers of deforestation and degradation leverages the 1) study done for ER-PIN (Annex 3 and 4), 2) "Spatial Distribution and Causes of Deforestation and Degradation and Analysis of Strategic Options, Proposed by the R-PP for the Republic of Congo," [4] 3) fieldwork conducted in Sangha and Likouala, and 4) additional studies of drivers in the region. It includes the drivers operating both within and where relevant outside the ER-Program Area, linking these to relevant agents and underlying causes and, where possible, identifies current policies that could contribute to the enhancement of carbon stocks.

The analysis also takes into account historical patterns of development, which vary somewhat across the ER-Program Area. To wit, the more accessible western part of the ER-Program Area (primarily Sangha) supported somewhat more economic activity than the more isolated eastern part (primarily Likouala). For example, the area contains some of the older forest concessions, and also harbored a relatively well-developed cocoa sector and oil palm plantations until their gradual demise starting in the 1980s. Similarly, more recent patterns, in particular the rapid development of infrastructure, concentrated primarily on Sangha, while Likouala still remains relatively inaccessible. As a result, the forest cover in Likouala is more intact than in Sangha. The design of ER-Program Activities takes these developments into account.

Deforestation and degradation result from a complex interplay of both direct (proximate) drivers (those human activities that directly affect forest cover and result in a loss of carbon stocks) and indirect drivers or underlying causes (the complex interactions of social, economic, cultural, political, and technological processes at multiple scales) that affect the proximate drivers to cause deforestation and degradation.[5]

Logging, agriculture, agro-industries, and mining, are identified as the primary direct drivers of deforestation for the period of 1990-2010 for the ER-Program Area.[6] These drivers overlap somewhat with those first identified in the R-PP in 2011, where shifting agriculture, fuel-wood collection, illegal forest exploitation, and urban development were cited as principal factors.[7] Indirect drivers or underlying causes identified include weak governance, lack of policy coordination and land use planning, poverty and insufficient enabling conditions for sustainable

[4] CN-REDD/BRL Ingenerie/C4-EcoSolutions (2014) "Spatial Distribution and Causes of Deforestation and Degradation and Analysis of Strategic Options Proposed by the R-PP for the Republic of Congo."

[5] Hosonuma, N., et al. (2012). "An assessment of deforestation and forest degradation drivers in developing countries." Environmental Research Letters **7**(4): 044009 and Geist, H. J. and E. F. Lambin (2002). "Proximate causes and underlying driving forces of tropical deforestation." BioScience **52**(2): 143-150.

[6] Ibid., CN-REDD/BRL Ingenerie/C4-EcoSolutions (2014).

[7] R-PP, 2011 (p. 49).

economic activities, population growth and infrastructure. Furthermore, urban expansion and new businesses bring job opportunities in the area[8].

Two field missions to Sangha and Likouala took place in September-October 2015 to further verify the drivers. The analysis consisted of field observations (tours of multiple concessions; rapid biophysical evaluations of forest cover change processes) and interviews with stakeholders throughout the two departments (including representatives from departmental governments, agro-industrial producers, forest concession holders, mining companies, communities and small-scale producers, illegal loggers and miners, and conservation organizations present in the region). The field missions provided a grounded understanding of actual, planned, and potential future development of drivers related to agriculture, mining, transport, and infrastructure in the ER-Program Area. Figure 5 graphically summarizes the drivers, underlying causes and agents in the ER-Program area.

[8] Ibid., CN-REDD/BRL Ingenerie/C4-EcoSolutions (2014), p. 18.

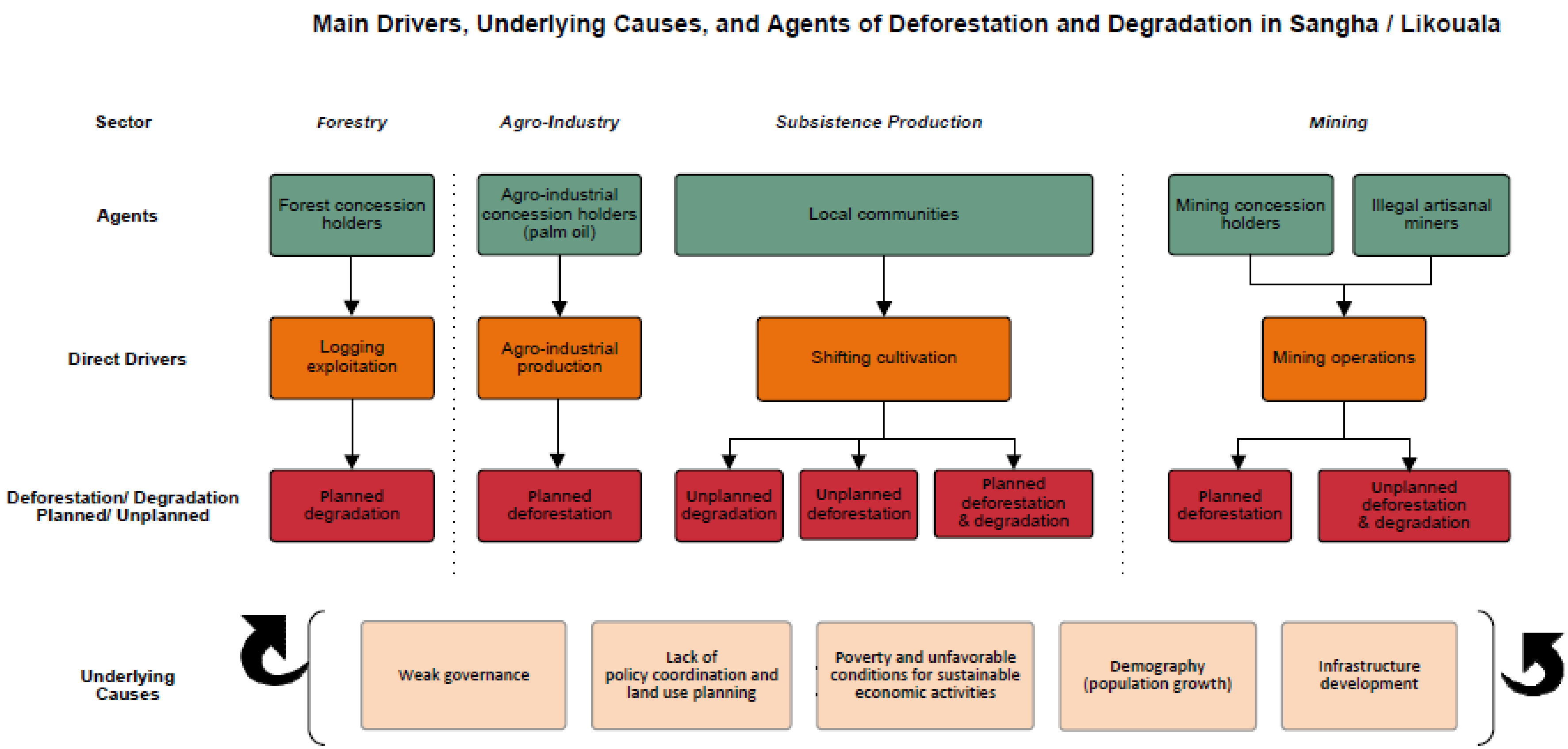

Figure 5. Main Drivers, Underlying Causes, and Agents of Deforestation and Degradation in Sangha / Likouala

Priority Direct Drivers of Deforestation and Degradation

Industrial Logging Exploitation

Congo has been a leader in regulating and assuring the sustainable development of the forest sector since the first industrial logging operations began in northern Congo in the late 1960s, and the establishment of the forestry code in 1974. Currently, 17 *Unités Forestière d'Aménagement* (UFAs) exist in the ER-Program Area, of which 16 are attributed to concession holders. Of the 16 attributed UFAs, 10 have approved forest management plans and 3 are in the process of being prepared or approved. Development of the logging industry historically centered on the more accessible Sangha department, with activities in Likouala being of a more recent nature.

Table 5. Forest Concession Holder and Nationality of Owners in Sangha and Likouala.

Attributed	Name of UFA	Name of Concession Holder	Department	Nationality of Owner
Attributed	MOBOLA MBONDO	Bois Kassa	Likouala	Congo
Attributed	LOPOLA	BPL	Likouala	Lebanese
Attributed	PIKOUNDA NORD	CIB-OLAM	Sangha	Singapore
Attributed	POKOLA	CIB-OLAM	Sangha	Singapore
Attributed	Kabo	CIB-OLAM	Sangha	Singapore
Attributed	LOUNDOUNGOU-TOUKOULAKA	CIB-OLAM	Likouala	Singapore
Attributed	NGOMBE	IFO	Sangha	EU
Attributed	BETOU	Likouala Timber	Likouala	EU
Attributed	MISSA	Likouala Timber	Likouala	EU
Attributed	MOKABI-DZANGA	Mokabi	Likouala	EU
Attributed	Moungouma	SEBT	Likouala	Congolese
Non-Attributed	Bonvouki	N/A	Likouala	N/A
Attributed	Karagoua	SEFYD	Sangha	Chinese
Attributed	MIMBELI-IBENGA	CIB-OLAM	Likouala	Singapore
Attributed	JUA-IKIE	SEFYD	Sangha	Chinese
Attributed	TALA-TALA	SIFCO	Sangha	Lebanese
Attributed	IPENDJA	Thanry-Congo	Likouala	Chinese

Each management plan is intended to guarantee sustainable management of the environment and natural resources. All management plans approved for UFA and UFEs in Sangha and Likouala were consolidated by analysis from: (i) mapping studies, (ii) the work of multi-resource inventories, (iii) dendrometic studies and ecological studies, (iv) socio-economic studies, and include (v) division of each UFA or UFE into respective series, and (vi) the determination of management measures for each.

All area within a UFA is divided up into one of five *séries d'aménagement*, defined as assemblages of land parcels grouped according to vocation and management objective. The *séries* include:

- Production Series, to ensure the sustainable production of timber;

- Conservation Series, to conserve biodiversity;
- Protection Series, to protect fragile or threatened areas;
- Community Development Series, to ensure socio-economic development of the populations;
- Research Series, to enable ongoing research.[9]

The majority of the degradation in forest concessions is related to logging and occurs in the production series, although limited logging is also permitted in the protection series. Despite the existence of the legal framework and government commitment to sustainable forest management, a few concessions either do not yet have approved management plans, or are not in compliance with their management plans.[10]

Some operators conduct illegal logging. The most recent 2014 report of the independent observer of the OI-VPA FLEGT notes in general the persistence of factors that contribute to the continuation of illegal logging including: illegal practices by forest concessions; the non-recovery of taxes and forest transaction costs; the partial or inadequate application of the forestry law, the weak allocation of budgets to departmental units to conduct field verification, and the lack of application of laws and related texts.[11]

In 2014, the independent observer for the VPA - VPA FLEGT documented concessions exceeding authorized road opening cutting widths resulting in extraction over authorized limits, in addition to unauthorized cutting within the ‘additional cut' of the annual cut of 2013.[12]

The agents of industrial logging exploitation, within the production areas for forest concessions are the forest concession holders. These include large international companies and smaller local companies.

Agro-industrial Palm Oil Production

Demand for palm oil is both regional (all of the countries in the region are net importers of palm oil) and global (for edible oil, industrial use, and biofuels). Current commercial production of palm oil in Congo covers only 5% of national demand, with imports reaching 30,000 tons per year for a value of 10 million CFA.[13] Three industrial plantation areas have been defined, and two concessions have been allocated thus far in Sangha, where the sector has its historical roots dating back to the colonial period. Field visits conducted in October 2015 identified other areas where smaller oil palm plantations are currently being cultivated outside of these formal concessions.

[9] Following Article 24 of decree 2002-437 and Arrêté n° 5053/MEF/CAB of the 19 Jun 2007.

[10] Brandt, J. S., et al. (2014). "Foreign capital, forest change and regulatory compliance in Congo Basin forests." Environmental Research Letters **9**(4): 044007.

[11] Rapport biennal conjoint 2013-14: République du Congo-Union européenne 2013-14. Sur la mise en oeuvre de l’VPA FLEGT en République du Congo.

[12] Projet OI-APV FLEGT, Rapport N°01/CAGDF

[13] PDSA, 2012, p. 79.

Table 6. Oil Palm Concessions and Holders within the ER-Program Area

Oil Palm Concession	Total Ha
ATAMA	56,288
Eco-Oil	47,320
Sembe Oil Palm and Macro Agriculture Zone (concession unallocated)	128,802
Total	**232,410**

Both ATAMA and Sangha Palm (now Eco-Oil) have recently initiated operations, are either beginning or have completed land clearing in initial areas and are starting to plant. In the case of Eco-Oil, land planned for clearing thus far consists of the mature Sangha palm groves in the Mokeko and Ouesso concession areas, which occupy a previously productive concession. However, there are forest areas within the concession, which can also be cleared. ATAMA's environmental impact assessment (EIA) states that 180,000 hectares across the Sangha and Cuvette departments will be developed in an area that has no pre-existing plantations, but although significant land clearing has occurred, very limited oil palm plantation has taken place.

The policies driving expansion in palm oil, as included in the Agriculture Sector Development Plan Sangha, identify several additional palm oil and agro industrial areas mostly in the western region. This includes an unassigned former plantation zone totaling 133,513 ha near Sembe; an additional 189,500 ha for palm oil production in the southernmost region of the department between the two rivers east near Epoma; and two more areas of 133,250 and 67,000 ha to be available still further west in the Souanke mining region. [14]

Owing in part to the incipient state of Congo's agricultural sector overall and the current lack of clarity regarding the rights and responsibilities of agricultural firms with regard to forests and adherence to the forest code, the agro industrial sector and most notably palm oil producers are currently highly unregulated. There is significant focus and even pressure from government to develop these areas, as they are seen to bring economic value to the country and concession holders are expected to exploit the industrial concessions they have been granted.

The agents of deforestation linked to agro-industrial palm oil production are national and international agro-industrial enterprises.

Shifting Cultivation Agriculture

Subsistence agriculture in Congo relies principally on the cultivation of cassava, maize, and forest crops such as oil palm for household consumption.

In Sangha, the pressure from agricultural production on forest areas is steadily increasing, especially along roadsides and within the CDZ.[15] Though agricultural production by and large is currently taking place within the allowed CDZ areas within forest concessions, there is growing concern that increased access by road development, urban expansion, and population growth in the region will increase pressure on other areas outside of the CDZs

[14] PDSA (2012), Sangha, p. 42

[15] CN-REDD, November 2014. Rapport Final "Etude de la spatialisation et de pondération des causes de la déforestation et de la dégradation forestière." (BLR Ingenerie et C4 EcoSolutions)

allocated to production, protection, conservation, and research. As an example, IFO-Danzer is undertaking educational efforts with communities to ensure that populations residing within the CDZ areas— principally along the now complete Brazzaville-Ouesso paved highway— are clearly aware of boundary markers posted along the CDZ and production series boundaries. Pressure from unplanned subsistence-based drivers is not limited to the CDZs; both agriculture and cut trees are evidence that deforestation is taking place within the protected areas and unattributed areas.

The agents of deforestation and degradation in the case of shifting cultivation are local residents of the two departments and migrants coming to the area for jobs who are engaged in subsistence farming almost entirely for household consumption.

Mining Exploitation

The last five years have seen Republic of Congo move aggressively into the development of its mineral resources. By the end of 2010, the Ministry of Mines had allocated 48 prospecting licenses to 28 companies and 49 research permits.[16] The rapid expansion of mining exploration permits was made possible by the introduction of a new Mining Code, in April 2005, which offered attractive terms and established a clear regime from exploration and exploitation agreements, and allows for foreign entities to control mining operations. Up until quite recently, the mining sector in Congo has been essentially artisanal: gold, diamonds, and industrial minerals such as salt, sand and marble.

Western Sangha is widely considered as an emerging iron ore province with three major iron ore mining projects (Avima, Nabeba, and Badondo) planned for the Djoua Ivindo forest area of Western Sangha.[17] There are two exploitation permits in the ER-Program Area, however, the actual impact of mining on deforestation in the areais minimal to date. While proven reserves have been found, falling iron ore prices have made it difficult for companies in the ER-Program Area to raise the required capital to begin exploitation. However, this could change in the future. Congo has very competitive production costs for iron allowing it to compete in global markets once operational.

Mining operations have direct and indirect impacts on deforestation and degradation. While direct impacts from mining are relatively modest in terms land clearing, mining does cause deforestation and habituate fragmentation in primarily dense tropical forests.[18] Mine-specific direct deforestation will depend on external factors related to the mining law and strength of enforcement, as well as mine-specific factors such as the stage of operations, spatial land use planning, type of mineral, location, need for development of transportation infrastructure, required labor pool, and the practices of the company that owns/operates the mine. For example, the direct footprint of the Nabeba Project is estimated to be 2,050 ha (800 ha for the Nabeba Mine and 1,250 ha for the rail spur), but the rail spur includes an estimated 550 hectares for forest offsets along the rail lines. While deforestation is relatively limited the

[16] K. Hund, C. Megevand, E. Pereira Gomes, M. Miranda, E. Reed, "Deforestation Trends in the Congo Basin: Reconciling Economic Growth and Forest Protection, Working Paper 4 - Mining," (The World Bank, 2013).

[17] De Wachter, P. and Mbolo, V., “TRIDOM Congo: Biodiversity conservation in an Emerging Iron Ore Province, Towards a Joint Effort with Mining Companies. *Presentation*, April 2015.

[18] Sundance Resources, Mbalam-Nabeba Iron Ore Project Annual Environmental Report 2013.

railway does however cause deforestation and habitat fragmentation in primarily dense tropical forests on elevated hills on Mount Nabeba.[19]

In terms of indirect impacts, infrastructure such as railways and mining settlements bring increased and easier access to forests, and increase population influx into mining areas. As such, these have a frontier effect increasing induced impacts such as agricultural expansion, bushmeat hunting, and logging are proven to increase illegal DF and DG associated with mining.[20] As in other countries in the Congo Basin, the laws in Congo are unclear about mining activities in and around various categories of protected areas, as well as on overlapping mining and forestry permits, increasing the possibility that forest concessions could experience mining-related deforestation/degradation related to exploration in forests previously assigned to a specific land use and management plan (e.g., production or protection).

Western Sangha is also considered as an emerging gold province especially in the area around Souanké, where artisinal mining has increased lately. In Likoula, diamond - which exploitation does not cause deforestation or forest degradation as diamonds can be found mainly in the riverbed - is prominent. There have been numerous studies on artisanal mining conducted by UNDP for the mining ministry. These have primarily covered the non-deforestation related issues, including the significant impact of mercury. The Ministry of Mines sees deforestation as a secondary negative impact from artisanal mining. But it is expected that as industrial operations grow and become successful, this will lead to further pressure on forests from the increased inflow of artisanal miners.

A new mining law is in the process of development. It is unknown at this time how the new law will impact the relationship between mining operations (both direct and indirect) and deforestation and degradation in the program area. One draft report analyzing the new law indicates that the new mining law may be less rigorous than the old one from an environmental perspective.

The agents of deforestation and degradation in mining exploitation are international and national mining firms, and to a lesser extent artisanal producers.

Table 7. Mining Companies active within the ER-Program Area (December 2015)

Permit Type	Company	Mineral	Department	District	Location
Exploitation	Motaba Mining	Diamond	Likouala	Dougou	Bangui Motaba
				Enyele	Mumbelly
Exploitation	Niel Congo	Diamond	Likouala	Dongou	Mokabi Ibenga
					Motaba
					Ipendja
					Iblinki
Exploitation	Congo Iron s.a	Iron	Sangaha	Souanke	Ibenga
Exploitation	Coré mining Congo ltd	Iron	Sangaha	Yangadou Souake	Mont Avina
Research	Sai-Congo	Rough Diamond	Likouala	Enyelle	Mokabi-lola
Research	Societe de distribution internationale	Diamond	Likouala	Betu	Lokoume
					Betu Koumba

[19] Sundance Resources, Mbalam-Nabeba Iron Ore Project Annual Environmental Report 2013
[20] Hund, et al., p. 45.

Research	Maud Cong	Titanium Iorn	Sangaha	Souanke	Gola Minguelakum
Research	Sanu Resources	Manganses	Sangaha	N/A	Seka
Research	Avina Gold SARL	Gold	Sangaha	Souanke	Mclamankoue (Avina-or)
Research	Golden Lion	Iorn	Sangaha	Souanke	Avina Est
Research	Sai-Congo	Rough Diamond	Sangaha	N/A	Ketta
Research	Mac- Congo Mines Auriferes et carrieres du Congo	Gold and related substances	Sangaha	Souanke	Elogo-Alangog Elogo- Jub
Research	Yuan Congo Wang	Gold	Sangaha	Souanke	Elen

Table 8. Land-use Change Impact by Stage of Mining

Stage	Land-use Change Impacts[21]
Exploration	Direct land-use impacts from exploration are relatively small with few invasive techniques as activity tends to follow existing roads and infrastructure. As exploration expands, construction of new roads for exploratory drilling can cause land-use change both directly or indirectly through opening up forested areas.
Construction	The construction phase of the mining cycle causes the greatest direct land-use change. Areas of vegetation are often cleared for mining areas, buildings and infrastructure (access roads, railways, pipelines and power transmission lines). Open pit mines, typical for iron mining, generally have the largest direct footprint.
Operation	Land-use change during operation is relatively small compared to construction, but may continue over time. The main land-use change from operations is the progressive expansion of the mine site as well as the deforestation impact from people moving into the concession areas to support the mine.
Closure	The level of restoration will depend on local requirements and governance capacity. However, this is not relevant for the ER-Program period.
Post Closure	Sites that have been mined out by large mining companies may still hold value for artisanal miners, which can lead to further deforestation or degradation. However, this is not relevant for the ER-Program period.

Underlying Causes of Deforestation and Degradation and Key Trends

Indirect drivers or underlying causes of deforestation and degradation for the ER-Program Area are much the same as for the national level: weak governance, lack of policy coordination and land use planning, poverty and insufficient enabling conditions for sustainable economic activities, population growth and infrastructure development. The changes in these indirect factors will affect the rate and type of future deforestation and degradation.

[21] Summarized from http://www.icmm.com/document/2662

Weak Governance

Forest governance in the Republic of Congo still presents some weaknesses. For instance, a bias in the legal and regulatory framework for industrial exploitation leads to the fact that artisinal sector - which represents 30% of total timber production - is hardly controlled.

Furthermore, as improved infrastructure makes informal wood extraction by small-scale operators more feasible, the informal sector is likely to play a larger role in forest degradation. Due to its decentralized and clandestine nature, it is notoriously difficult to control.

In the industrial sector, law enforcement and application varies significantly between different forest concessionaires, i.e. the application of laws and reduced impact logging requirements still lags in many concessions. In addition, transparency in the allocation of forest concessions and control could be improved. All this results in higher unplanned forest degradation risks.

Lack of Policy Coordination and Land Use Planning

REDD+ must be inter-sectoral if it is to address its social and institutional dimensions, mobilize the various economic sectors and levels of authority, and counter divers of deforestation and degradation with a multi-sector and integrated approach. Policy coordination is not effective and the Decree No. 2009-904 of 31 August 2009 establishing an inter-ministerial committee for consultation in case of overlapping uses in natural ecosystems is still not implemented.

The Republic of Congo has not yet been able to align sectoral policies such as the key economic activities as laid out in the National Development Plan. Especially with regard to the stresses related to global demand for agricultural products such as palm oil and cocoa, mining products, and infrastructure development, the lack of policy harmonization still poses challenges.

Tradeoffs exist between different economic interests at the national level. High-level political involvement is needed to reconcile competing land uses, among them agriculture, mining, infrastructure, and forestry.[22] While Law No 43-2014 of 10 October 2014 for Planning and Development of the National Territory demonstrates Congo's commitment to sectoral harmonization, the National Land Allocation Plan is yet to be rolled out.

It should be noted that Congo has applied for CAFI funding to address this gap. CAFI's two-fold objective is that: (i) ROC will use the NIF as a coordination platform. That means that development partners will be encouraged to align their programs and initiatives with the NIF and (ii) ROC also intends to use the NIF to mobilize additional resources and direct them towards priority programs identified in the comprehensive investment plan.

[22] ibid., Megevand, C. (2012).

Poverty and Insufficient Enabling Conditions for Sustainable Economic Activities

Congo's development strategy, articulated among others in the National Development Plan, foresees exploiting the country's non-hydrocarbon natural resources (including timber, minerals, and agricultural products) to diversify its economy. Provided global commodity markets offer sufficient price incentives, this will increase competition for forest lands, in particular while oil prices remain low.

In addition, if nothing is done to fill the lack of upfront funding, incentives and transfer of knowledge at a national level to allow populations to develop agriculture (e.g. alternative cash crops take 3 to 5 years to generate income), poverty in the program area will be worse and will limit population's participation to the program's activities and increase pressure on natural resources to meet LCIP basic needs (such as food security and fuelwood).

Furthermore, the lack of support to sustainable economic activities through the implementation of necessary enabling conditions coupled to an unfavorable business climate (RoC is facing some problems with the oil prices fall) is limiting stakeholders' involvement in the value chains (processing, marketing etc.) for agricultural and wood products. The development of perennial crops to generate revenues and employment becomes even more difficult.

Population Growth and Migration

National population growth was 2.94% in 2014, and the expansion of infrastructure means that populations can spread to newly reachable settlements with relatively abundant resources in the ER-Program Areas.23 Population growth contributes primarily to unplanned degradation and deforestation as a result of small-scale agricultural activities and demand for wood energy. Refugees from CAR and DRC can also represent a potential threat. Further work is ongoing with UNHCR to try and quantify the impact refugees have and can have in the future. The results from this work will be integrated into the further ER-PD version.

Infrastructure Development

Until quite recently, much like other countries in the Congo Basin, transportation infrastructure in northern Republic of Congo was among the most deteriorated in the world, with the ER-Program Area essentially disconnected from the southern half of the country and Brazzaville. Between 2006 and 2011 public financing to the transport sector increased by a third.[24] A high quality highway from Brazzaville to Ouesso is now complete. An additional east-west trunk line from Ouesso to Sembe was completed in September 2015 with the extension of this road to neighboring borders of Cameroon and CAR planned for the near future. This means that access to forests and land in Sangha west of the Sangha River has dramatically improved. Meanwhile, while Likouala and Eastern Sangha are still more isolated, plans are afoot to connect Ouesso to Bangui through a major trunk road, and companies in the ER-Program Area are continuing to invest in roads and bridges.

[23] World Bank Indicators, Congo.

[24] African Development Bank, 2011 African Development Bank. 2011. Développement des infrastructures au Congo: Contraintes et priorités à moyen terme. Département régional centre (OCRE). Tunis, Tunisia: African Development Bank.

Though improvements in transportation infrastructure are a prerequisite to regional development and direct impacts on forests have only recently been a contributing factor to deforestation, these indirect and induced impacts (expansion of settlement, roads, increasing conversion of forest to subsistence and industrial agriculture), if left unmitigated, could be severe and widespread. Of all of the different scenarios tested by the CongoBIOM model,[25] a scenario modeling improved transportation infrastructure is "by far the most damaging to forest cover", with most impacts resulting not from direct impacts but from indirect impacts associated with higher connectivity. Assuming that the region implements the planned transportation infrastructure, indirect impacts associated with mining could be very large with an estimated 234% increase in deforestation as modeled for the Congo Basin[26]

4.2 Assessment of the Major Barriers to REDD+

Efforts beyond the forest sector and engagement with a wide variety of stakeholders and actors in Congo's development process will be required to support successful development of REDD+ in Congo. Several challenges across a range of sectors can be identified:

Rural poverty

Farmers' means and capacity to invest in sustainable agricultural practices are limited due to a lack of economic opportunities, access to credit and low access to capital for rural families. Upfront financing for these kinds of investments is virtually non-existent, leading to reliance on external funding sources.

Land tenure insecurity

The National Forest Domain is not entirely defined yet. This results in misunderstandings between users and especially on the question of overlapping uses. Land tenure insecurity, which not only compromises investment and sustainable and long-term land management, but also encourages the rapid and short-term exploitation of resources.

Legal barriers

Customary right - as applied by local population - is often hampered by written modern law (written right). Illiteracy, fiscal constraints and administrative registration, are all obstacles to the success of registering customary land rights in the official register of mortgages. Moreover, it often happens that local people do not recognize the value of the written modern law. This represents a source of conflict and a risk of non-participation of rural people to REDD + activities to which limited resources allocated to state control officers to enforce the law and ensure the right of ownership to citizens can be added .

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[25] In an effort to investigate drivers of deforestation and resulting greenhouse gas emissions by 2030, the World Bank, in partnership with the six Congo Basin countries and partner organizations agreed to collaborate and analyze major drivers of deforestation in the region. CongoBIOM, is an adaptation of the GLOBIOM model set up by the International Institute for Applied Systems Analysis (IIASA) and tailored to the Congo region (CongoBIOM). The scenarios developed were intended to highlight internal and external drivers of deforestation.

[26]Ibid., p. 23.

The legal status of carbon credit claimers is not clarified yet. This is a major step to secure and facilitate the completion of transactions in response to a request that could come from both governmental and private entities.

Unclear Framework for Sustainable Management in Agroindustry and Mining Sectors

Agroindustrial and mining actors have a potential positive role to play in reducing deforestation and degradation in the program area, but left unaccompanied they also represent a risk. For the moment, it is not clear how the new mining code will enhance sustainability or advance high environmental management standards.

Weak political and administrative coordination

As highlighted in the National REDD+ Strategy Framework, REDD+ must span multiple fields of development if it is to address its social and institutional dimensions, mobilize various economic sectors and levels of authority in a consistent and coordinated manner and counter the direct and underlying causes of deforestation and degradation with a multi-sector and integrated approach. Insufficient engagement of all sectors and all levels of administration (from central to decentralized levels) continues to be a barrier to the effective implementation of REDD+.

4.3 Description and Justification of the Planned Actions and Interventions Under the ER-Program that will Lead to Emission Reductions and/or Removals

Strategic Vision and Approach to Sustainable Development

After many years of relative geographic isolation, the two primary forest departments in the Republic of Congo, Sangha and Likouala, have been transforming rapidly in recent years from west to east with increasing infrastructure development. This potential is projected to grow further in the future. The ER-Program is designed to shift the two departments onto a more sustainable development pathway by providing incentives to reduce deforestation and forest degradation, while not curtailing their economic development. Moreover, one of the main characteristics of the program area is that spatially there are still a lot of differences in population density and there are large areas that can be potentially kept under forests, either through conservation areas or certified forest management (as shown in Figure 6 below).

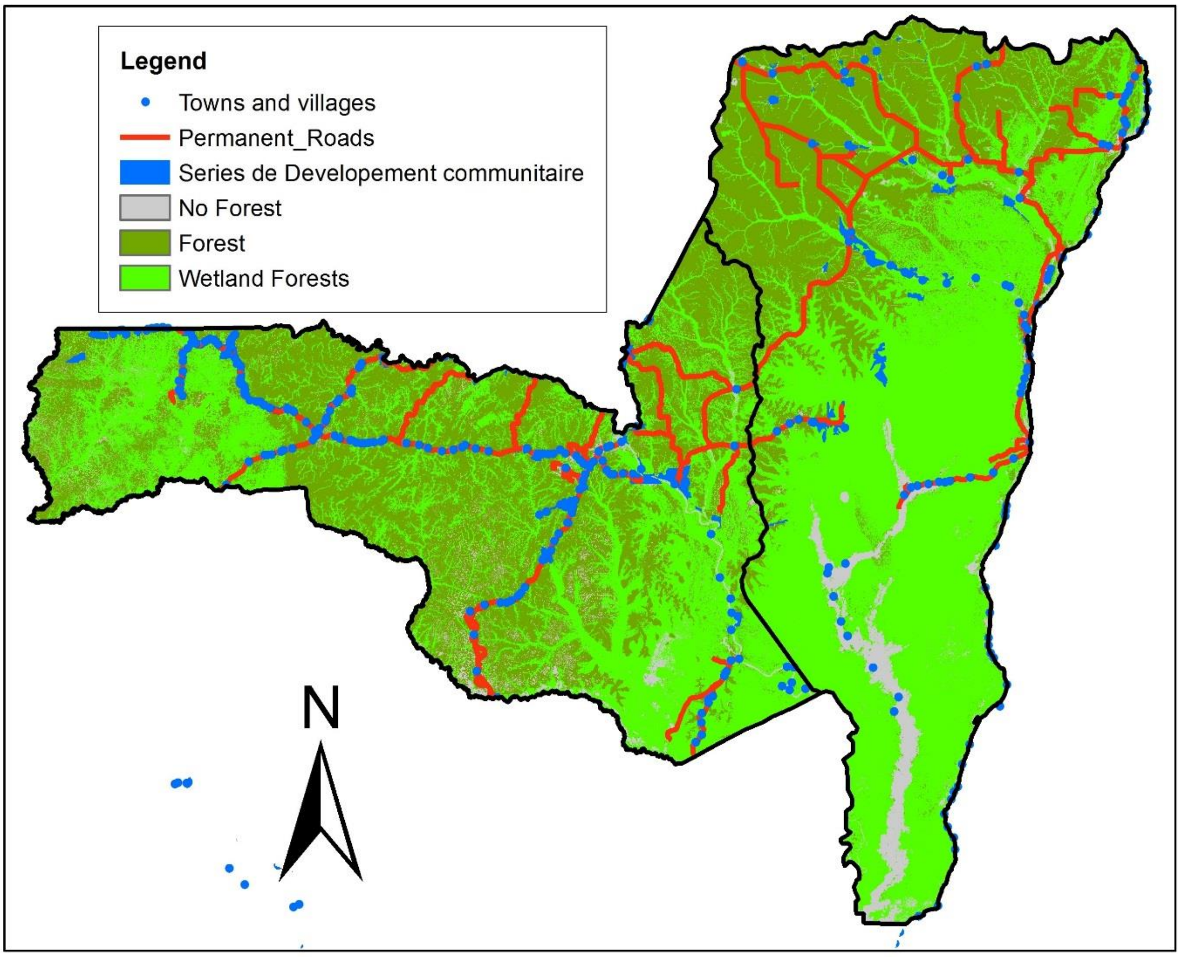

Figure 6. Population repartition in the Program Area

In order to achieve the program objectives and attain the transformational effects needed, the program will adopt a a sub-regionally diversified, multi-sectoral strategy that combines sectoral activities and enabling activities in accordance with the five pillars of the national

REDD+ strategy. It will work with and through departmental and local structures, e.g. the CODEPA REDD and LCIP, to integrate REDD+ into local development planning.

Enabling activities aim at creating favorable conditions to the implementation of sectoral activities while also addressing underlying causes of deforestation. They do not generate emission reductions directly.

Sectoral activities aim at addressing direct causes of deforestation and forest degradation. They generate measurable and verifiable emission reduction. The sectoral activities are designed to address major drivers of deforestation in conjunction with sustainable development objectives of the primary sectors of the northern economy. They are planned to incentivize:

1) the conservation and sustainable management of forests;
2) the reduction of conversion of forests to oil palm plantations;
3) improved planning of mining infrastructure;
4) the adoption of perennial crops, agroforestry systems and sustainable agricultural systems on degraded lands in lieu of more extensive slash and burn agriculture;
5) the development of outgrower palm oil schemes on degraded lands;
6) improved management of protected areas.

Based on the strategic options of the National REDD+ Strategy (Strategic Option 2 Sustainable forest management, and Strategic Option 3 Improvement of agricultural systems) and tailored to the geography of the ER-Program area, in which concessions cover a large majority of the forest area and exert corresponding influence on the forest cover, the program leverages private sector participation while supporting the active participation of LCIPs so as to produce broad development benefits.

Crucially, the ER-Program uses climate finance to set the development path of a new and rapidly growing commodity sector on a sustainable track by supporting forest-friendly approaches to cocoa cultivation. There is significant leverage potential of private sector resources in this sector, which the government intends to exploit. The proof of concept that the ER-Program provides hence can have an impact well beyond its accounting area.

Table 9 summarizes the set of enabling and sectoral activities of the ER-Programm in line with the strategic options of the national REDD+ strategy.

Table 9. Summary of the enabling and sectoral activities of the ER-Program

National REDD+ Strategic Option	Activity	Description	Impact on ERs	Geographic Focus
		SECTORAL ACTIVITIES		
FOREST OS2 Sustainable forest management	**SA1.** Reduced Impact Logging with Concession Holders	• Adopt Reduced Impact Logging to minimize DF and DG in production areas	• Reduced planned DG from improved extraction processes	• Entire ER-P Area
	SA2. Logged to Protected Forest	• Protect areas that could have been logged	• Reduced planned DG from protecting areas that would have been logged	• Entire ER-P Area
	SA3. Smallholders conservation payments	• Collective and individual PES to support conservation	• Reduced unplanned DF and DG in forest areas by participating communities	• Entire ER-P Area
AGRICULTURE OS3 Improvement of agricultural systems	**SA4.** Avoided Conversion in Industrial Oil Palm Plantations	• Contractual agreements to not convert HCV areas within concessions that could be legally and biophysically cleared and planted with oil palm	• Reduced conversion from forest to oil palm (avoided planned DF) • "Reforestation" of non-forest to oil palm	• Southwest Sangha
	SA5. Smallholder shade cocoa in Community Development Zones	• Promote the production of Cocoa by smallholders in deforested/degraded forest in/near community areas in forestry concessions based on local land use planning to reduce shifting agriculture	• Increased forest carbon stocks by adding Cocoa plantings and shade crops to degraded forests, which reduces the surface area under annual crops and unplanned DF and DG in forest areas within impact zone of participating communities	• Entire ER-P Area
	SA6. Palm oil outgrower schemes in Community Development Zones	• Oil Palm concession holders (or others with processing capacity) promote new plantings in non-forest areas to smallholder outgrower schemes for processing in their facility	• "Reforestation" into new smallholder oil palm systems • Reduced unplanned DF and DG in forest areas within impact zone of participating communities	• Western Sangha
	SA7. Sustainable subsistence farming and others	• Promoting improved agricultural productivity and crop diversification	• Reduced unplanned DF and DG	• Entire ER-P Area

	livelihoods activities			
ENABLING ACTIVITIES				
Governance OS1 Governance Reinforcement	**EA1.** National land-use planning	• Support for roll-out of national land-use planning to optimize land use	• Will help reduce unplanned and planned DF and DG by optimizing land use and avoiding overlapping land use claims	• National
	EA2. Local land-use planning	• Planning land use in Community Development Zones	• Will help reduce unplanned DF and DG to direct establishment of agroforestry and intensified agricultural systems	• Entire ER-P Area
	EA3. Community level governance	• Reinforce local governance and local development funds	• Will help reduce unplanned DF and DG by enabling communities to harness carbon payments for local development initiatives	• Entire ER-P Area
ENABLING FOREST OS1 Governance Reinforcement OS2 Sustainable forest management	**EA4.** Forest governance	• Adoption of new forest code • Improved governance of timber operations • Supplemental investments: Support VPA/FLEGT	• Will help reduce planned DF and DG	• National
	EA5. Improve protected area management	• Support management of protected area, creation of new PA, implement ecological corridor • Local multi-stakeholders anti-poaching strategy	• Will help reduce unplanned DF and DG	• Entire ER-P Area
ENABLING AGRICULTURE OS3 Improvement of agricultural systems	**EA6.** Support for developing sustainable palm oil production	• Inclusion of RSPO as priorities in national agricultural/oil palm strategy	• Will help reduce unplanned and planned DF and DG	• Western Sangha
	EA7. Support for developing sustainable cocoa production	• NDP Cocoa • Supplemental investments: Infrastructure investments (roads and port storage)	• Will help reduce unplanned and planned DF and DG	• Entire ER-P Area
	EA8. Support for sustainable subsistence farming value chain	• NDP Agriculture • Supplemental investments: Infrastructure	• Will help reduce unplanned and planned DF and DG	• Entire ER-P Area

		investments (roads and port storage)		
MINING OS5 Development of a green mining sector	**EA9.** Reduced Impact Mining	• Reduced deforestation through government requirements for permits and better governance • Voluntary adoption of more sustainable practices by mining companies	• Will help reduce planned DF and DG	• Entire ER-P Area

Sector Activities

FOREST PILLAR

Sector strategy

Tropical forests generally have a diversity of tree species, most of which have either unknown or commercially undesirable wood properties, are too small or are too rare and therefore unknown.[27] Thus, only a small selection of species delivers economic benefit for timber production. Most concession holders on natural forests practice some form of selective logging, which is the case in the ER-Program Area. However, the practice of selective harvesting and its impact on forests vary.

The strategy of the program relies on two main approaches: (i) reduced impact logging and (ii) conservation.

- To achieve the double goal of reducing deforestation and degradation due to industrial logging while meeting the demand for wood products on both national and international markets, the program will support logging companies (i) to reduce their impact on forests through the adoption of RIL techniques and (ii) to comply with certification requirements.
- To promote conservation and increase carbon stocks, the program will support the creation/extension of conservation concessions.

The program will reward efforts to reduce emissions in logging concessions already advanced in the process of forest management. Transparency and monitoring will be the program's strength to demonstrate that the Republic of Congo is a leader in sustainable forest management.

<u>Medium-term vision and sustainability:</u>

- Of the 5.5 million ha of FSC-certified forests in the Congo Basin, the Republic of Congo has 2.5 million FSC certified ha in its northern territory, which represents almost half of the total certified area in the region. The two companies (CIB-OLAM, IFO) managing those 2.5 million ha are leading the way and showing that this type of forest management can deliver substantial ecological and development benefits when compared with conventional approaches, while being commercially viable. The example of these two companies will help promote RIL and reach the mid-term goal to increase the number of concessions in the program area to adopt RIL. The gradual dissemination of sustainable practices will bring significant opportunities to the forest sector. Indeed logging companies' participation in the ER-Program will enable them to: (i) be rewarded for their efforts to reduce their impact on forests and (ii) foster higher trust with commercial partners, especially through certification.
- The development of conservation concessions represents an opportunity to reduce both planned (from logging companies) and unplanned (from communities) deforestation and degradation, as they provide alternative value to forests.

[27] Lindenmayer and Laurance 2012

Conservation concessions can also be subject to other economical uses, such as NTFP collection.

- The ER-Program will gradually implement a payment system for environmental services, for both conservation concessions and community forests (in the Community Development Zones). Proceeds will be invested in the medium-term by a revolving fund such as the Local Development Funds.

Key activities

SA1. Reduced Impact Logging

Reduced impact logging (RIL) deploys practices that involve selective logging and intensively planned and carefully controlled implementation of timber harvesting operations, to reduce the environmental impact on forest stands and soils. Under RIL, a number of measures are undertaken to minimize the damage to the residual forest, and particularly future timber trees. This may or may not be accompanied by certification under FSC or other recognized standards.

RIL measures support long-term sustainable forest management practices, while allowing for income generation from timber extraction. Generating emission reductions by these ER-Program Activities involves implementing RIL coupled with adopting or maintaining certification under an ER-Program-accepted RIL standard on forest concessions in the ER-Program Area. RIL actions will include reduced timber extraction volume, reducing width and distances of primary and secondary logging roads, optimizing the skid trail network, and reducing damage done by cutting trees.

Two concessionaires within the ER-Program Area (CIB-OLAM and IFO-Danzer) currently practice RIL. Between 2006 and 2011, four concessions held by these two companies within the ER-Program Area secured FSC certification, which involves adoption of RIL practices, accompanied by other sustainable development and production measures. These concessions will need to maintain their commitment to FSC certification or adopt another recognized standard, and new concessionaries are expected to adopt RIL practices and potentially complete certification to reduce the planned deforestation and degradation in their production areas.

SA2. Set aside or Logged to Protected with Forest Concessionaires (LtPF)

In addition to RIL, forest concession holders may also elect to set aside forest areas for protection beyond those required by law. This is called Logged to Protected Forest (LtPF), which could include (1) protecting currently logged or degraded forests from further logging and degradation, and (2) protecting unlogged forests that would otherwise be logged.

For LtPF, the timber operator agrees not to harvest all or part of the areas that could feasibly be harvested. This activity would include the cancelation of the planned degradation and deforestation activities and the decision to instead protect the forest area, while maintaining and protecting the biodiversity of the area. This can be particularly valuable as the Program Area features considerable biodiversity, including one of the largest known lowland gorilla populations in the Congo basin.

Currently one Verified Carbon Standard (VCS) project in the ER-Program Area, Pikounda Nord, is implementing LtPF. This project has issued verified emission reductions under the VCS that will be integrated into the ER-Program (Chapter 18.1). There is also a new conservation area that is being created in two forest concessions, Tala-Tala and Jua-Ikie, referred to as Messok Dja. This has been facilitated by WWF.

RIL and LtPF ER-Program Summary of Activities	
Incentives	• Carbon-linked payment per hectare of RIL/LtPF
Program targets after 5 years	• 7 concessions with certified RIL • 2,852,204 hectares RIL certification with 10% LtPF
Potential Implementing Partners	• Timber concession holders
Direct Beneficiaries	• Timber concession holders • Communities through a contribution (5% under consideration) to the community development fund.
Enabling activities and programs related	• New forest code • Improved governance of timber operations • FLEGT and VPA
Links to national strategy	• Policy Option 2: Sustainable management of forest resources.

SA3. Smallholders conservation payments (PES)

Smallholders conservation payments consist of providing incentives for the conservation of local community forests (located in the CDZs and in protected area buffer zones) in line with Simple Management Plans (*Plans Simples de Gestions* in French*)* developed by FEDP (see EA2).

The smallholders conservation payments will be deployed at two levels:

1. **Collective incentive for conservation**. This payment aims to address community activities such as illegal logging or artisanal mining that can represent threats to forest sustainability. These activities can be organized at a community level and should respect local land-use planning.

2. **Individual incentive for conservation**. This payment aims to accompany the three agricultural activities further developed in Agricultural Pillar. In that case, the conservation payments will help smallholders give up shifting slash and burn practices and limit any rebound effect. Individuals will receive payments to reinvest in their sustainable agriculture model and to maintain those agricultural schemes.

Those payments will be based on performance (on the number of ha of forest conserved that would have normally been burnt and deforested by slash and burn agriculture practices). Communities and individuals will receive incentives only on the condition that they strictly follow the rules associated respectively to (i) the Simple Management Plans, (ii) the agricultural scheme they chose to implement (sustainable shade cocoa, smallholder oil palm or sustainable subsistence farming), and (iii) the reduction of areas burnt for their agricultural practices.

Smallholders conservation payments (PES)	
Incentives	• Collective to address illegal logging, artisanal mining. • Individual to help smallholders give up shifting slash and burn agriculture
Program targets after 5 years	• 1.147.891 ha of local forest conserved
Potential Implementing Partners	• CMDC, FDL
Direct Beneficiaries	• Communities in CDZ and PA buffer zones
Enabling activities and programs related	• Local Land-use Planning • Community level governance
Links to national strategy	• Policy Option 2: Sustainable management of forest resources.

AGRICULTURE PILLAR

Sector strategy

Slash and burn agriculture is one of the main driver of deforestation in the Program Area. In addition, industrial agriculture is also threatening to become a major driver of deforestation.

To address those two drivers, the strategy relies on two main objectives: (i) to reduce the impact of industrial commodities and shift them to non-forest areas, (ii) to generate alternative income and food security for rural communities. These objectives will be met through: (i) trainings and technical assistance, (ii) up-front material support (inputs, tools, etc.) and (iii) results-based payments.

This will further depend on (i) enabling activities that provide general support to value chain development, (ii) local land use planning, and (iii) agreements with farmers for using a reduced forest area in exchange for inputs into crop production that will boost their incomes.

<u>Mid-term vision and sustainability:</u>

- The gradual dissemination of more sustainable practices will bring significant opportunities for the palm oil sector. Indeed agro industrial companies' participation to the program will enable them to: (i) be rewarded for their efforts to reduce their impact on forests and (ii) foster higher trust with commercial partners, especially through certification.
- Through a combination of investment and results-based payments, the program will propose a set of activities to encourage households and small farmers to reduce the surface area required by slash-and-burn agriculture. The three activities of (i) smallholder cocoa in degraded forests, (ii) outgrower oil palm in existing non-forest areas, and (iii) sustainable subsistence farming and other livelihood activities are designed to work together to boost incomes and reduce the area needed for food production.
- The non-carbon revenues generated by agricultural diversification will be an incentive to maintain these sustainable agricultural practices over the medium-long term.

Key activities

SA4. Reduction of Forest Conversion from Industrial Oil Palm (HCVPalm)

Two large industrial plantations in the ER-Program Area have been granted to concession holders: (i) ATAMA concession to Wah Seong Corporation, a company listed on the Malaysian stock exchange, which holds a concession located primarily on largely untouched forests and (ii) Eco-Oil Congo to the national WEC group, with operations primarily on a defunct former oil palm concession. Another large area has been identified and targeted under the Sangha Agriculture Sector Development Plan, but without a concessionaire to date. The ER-Program promotes (i) commitments to minimize the conversion of forest area beyond what is required by law, and/or (ii) adoption and certification under Roundtable for Sustainable Palm Oil (RSPO) standards. While related, reduced conversion from industrial oil palm is considered separately from the promotion of smallholder outgrowers for processing with the plantation operators.

The government policy of promoting palm oil is a strong economic driver and development tool. While options are under investigation in both the private and public sectors to avoid deforestation and degradation, including identification of High Value Conservation (HVC) areas and RSPO certification within agricultural concessions, none of these policies or activities are currently in evidence in the Program Area.

Identifying, Preserving and Maintaining HCV Areas

Companies implementing ER-Program activities that set aside HCV areas will identify areas of natural habitat within the plantation estates which have critical ecological benefits, and that are valuable to the biodiversity of the area as well as to local stakeholders. The companies would agree to prevent the conversion of the HCV areas to palm oil plantation, and to implement a management plan to monitor these areas to ensure permanence of their inherent environmental and social value. In addition to preserving invaluable environmental benefits, avoiding the conversion of HCV areas to oil palm will generate emission reductions, which will result in carbon-linked incentive payments. This carbon revenue will be used to fund the ongoing maintenance of HCV areas, and ensure that these areas are protected from the operation of the oil palm plantation.

An initial HCV analysis was conducted on the concessions in the ER-Program Area. The proposed HCV areas were delineated based on relative levels of biodiversity, ecological productivity, and social impact following methods outlined by the Zoological Society of London (2013)[28] and Whitehead et al (2014)[29].

The participants will be palm oil concessionaires.

The ATAMA concessions in Sangha (which entered the palm oil business in 2009) include large areas of primary forest. Opportunities for participation in the ER-Program would be to identify and protect the HCV areas in the concession that would have been suitable (legally and biophysically) for conversion from forest to oil palm and adopt RSPO certification.

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[28] Zoological Society of London. 2014. A Practical Handbook for Conserving High Conservation Value (HCV) Species and Habitats Within Oil Palm Landscapes in West and Central Africa. World Bank/IFC.

[29] Whitehead, Amy; Kuajala, Heini; Ives, Christopher; Gordon, Ascelin; Lentini, Pia; Wintle, Brendan; Nicholson, Emily; Raymond, Christopher. 2014. Integrating Biological and Social Values When Prioritizing Places for Biodiversity Conservation. *Conservation Biology* 28: 4, 992-1003.

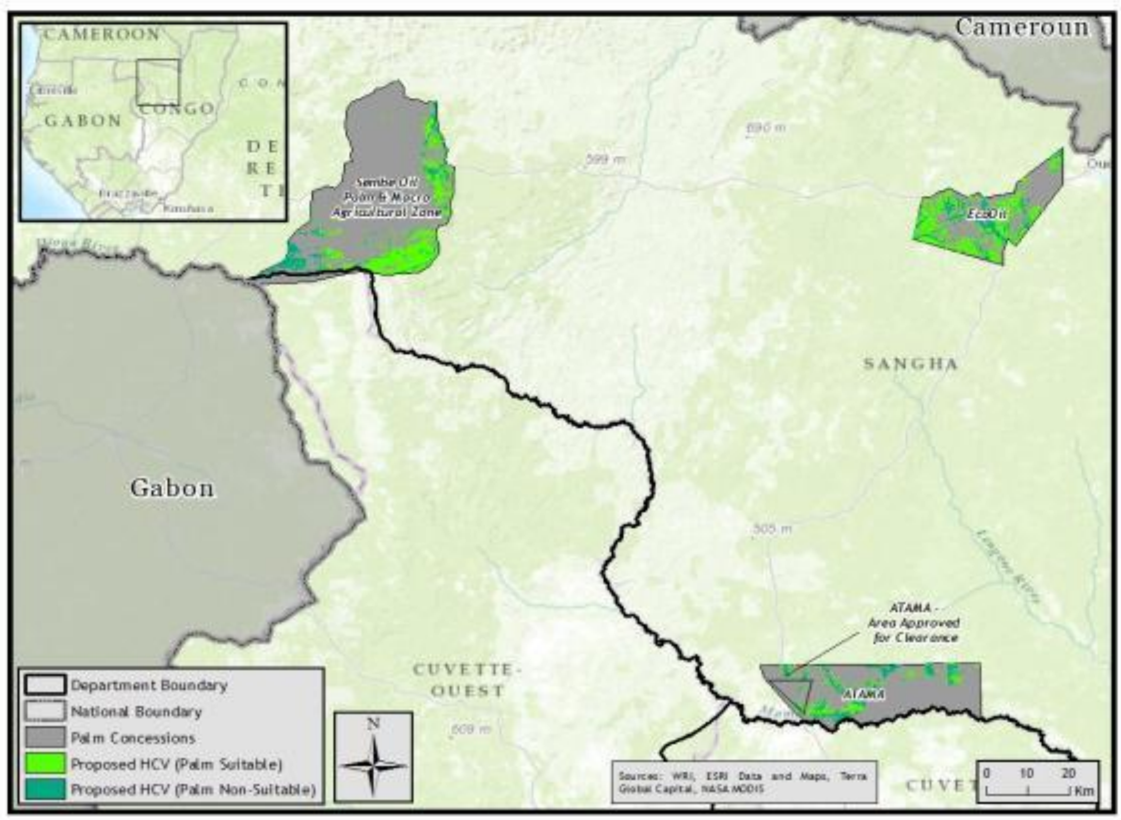

Figure 7. Map of Preliminary HCV Areas in Industrial Plantations

The Eco-Oil concession (which entered the palm oil business in 2013) contains significant areas of old oil palm plantations that can be developed without causing deforestation of natural forests but through converting old plantations into new productive plantations with the same long-term carbon stocks. However, Eco-Oil's business plan is not solely supported by the replanting of these old plantations. Their adoption of HCV set-asides and RSPO is a targeted ER-Program activity. Eco-Oil began evaluating the requirements for RSPO certification in 2015, and has indicated that this is a priority.

The ER-Program will incentive oil palm concession holders to adopt practices that strike a balance between protecting HCV areas and maintaining business viability and development objectives.

The identification of HCV areas would be conducted with the aid of local populations, NGOs, and local and national governments using remote sensing data and field visits using RSPO best practices. Concession holders can adopt the ER-Program measures at two levels, (i) reduced cleared areas beyond those which are legally granted under the concession, and (ii) adoption of RSPO certification, which allows no clearing of HCV or selected clearing of HCV with offsetting. Adopting and certifying under RSPO stipulates certain requirements for certification with regard to assessment and protection of HCV areas, which would result in avoided planned deforestation.

Industrial Oil Palm ER-Program Summary of Activities	
Activities/incentives that promote adoption	• Carbon linked payment for HCV Areas
Program targets after 5years	• 6449 hectares are declared HCV • 2 concession holders have certified RSPO
Potential Implementing Partners	• Existing concession holders, Eco-Oil and ATAMA
Direct Beneficiaries	• Palm Oil companies • Communities who receive the opportunity to adopt outgrower palm oil, which is a separate ER activity but is promoted by palm oil companies in part to defray the loss in production from HCV set-asides
Enabling activities and programs	• Ministry of Agriculture's support of RSPO adoption for existing concessions • Ministry of Agriculture's consideration of a company's willingness to adopt RSPO in granting new concessions • Improved land-use planning in developing new concession boundaries and plans
Links to national strategy	• Policy Option 3: Improvement of agricultural systems

SA5. Smallholder shade cocoa in Community Development Zones

The primary agricultural activity in the ER-Program area is slash-and-burn agriculture, with a focus on cassava production. Under this system, the average household occupies an area of between five and seven ha. With mounting population pressure in the area, the overall amount of space necessary to support the income and dietary needs of the population has been continuously rising. It is therefore necessary to identify and promote agricultural models that can at once meet the needs of farmers and reduce the impact of agriculture on the forest.

The revitalization of the cocoa sector – in relative dormancy since the 1970s – is a priority for the government. The ER-Program provides an opportunity to set this emerging sector onto a green development path. The ER-Program also presents an opportunity to leverage additional private sector investment in the sector.

Cocoa has a long history in Northern Congo, having been grown throughout the colonial period and after independence up through the 1970s. Conditions for growing cocoa in Sangha and Likouala are ideal, and there are several areas where the smallholder tradition of growing cocoa has continued, principally in western Sangha around Souanké and Sembé, but even as far south as the Ntokou-Pikounda axis, albeit under extremely low management and input regimes resulting in the production of relatively low quality cocoa. More recently, with initial set up and technical support from the Ministry of Agriculture, the cocoa sector has started to revitalize in the ER-Program area, primarily in Sangha. WCS has also begun to assist the cocoa revival around (and within) Lake Tele Community Reserve.

The aim of the program is to encourage rural communities to revive their interest in cocoa as an alternative to slash-and-burn agriculture, which is the current dominant agricultural activity in the ER-Program Area. Support would be strictly limited to degraded forest areas as a means to reduce the surface area each households needs to ensure their household income.

At the same time, the adoption of shade-grown cocoa is expected to boost household revenues.

The presence of companies interested in re-invigorating the sector, such as CIB-OLAM, the launch of a national plan for the development of the cocoa sector of the Ministry of Agriculture for 2014-2018, and an expected 2% annual increase in global market demand for cocoa suggests the potential for significant business opportunities associated with building the smallholder cocoa sector, while supporting smallholder farmer income generation and reducing deforestation and forest degradation. These activities are expected to support producing emission reductions under the ER-Program Congo, as cocoa production will be promoted only under shade and in degraded forests[30]. Success of the cocoa sector and any business investing in the sector relies on increased production of cocoa, which requires local growers to take up new practices. It also requires that economies of scale can be reached in technical assistance, production, field processing, transport and finance that can be applied across groups of farmers.

The promotion of smallholder cocoa would be limited to degraded forest areas of the community development zones. This will increase the surface area of productive secondary forests with shade cocoa inter-planted among shade trees. In addition to increasing the biomass in these areas, the activity is expected to further reduce degradation in larger forest areas that are accessible by communities within the concessions by reducing pressure to collect timber and fuel wood outside of the agroforestry-cocoa production areas. Cocoa will be intercropped with other marketable crops including banana, avocado, and other fruit to provide shorter term and diversified income streams.

To evaluate the potential size of area suitable for cocoa in degraded forest, an initial suitability analysis was conducted of the CDZs. The methods are described in the Box 2.

This initial study coupled with the national cocoa plan provided information for the initial design and scoping of the ER-Program's potential and budgeting process. A more detailed cocoa feasibility is currently underway, funded by AFD.

Besides providing farmers with seedlings and technical assistance, the ER-Program will provide support to organize farmers into cooperatives and provide incentives by covering a portion of the labor required to cultivate new cocoa. These labor and input-based incentives are important for adoption since farmers will need to divert time from other income-generating activities, or hire others to do the work. The labor-based payments (in the initial years, until production builds) will also be linked to performance requirements based on the number of hectares established on degraded forest land and under shade-covered cultivation. These incentives will require monitoring of production practices to ensure that they have not caused deforestation.

[30] See Annex XX that describes the agroforestry models the program is going to rely on

Preliminary Cacao Suitability Analysis

The community development zone surface areas were obtained from shape files of individual forest concessions; in the case of a lack of existing geospatial data, community areas were digitized from the concession's forest management plan. While smallholder cocoa will be targeted within the community development zone of the forest concessions, the individual community areas vary widely in their relative suitability for the crop given soil conditions, proximity to nearby villages, roads, and size of available degraded forest. A multi-criteria weighted overlay technique, a common geospatial analysis methodology using hierarchically ranked criteria, was used to determine the optimal areas to target for smallholder cacao production. Criteria for the analysis included distance from roads and villages, elevation and slope, and soil class. All data layers were clipped to the extent of the community areas, and hierarchy from 0-100 according to their relative suitability to sustain smallholder cacao. The layers were then weighted by their importance to cacao productivity and economic feasibility, and then added to generate an index ranking of overall suitability for cacao production, which was then extracted to fit only regions within degraded forest classes. A quantile ranking was applied to the suitability index to generate five distinct 'suitability classes', of which the top two were selected to demonstrate the hectares of land optimal for cacao production in the region.

The cacao suitably analysis was conducted on 42,211 hectares of degraded forests in community development zones, which yielded 20,695 hectares in the two highest suitability quintiles. Once these were further limited to those community areas with more than 250 hectares of highly suitable cacao, there were 17,215 hectares across 16 community areas in seven concessions.

Box 2. Preliminary Cacao Suitability Analysis

For this activity to result in net emission reduction benefits it will be important that business practices used to promote cocoa be designed to either (i) establish new cocoa trees within degraded forests, with careful attention paid to conducting clear baseline analyses of degradation levels, or (ii) establish plantings in existing non-forest areas (which is more costly). Careful attention will be paid to the development and implementation of the appropriate technical support, field-based activities and monitoring to ensure the establishment of a cocoa value chain in the ER-Program Area follows the specific methods of cocoa cultivation to minimize motivation for growers to clear existing forests to establish new plantings.

Smallholder Cocoa ER-Program Summary of Activities	
Incentives	• Subsidize seedlings and technical support to farmers • Build technical capacity • Support to organization of farmers into groups • Partial compensation for labor in early years • Inputs for cultivation • Provide links to markets at predicable and fair terms
Program targets over 5 years	• 4016 ha of shade-grown cocoa on degraded forest land
Potential Implementing Partners	• Ministry of Agriculture • CIB/OLAM • Communities within CDZs • Financing support for upfront activities (NDP, PDARP2, AFD, FIP, GEF, PFDE)

Direct Beneficiaries	• Participating communities
Enabling activities	• Development of renewed and comprehensive national cocoa strategy, commercialization and exportation standard, national cocoa quality standard • Improved infrastructure (roads and storage)
Links to national strategy	• Policy Option 3: Improvement of agricultural systems • Policy Option 2: Sustainable management of forest resources.

SA6. Palm Oil Outgrower Schemes in Community Development Zones (SHAgPalm)

The operators of industrial palm oil in Congo are investing in nurseries and processing infrastructure but are also being pressured to limit their conversion of forests by NGOs and through the ER-Program. Smallholder outgrowing schemes on deforested land provide them with an opportunity to expand their production and profitability while minimizing the area cleared for oil palm.

Successful and scalable smallholder oil palm programs involve smallholders with available degraded land who live near palm oil processing plants to provide fruit for larger palm oil processors. To promote the planting of oil palm, either the government or private palm oil companies provide the smallholders inputs for seedlings, technical assistance, and other inputs. This is becoming an increasingly popular practice particularly with increasing pressure and commitment to reduce deforestation, increase production, and deliver livelihood improvement to the communities living around plantations.

Unlike cocoa, oil palm only grows successfully in sun. This would be in the non-forest areas with soils conducive to oil palm located close to the processing facilities. In the ER-Program Area, land that is suitable for oil palm has a minimum mean temperature during the coldest month below 18°C and maximum mean temperature in the hottest month less than 34°C. Mean rainfall should be greater than 1200 millimeters. The lateritic soils in most of Congo, including in the ER-Program Area, are suitable for oil palm, except those that are temporarily or permanently waterlogged. Traditionally, oil palm is cultivated in Congo on small family farms that range from 2-5 ha. They produce and sell fruit bunches. Some process small quantities for sale on the roadside.

Like with cocoa, ER-Program support for promoting outgrower oil palm in non-forest areas in the CDZs and around protected areas will be based on local land use planning, agreements with farmers on the area to be used, and combined wherever possible with support for sustainable agriculture to increase yields, boost incomes, and reduce the need for slash and burn agriculture. Further, establishment of agroforestry oil palm systems in non-forest areas will increase tree/forest cover and availability of fuelwood for household consumption, thereby reducing pressure on nearby forests for the production of fuel-wood. Based on the conditions of the areas for cultivation, particularly considering the need to produce food crops in existing non-forest areas, the promotion of oil palm should focus on establishing systems in non-forest areas while still allowing for production of food crops.

The ER-Program's initial focus will be on increasing smallholder outgrowers' production while ensuring new production is established only in existing non-forest areas. The possibility to deliver RSPO certified palm oil from smallholders will be evaluated as part of the ER-Program.

RSPO has been working since 2009 to support ways to allow smallholders to be RSPO certified.[31]

Leading stakeholders of promotion of smallholder oil palm outgrower schemes will be palm oil concessionaires. Eco-Oil has identified this as a priority with limited implementation in 2015. Much like smallholder cocoa, companies promote adoption by outgrowers to build their value chains by providing technical assistance, seedlings, transportation, and purchase agreements. Initial participating stakeholders in village outgrower schemes will be inhabitants of CDZs within 30km from Eco-Oil's factory (for Eco Oil principally along the main road through Ngombe, but also in the urban areas around Ouesso). Engagement of these stakeholders in smallholder oil palm outgrower schemes will further support the improvement of household agricultural systems contributing to their ability to organize, access credit, diversify, and improve agricultural productivity, as well as their ability to plan and manage agroforestry systems at the landscape level.

Outgrower Oil Palm ER-Program Summary of Activities	
Activities that promote adoption in-kind by corporate buyers	• Provide seedlings and technical support to farmers • Build technical capacity in institutions • Support to organization of farmers into groups • Partial compensation for labor in early years • Inputs for cultivation • Provide links to markets at predicable and fair terms
Program targets after 5 years	• 5840 ha of smallholder oil palm in non-forested areas
Potential Implementing Partners	• Eco-Oil • Other oil palm concession holders • Communities initially within agro industrial CDZs
Direct Beneficiaries	• Participating communities • Participating palm oil companies
Enabling activities and programs	• Financing support for upfront activities • Development of national oil palm strategy that covers outgrowers
Links to national strategy	• Policy Option 3: Improvement of agricultural systems • Policy Option 2: Sustainable management of forest resources

SA7. Sustainable agriculture and others livelihoods activities

Population growth, in addition to growth due to the expansion of employment opportunities in the ER-Program will drive increased demand for food in the ER-Program Area. While

[31] The approach allows for group certification and the requirements around new plantings vary based on the group's size of new plantings. There was also a fund, the Smallholders Support Fund (RSSF), established in 2013, that is designed to support the costs of High Conservation Value (HCV) assessments for smallholders within plantations that are considered high-risk areas. However, it has been recognized that there is limited capacity for smallholder groups to complete the processes required to meet these criteria. Therefore, since July 2010 RSPO has been working to develop a simplified generic guidance document for independent smallholders to address the requirements in Criteria 5.2 (species protection) and 7.3 (new planting).

swidden systems can be maintained without significant forest loss under certain clearing regimes with limited population growth, swidden cultivators without support for increased productivity will expand into forest areas, in particular when population levels are rising. The ER-Program will implement sustainable agriculture activities[32] to ensure that, in addition to the cash crops of cocoa and oil palm, local communities can intensify and augment household food production, reducing the need to clear more land and harvest wood. In addition, by increasing LCIPs revenues sustainable agriculture will help address other drivers of deforestation such as illegal mining and illegal logging as those activities are primarily done to fill the gap of low incomes. This activity will primarily take place in the CDZs, on previously deforested or heavily degraded land. The ER-Program will provide support to farmers following a ratio of 1 ha of sustainable shade cocoa for every 2 ha of sustainable agriculture to minimize the practice of extensive shifting slash-and-burn agriculture.

As a foundation for implementation of sustainable agriculture and other livelihood activities, the ER-Program will build additional technical and extension capacity, as there is not sufficient capacity to promote the practices at scale. The ER-Program will promote good agricultural practices through trainings, technical assistance and inputs. It will promote crop rotations including nitrogen-fixing legumes to maintain soil fertility and reduce fallow periods, while providing alternative food and income sources. Inputs will consist mainly of high-yield hybrids, seedlings for agroforestry systems, nitrogen-fixing varieties and compost for soil fertilization, and potentially biochar. The program will also help diversify agricultural products (cassava, maize, banana, chili, eggplant, honey and caterpillar, etc.) to both food and fodder.

Sustainable Agriculture ER-Program Summary of Activities	
Incentives	• Build local extension capacity for farmer outreach • Extension training for farmers • Seeds / seedlings • Sustainable agriculture input pack
Program targets after 5 years	• 3151 ha of sustainable agriculture
Potential Implementing Partners	• Ministry of Agriculture and Livestock • WCS, CIB/OLAM, FAO, and ICRAF • Financing support for upfront activities (FIP, GEF, PFDE)
Direct Beneficiaries	• Participating communities
Enabling activities and programs	• Support to the sustainable agriculture value chain • Prioritization within agricultural strategy
Links to national strategy	• Policy Option 3: Improvement of agricultural systems

[32] See Annex XX that describes the agroforestry models the program is going to rely on

Enabling Activities

GOVERNANCE PILLAR

Strategy

In order to successfully roll out the key deforestation reduction activities, address underlying causes of deforestation and generate a concise management plan for the Accounting Area, the program will finance enabling activities in national and local land-use planning and community-level governance.

Mid-term vision and sustainability:

The aim of the enabling activities is to strengthen significantly local cross-sectoral land-use and coordination to:

- prevent overlapping land uses that can lead to deforestation or forest degradation,
- allow the identification of potential synergies and tradeoffs when considering land allocation decisions, in particular with regard to mining, forestry, conservation, and infrastructure.
- lay the foundation (local governance + local land-use planning) to enable the success and sustainability of smallholder activities by the program.

Key enabling activities

EA1. National Land-use Planning

There currently is no functioning overarching framework for allocating and optimizing land use, prioritizing land use, or defining procedures in case of conflict between uses. As the mandates of some government departments and ministries overlap, effective management of land use can be challenging. For example, as different ministries have the authority to grant different types of concessions (forestry, mining, agriculture), overlapping concessions, and thus conflicting land use rights, can exist on the same piece of land. The Ministry of Planning intends to implement a national land use plan, which the ER-Program would support through CAFI funding (to be mobilized) to allow for the identification of potential synergies and tradeoffs when considering land allocation decisions. Indeed, CAFI funding will complement existing efforts to ensure government approval of a single, broadly supported, multi-sector REDD+ National Investment Framework that supports and encourages stakeholder efforts to reduce forest loss and degradation and clarifies land-use planning at a national scale.

Law n. 43-2014 for the “orientation and development of the territory” lays the basis for this activity. It stipulates in Section 2 (Territorial Zoning), for example, that the national territories be zoned around priority economic activities and that the planning connect the geophysical characteristics of the territory to their specific economic vocations.

National Land-use planning	
Key results in 5 years	• Draft PNAT available • Multi-sectoral coordination functional
Potential Implementing Partners	• Ministry of Planning (MINAT) • WRI • CAFI
Direct Beneficiaries	• Communities • Private Sector • Government
Links to national strategy	• Policy Option 1: Governance strengthening

EA2. Local Land-use Planning

The program will engage in participatory local land use planning to work with LCIPs to define how they allocate their land (CDZs or otherwise), optimize resource allocation, reduce the potential for conflict, and identify options for minimizing damage to the forest stock.

Through the FEDP, local sustainable management development plans are currently being developed. They will set the basis for local sustainable natural resources management, local land-use defining property rights and customary lands, and will zone the CDZs to plan the most suitable activities considering biophysical and socioeconomic realities on the ground (i.e. soil analysis, tenure rights, market access, human-wildlife conflict potential, etc.). These plans will be developed with and validated by Community Development Management Committees, which are the lowest level of government representation in Republic of Congo. Thus, CDZs will be co-managed by both LCIP and the government.

Local Land-use planning	
Key results in 5 years	• Consensus on land and natural resources uses in CDZs • Systematic land-use planning • Simple Management Plans implementation
Potential Implementing Partners	• Local Administrations • FEDP
Direct Beneficiaries	• Communities
Links to national strategy	• Policy Option 1: Governance strengthening • Policy Option 2: Sustainable management of forest resources

EA3. Community-level governance

Social organization in rural communities in Congo is ruled by village chiefs and neighborhood chiefs. The latter, as representatives of the state, are charged with providing strategic direction, coordination, and monitoring of village activities from an administrative standpoint[33]. To strengthen the ability of local communities to implement their Simple Management Plans, enable them to better promote the socio-economic interests of the

[33] Décret n°2010-792 du 31 décembre 2010 relatif à l'administration du quartier et du village.

populations they serve, and to support the priority investments the program will carry out, the program, through GEF funding, will reinforce local governance, including through the instrument of REDD+ Participation Agreements, and enhance local capacity by providing organizational capacity building support to two sets of local governance structures:

- Local Development Funds (*Fonds de développement locaux,* FDLs): These constitute a form of local governance, but also of development finance. Each forest concession with an approved management plan has such a structure, which is charged with administering the royalty fee of FCFA 200/m^3 that forest concessionaires pay to communities based on their production. The FDLs will also administer the carbon royalties generated by the program and destined for communities as per the benefit sharing plan. The support to FDLs will aim to increase the flow of available funds from their accounts and enable them to better fulfill their mission to reduce poverty. They will also receive technical support for the coordination committees to improve their governance and improve their ability to guide beneficiaries in structuring, implementing and monitoring their micro projects submitted for FDL funding. The program will also provide support to economic, social, and cultural interest groups in identifying, designing, and managing micro projects to improve the quality of the proposals the FDLs receive.
- Community Development Management Committees (CDMC or *Comités de gestion du développement communautaire*) are a local governance structure provided for by Congolese law. Organized at the village or neighborhood level, they are responsible for the development and implementation of simplified management plans in the community development areas of forest concessions. However, in practice, they are rarely functional. 67 of these bodies therefore received initial support from the FEDP, and played an active role in the development of the 15 simplified management plans the project sponsored. On the basis of the Simple Management Plans, the FEDP already implemented a series of micro projects in its ongoing phase. The program will provide operational support to the CDMCs to set up and operate revolving funds that would disburse funds for the implementation of micro projects to the communities they serve.

Community level governance	
Key results in 5 years	• Two sets of local governance bodies have strengthened organizational capacity • FDLs are a reliable funding structure and help finance micro projects, redistribute carbon revenues to LCIPs • CDMC operate revolving funds which improve the sustainability of the program
Potential Implementing Partners	• CDMC • Local administration • WB/GEF, AFD
Direct Beneficiaries	• Communities
Links to national strategy	• Policy Option 1: Governance strengthening • Policy Option 2: Sustainable management of forest resources

ENABLING FOREST PILLAR

Strategy

The overall aim of the enabling activities of the forest pillar is to lay the foundation for the forest activities to succeed. The Government's objective is to promote sustainable forest management and remain a leader in that sector. The ER-Program will support both these goals through support to (i) forest governance and (ii) to the management of protected areas.

Mid-term vision and sustainability:

- The government has the capacity to control the legality of timber and to check compliance with management plans and FLEGT standards.
- Illegal and semi-industrial logging are significantly reduced
- Collected taxes and fines can be reinvested into forest sector-strengthening activities (governance, afforestation/reforestation, etc.)

Key enabling activities

EA4. Forest Governance

The adoption of the new forest code supports the implementation of RIL and LtPF. While the 2000 Forest Code contained important implicit provisions that moved Congo toward more sustainable logging management plans, RIL was not explicitly required (Ezzine de Blas et al., 2008). The new Forest Code explicitly states that logging 'must meet reduced impact logging rules as defined by current norms[34]. The FEDP is supporting the development of application texts and the new code should be validated in 2017. In addition, in preparation for the ER-Program, CN-REDD is developing a manual of standard operating procedures for RIL and LtPF to serve as a standard. This will draw on many of the certification requirements, but will capture local circumstances.

Then, the negotiation and implementation of REDD+ Participation Agreements and the Support better understanding and implementation of the 2011 Indigenous Peoples Act will also be a priority in the REDD+ portfolio.

The implementation of FLEGT supports the implementation of REDD+(ER-Program). The government has signed a Voluntary Partnership Agreement with the European Union (EU) and receives support from both the EU and DFID (through AFD) for its implementation. The EU is supporting logging companies in meeting the requirements of the forest legality criteria and indicator, revising forest legislation to integrate FLEGT, strengthen the capacity of the MEFDDE to oversee the VPA-FLEGT, and support civil society participation. The Republic of Congo and its partners are currently in the process of installing a timber tracking system and the necessary regulatory framework and equipment.

FLEGT and REDD+ are interdependent. Indeed, by directly addressing some of the key drivers of deforestation and forest degradation, FLEGT can promote the effective implementation of REDD+.

[34] 2000 Forest Law, Art 63

Forest Governance Summary of Activities	
Key results in 5 years	• The new forest code is validated and implemented • A RIL manual is available and MRV operations rely on the latter • VPA-FLEGT is implemented and supports REDD+ in RoC
Potential Implementing Partners	• Ministry of Forest Economy, Sustainable Development and Environment • OI-FLEGT • FEDP • EU, AFD (DFID), FAO
Direct Beneficiaries	• Forest sector (both government and private sector) • Communities living in and near forest areas
Links to national strategy	• Policy Option 1: Governance strengthening • Policy Option 2: Sustainable management of forest resources

EA5. Improved Protected Area Management

The ER-Program Area is home to three national parks and one community reserve: 1) Nouabalé-Ndoki National Park (NNNP), managed by WCS and part of the Sangha Trinational UNESCO World Heritage Site (TNS), the single most biologically intact landscape in the Congo Basin. 2) The Lac Tele Community Reserve (LTCR), co-managed between WCS and local communities, is part of the Lac Tele-Lac Tumba Forest Landscape, the world's largest swamp forest and the world's second largest wetland area (after the Pantanal in South America).; 3) Odzala-Kokoua National Park (OKNP), managed by African Parks Network, is part of the TRIDOM landscape that reaches across Congo, Gabon, and Cameroon; 4) Ntokou-Pikounda National Park, established in 2012 and currently without a significant management strutcure.

The ER-Program will support the improvement of protected area management. In particular, in Ntokou Pikounda National Park, the ER-Program[35] will support the set-up of a management unit that will be in charge of the protected area. It will devise a management plan, zoning / demarcation, and bulid general technical capabilities of the park. UNDP will implement its TRIDOM2 project in the landscape surrounding OKNP. An AFD project will enable MEFDDE to work with logging companies to strengthen their ecoguard units (*Unités de Surveillance de Lutte Anti-Braconnage,* USLAB) to fight against poaching to preserve biodiversity.

Protected Areas ER-Program Summary of Activities	
Program targets after 5 years	• Ntokou Pikounda National Park has management with community participation • Logging companies and their USLABs are key partners in biodiversity protection
Potential Implementing Partners	• WCS, African Parks, WWF • Logging companies • UNDP (TRIDOM2), WB (GEF), AFD (PPFNC)
Direct Beneficiaries	• Communities living in and near protected areas
Links to national strategy	• Policy Option 2: Sustainable management of forest resources

[35] Through upfront GEF-6 funding

ENABLING AGRICULTURE PILLAR

Strategy

The overall aim of enabling agricultural activities is to lay the foundation for the agricultural program activities and to enable their success and sustainability. This will be done through support to (i) the integration of sustainable palm oil production in policies, and (ii) agricultural value chain development (for cocoa, palm oil, banana, etc.).

Mid-term vision and sustainability:

- Industrial palm oil production is not done at the expense of forests anymore and follows RSPO guidelines.
- Investment made in value chains will attract professional operators. Those operators will be responsible for maintaining price stability, high product quality and compliance with strict specifications relating to the reduction of deforestation and degradation of forests. The agricultural processing facilities installed will be a key means to reduce poverty and create jobs.

Key enabling activities

EA6. Inclusion of Responsible Palm Oil Production in Agriculture Strategy

The ER-Program will offer support to the government to formulate policies and programs that promote responsible palm oil in its NDP, including for aligning future palm oil development with non-forest areas and the pursuit of RSPO as a priority for new development.

Support to SHpalm value chains	
Key results in 5 years	• New concessions allocated in non-forest areas • RSPO is promoted and part of NDP and agricultural policies
Potential Partners	• Ministry of Agriculture • Eco-OIL, ATAMA • CIRAD
Direct Beneficiaries	• Communities living around oil palm concessions • Industrial Oil Palm companies
Links to national strategy	• Policy Option 3: Improvement of agricultural systems • Policy Option 2: Sustainable management of forest resources

EA7. Support to the sustainable cocoa value chain

The development of a sustainable cocoa sector requires investments that go beyond cocoa cultivation. To this end, the ER-Program will also support underlying infrastructure, such as storage facilities, trading centers, access roads, and services such as extension and research.

AFD has financed a feasibility study to relaunch the cocoa sector and a first draft is available. A conference on cocoa is being organized in Brazzaville by the government and is supposed to take place in November 2016. This meeting will be an opportunity to formulate governmental orientations for the sector and define support to strengthen the cocoa value chain.

Support to the cocoa value chain	
Key results in 5 years	• Access roads are improved • Storage facilities are renovated • Value chain is better organized • Better access to market to sell cocoa culture production
Potential Implementing Partners	• Ministry of Agriculture • OLAM • Commercial Agriculture Project (WB), AFD, FIP
Direct Beneficiaries	• Communities
Links to national strategy	• Policy Option 3: Improvement of agricultural systems • Policy Option 2: Sustainable management of forest resources

EA8. Support to the sustainable subsistence farming value chain

The development of sustainable subsistence farming requires investments that go beyond crop cultivation. To this end, the ER-Program will also support underlying infrastructure, such as storage facilities, trading centers, access roads, and services such extension and research.

Using GEF funding, to ensure sustained commercial interest in agroforestry systems, the ER-Program will support processing and marketing, both of which are generally underdeveloped in the program area, in particular for products other than fruit and cassava. To this end, the program will establish and train farmer groups and provide simple mechanized processing units (mobile or in key centralized locations).

To enable farmers to reduce losses and benefit from periods of higher prices, the program will support communities in renovating existing storage facilities for basic foodstuffs, and training farmers in the management of their products and storage techniques.

To improve market access, the program will organize farmers into groups that would pool their products, thus providing sufficient volume for transporters (which often double as wholesale buyers) to bring their products to market. Further support would be provided to associations for budgeting, accounting, and marketing.

The Commercial Agriculture Project will also focus on improving access to roads so that smallholders can easily bring their crops to market.

Support to Sustainable Agriculture value chains	
Key results in 5 years	• Access roads are improved • Storage facilities are renovated • Market access improved • Farmer groups organized
Potential Implementing Partners	• Ministry of Agriculture, MINAT • Communities • GEF, Commercial Agriculture Project (WB), FIP

Direct Beneficiaries	• Communities •
Links to national strategy	• Policy Option 3: Improvement of agricultural systems • Policy Option 2: Sustainable management of forest resources

MINING PILLAR

Strategy

Following the adoption of a more attractive Mining Code in 2005 (with updates in 2007 and 2008), the Republic of Congo has moved aggressively into the development of its mineral resources. This is both an opportunity and a challenge for the government. Based on prospecting permits in Sangha and Likouala, diamonds, gold, iron and titanium are the most abundant minerals[36]. Most relevant from a production standpoint is iron, as three large iron mines are operating or in development in the two departments.

The enabling activity for the mining sector will consist of support to companies in designing reduced impact infrastructures.

<u>Mid-term vision and sustainability:</u>

- Adoption of new mining code that institutionalizes requirements for improved mining practices
- Improved land-use planning for granting concessions and related infrastructure development

Key enabling activities

EA8. Reduced-Impact Mining

Implementation of reduced-impact mining will be pursued through voluntary corporate responsibility actions. This is dependent on companies' assessment of the value of adopting reduced-impact practices based on a cost benefit analysis and their overall corporate commitment to sustainability.

The ER-Program will focus on those projects closest to the operations phase. Activities include i) advanced application of spatial land-use planning in concessions and for the planned infrastructure improvement to reduce impact, ii) participation/certification under international responsible mining initiatives, iii) developing PPP investments structures, iv) commitment to biodiversity/mitigation offset programs, and v) implement strong forest protection programs within the mining concessions.

[36] Ministry of Mines and Geology, 2011.

Green Mining ER-Program Summary of Activities	
Program targets	• Any mines that enter production apply practices to reduce impact on forest cover
Potential Implementing Partners	• Ministry of Mining • Congo Iron, Motaba Mining, Niel Congo, and Core Mining Congo ltd.
Direct Beneficiaries	• Communities living around mining areas • Mining companies
Links to national strategy	• Policy Option 5: Development of a green mining sector

4.4 Assessment of Land and Resource Tenure in the Accounting Area

Overview of Land and Forest Tenure in Congo

A number of studies exist on land tenure and access to resources in the Republic of Congo, with a particular focus on REDD+.[37] The report accompanying the Strategic Environmental and Social Evaluation (SESA) describes the land tenure situation as "complex".[38] The SESA process identified the development of a National Land-Use Plan (Plan National d'Affectation des Terres, PNAT) as a particular strategic option, a suggestion that the legislator put in action, when issuing the Planning Law in late 2014. The PNAT or "SNAT" – "*schema national d'aménagement du territoire*", in the enhanced form set out by the Planning Law No 43 of 2014 – is under development.

The land tenure law of the Republic of Congo has its basis in the country's constitution – adopted[39] in 2015 through public referendum – and in specific laws and statutes, governing, among others, property law (*Code civil*), land registration law (*Régime de la propriété foncière*[40]), forestry holdings (*Code forestier*[41]), agriculture, mining, and planning law.

While recognizing the right of the individual to property and inheritance (Article 23), the Constitution of 2015 reconfirms, in its preamble, the "permanent right" of the Congolese people and its "inalienable sovereignty over all natural treasures and national resources as fundamental elements of its development". The Constitution further guarantees the "promotion and protection of the rights of indigenous people" (Article 16). The detailed land tenure regime that follows from the constitutional guarantees are otherwise dealt with in specific legislation.

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[37] Cadre juridique et et economique de mise en œuvre du mecanisme REDD+ en Republique du Congo, agrer Décembre 2014 ; Schmitt, A. / Baketiba, B. et al., Revue et analyse des principaux mécanismes de partages de bénéfices existants en République du Congo, ILD 2015; UN REDD 2011, at http://theredddesk.org/countries/republic-of-congo;

[38] Ministère de l'Economie Forestière et du Déveleppement Durable, Evaluation Environnementale et Sociale Strategique du Processus REDD+ en Republique du Congo (Rapport préliminaire, Novembre 2014).

[39] Adopted on 25 October 2015.

[40] Law No 17-2000 of 30 December 2000, with revisions of 2012 and 2015.

[41] Law No 16-2000 of 20 November 2000.

Forestry holdings. Forest land falls in two basic categories: state-owned (accounting for the vast majority of all forest land) and private-owned (Article 3 Forestry Code, FC). The state-owned forests are divided in the 'Permanent Forest Estate' and the 'Non-Permanent Forest Estate'. The Permanent Forest Estate – representing more than 80% of the Republic of the Congo's forested land – includes all *classified* forested and/or wildlife areas. Classification classes are: (i) 'Private State Holdings', (ii) 'Forests in Public Ownership', and (iii)) 'Communal (Territorial Collective) Forests' (Article 6 Forestry Code, FC). The Non-Permanent Forest Estate denominates all non-classified forest lands, deemed 'protected forest land' by law (Article 13 FC). Local communities are given special *rights of use* in the Non-Permanent Forest Estate: for collecting wood fuels, for hunting purposes, other subsistence needs, and cultural use.[42] All products sought are for subsistence purposes only; they may not be commercially sold (Article 42 FC).

Private State Holdings – accounting for the largest part of the Permanent Forest Estate – need to be assigned as (1) 'Protection Forests' (not: 'protected forests', a category reserved for the Non-Permanent Forest Estate'), or (2) Nature Conservation Forest, or (3) Production Forest, or (4) Recreational Forest, or (5) Research Forest (Article 8 FC). As part of the classification, special areas for local communities and customary rights of use may be assigned, with rights of use similar to those in protected forests (Article 41 FC).

The Permanent Forest Estate as a whole is structured into separate Forest Management Units, i.e. *Unités Forestières d'Aménagement* or "UFA" in abbreviation of the French term (Article 54 FC). The UFAs are adopted by decree of the Council of Ministers (Article 56); the management is in the hands of the local administration for waters and forests. The Accounting Area includes 17 UFAs, 13 of which are linked to a specific concession; the remaining 4 are not.

All concessions must respect the terms of the UFA concerned. The Forest Code lays down different forms of concessions and permits (industrial transformation concession, management concession, logging permit, and special permit, Article 65 FC). These give the holders the right to plant and/or harvest trees and/or to use and market forest products. Note that "forest product" has no express legal definition. From the term's history and usage – including in secondary legislation with forest product listings – it is assumed, however, that the concept refers to tangible objects only. "Carbon rights" inherent in trees and woodlands or flowing from certain woodland-related practices – assuming these had an *a priori* basis in Congolese law – do not fall under the category "forest product" and they cannot be subject to any of the forest concessions (on forest-related carbon rights see below).

A specific type of concession concerns agricultural holdings involving the clearing of forested land. Such concessions are based on the principles of general land law[43] (i.e. ownership of the state) rather than the Forest Code, and they are given out by Presidential Decree (with the

[42] Article 40 FC specifies: In protected forests the local populations, whether Congolese or foreign nationals, who are subject to the regulations under this article may enjoy use rights allowing them to:

- Collect large sticks, branches, and other wood products needed for the construction and maintenance of their homes, furniture, household utensils and tools, as well as dead wood and plants for cultural, medicinal or food uses;
- Hunt, fish and harvest crops within the limits set by the law;
- Establish beehives and crops or graze their livestock or collect fodder.

[43]Loi No 9-9-2004 du 26 mars 2004 portant code du domaine de l'Etat; Loi No 10-2004 du 26 mars 2004 fixant les principes généraux applicables aux régimes Domanial et foncier.

Minister of Sustainable Development co-signing).

Delegated legislation contains further specifications and requirements for concessions. A mandatory element in UFAs (and, consequently, concessions) is the allocation of community development areas, in which local communities have the right of access, harvest and other use.[44]

On the side of privately owned forests ("private forests") – not relevant for the Accounting Area – one distinguishes the private forests proper and the private forest plantations (Article 33 FC). Private forests are those wooded lands which are owned by a private person; private plantations, on the other hand, are those planted (afforested or reforested) by a private person on non-permanent (State) forest land (Article 26 FC). Private forest owners can freely dispose of all related plant products, subject to specific management plans and any government regulation (Article 39 FC).

The revised Forest Code of December 2014 for adoption in 2016 ("FC 2016", not yet formally adopted) replicates the existing approach to forest land classification approach and customary rights, while strengthening both substantial and procedural rights of stakeholders, notably of local communities and indigenous people (the latter were recognized only indirectly under the Forest Code of 2000). The revised Code recognizes the right of communities to all "forest products" derived from community forest sourcing (Article 32 FC 2016), and it lays down the principle of *free*, *prior, and informed consent* (FPIC) of concerned stakeholders including indigenous people for forest classification as such (Article 37 FC 2016). It also defines a customary right of use (*droit d'usage*), representing the sum of "rights derived from custom and local traditions through which local communities and indigenous people, in forest areas that they do not own, may harvest certain products and engage in certain production activities, including for sale, within the limits of vital domestic and customary needs" (Article 6 FC 2016). Article 71 FC 2016 recognizes the customary rights of use *directly* for protected forests (in the Non-Permanent Forest Estate). For the Permanent Forest Estate, the law (Article 72 FC 2016) clarifies that the UFAs in turn *must recognize* the customary rights of use (*indirect guarantee*). This clarification, when adopted, will be an important enhancement of the rights of local communities and indigenous peoples, in particular. As noted above, the current legislation makes the recognition of customary rights conditional on the adoption of a (discretionary) implementation act (Article 41 FC).

The new regime, thereby, aligns the forestry governance with the Law on the Promotion and Protection of Indigenous People of 2011[45], a statute for which the Republic of Congo has been much commended internationally. The 2011 law recognizes the "collective and individual right" of indigenous populations "to property, possession, access and utilization of the lands and natural resources that they occupy or use traditionally for their subsistence, medical use and work" (Article 31). While assigning the task of delimitation of the lands "on the basis of customary tenure" to the State, the law makes clear that the customary rights are not conditioned on formalized delimitation. Rather, "in the absence of land titles, the indigenous populations preserve their pre-existing land tenure" (Article 32). The same article also guarantees that "the land rights of the indigenous populations are indefeasible and inalienable except in cases of expropriation for public interest". This provides for an a-priori

[44] Article 18 of Regulation 5053 of 19 June 2007 (Arreté 5053 définissant les directives nationales d'aménagement durable concessions forestières).

[45] Loi No 5-2011 du 25 February 2011 portant promotion et protection des droits des populations autochtones.

hierarchy of norms with customary rights given a quasi-constitutional status.

Forest holdings in the Accounting Area. The accounting area, mostly forested, includes the following land types and land concessions:

67% Permanent Forest Domain:

- 53% of the area is under 15 year large-scale concessions (industrial transformation or management concessions, Articles 66 and 67 FC);
- 12% are designated as protected area;
- 2% are under agricultural (palm oil) concession (under specific concession by Presidential Decree); and

33% Non-Permanent Forest Estate:

- protected forests;

The Accounting Area includes a population of about 300,000 (109,000 live in Sangha, 196,000 live in Likouala), see chapter 3.2.5 Overview of Stakeholders and Rights-Holders. The local population, including Indigenous Peoples, is spread across both the Permanent and the Non-Permanent Forest Estate. Within the Permanent Forest Estate, some local communities, including Indigenous Peoples, live in protection areas ("*Séries de Protection*") and most live in community development areas ("*Séries de Développement Communautaires*"), where these have been established.[46] For community development areas, customary right are explicitly recognized. Note that with the adoption of the new Forest Code (FC 2016), the new concept of "communal forests" ("*forêts communautaires*") will be introduced, which offers local communities, including Indigenous Peoples, a simple process of registration with the director of the regional departments for waters and forests. Registration is open for communities in the Permanent Forest Estate and the Non-Permanent Forest Estate. Registration of land within the Non-Permanent Forest Estate makes the land in question automatically part of the Permanent Forest Estate (cf. Article 31 FC 2016).

Mining: Apart from the forestry and agricultural concessions, the Accounting Area is also subject to a number of – currently inactive – mining concessions. The Mining Code of 2005 lists, in the form of an exclusive list, the different mining titles and clarifies that the holding of a mining concession is distinct from the property holdings of the area in question (Article 16.2) and that they do not confer any rights other than prospecting, research, exploitation, and transformation (Articles 15, 41, etc. Access rights come with a mining concession, however, affecting above- and below-ground vegetation as well as forestry-related concessions for the area concern).

Infrastructure: Existing roads, bridges and other land ways are owned by the state. Plans exist, promoted by the mining industry, to build railways in the future. These may be owned and operated by the state, or leased to industry, or industry may buy the related lands and operate the rails privately. The works concerned are likely to add to deforestation planned and unplanned, see chapter 8.4. There are no implications, however, for the question of land tenure and carbon rights see below, chapter 4.4.2 Tenure Schemes in ER-Program Area.

[46] For now, only 10 UFAs have approved management plans in place (see above, chapter 4.1).

Tenure Schemes in ER-Program Area

Carbon-related rights are not explicitly referenced in the country's legislation, except recently in the context of administrative procedural law laid down in Presidential Decree 260 of 2015 (see below) and as part of the revised Forestry Code (not yet adopted, see below).[47]

Applying general principles of the laws of the Republic of Congo, one needs to distinguish (i) the right to emission reductions as *obligatio*, i.e. the *legally binding commitment of the seller to transfer carbon units issued within a dedicated registry for REDD activities and outputs as defined under any specific ER-PA*, and to refrain indefinitely from creating, selling or transferring any carbon units issued with respect to such activities and outputs; (ii) the legal concept of a right to emission reductions as a right or *ius in rem*, and (iii) arrangements under public and administrative law (administrative agreements) of the Republic of Congo aimed at conservation measures, in general, and the implementation of REDD activities and the sharing of benefits, in particular.

Right to Emission Reductions (obligatio)

This right to transfer carbon emissions has its legal basis in the Republic of the Congo's law on contractual obligations (Article 1 *Code civil, livre Troisième: Des contrats ou des obligations conventionnelles*).[48] The government – represented for the purpose of the (first) ER-PA under the FCPF by the Ministry of Finance (see chapter 17) – assumes this legally valid *obligatio* upon execution and is bound under the Congolese Code civil or any other private law regime applicable to the ER-PA.

The government will agree with a range of REDD+ stakeholders similar terms to secure that carbon asset generation is exclusive and centralized in one actor (e.g. the central government) and that the stakeholders concerned will abstain from marketing the REDD+ activities to third parties.

Right to Emission Reductions (ius in rem)

A right *in rem ("droit reel")* in immovable objects, under the laws of the Republic of the Congo, is conditional on registration (Article 16 of the Land Property Law of 2000[49]). A *numerus clausus* of rights, i.e. a limited class of expressly defined property/ servitude ("droits reels) rights, applies, as per the Republic of the Congo's civil law, namely:[50]

- Ownership ("propriété");
- Usufruct ("usufruit");

[47] Decree No 250-260 of 27 February 2015 concerning the creation, organization, attribution and institutional functioning of REDD+ management.

[48] Décret of 30 juillet 1888, as amended numerous times

[49] Law No 17-2000 of 30 December 2000: Régime de la propriété foncière.

[50] The concept is applied throughout the Republic of the Congo's civil law, cf. recently Law No 24 – 2008 of 22 September 2008 portant régime foncier en milieu urbain, Articles 6 et seqq. Note that the list of rights in rem for movable objects is different and not concentrated in a single regime; the Forestry Code, for instance, establishes a right in rem for the State over export products (Article 86 FC).

- Servitude (“droit d’usage et d’habitation”);
- Heritable building right (“droit de superficie”);
- Long-term lease (“droit d’emphytéose”);
- Building lease (“bail a construction”)
- Mortgage (“hypothèque”).
- Privilege (“privilege”);
- Pledge/antichresis (“antichrèse”);
- Real servitude (“servitude foncière”).

These rights share as common feature that they represent an inherent claim to a particular object (whether movable or immovable) and that they give an *absolute* or *restricted* **right of use**. From the point of view of the Republic of the Congo’s law, emission reductions are neither considered an object – they lack the physical form – nor a forest product[51] nor do they indicate a particular *form of usage*. Rather, they represent the *result* of an effort and an achievement. They may be the result of a concrete set of land and area-related actions (e.g. reforestation of a particular stretch of land) or they may be created through activities further removed from particular lots of land such as the introduction of certain policy measures with an impact on country- or jurisdiction-wide deforestation.

It follows that the law, as it stands (for future changes related to the adoption of the new Forestry Code see below), does not recognize a right to emission reductions as a *ius in rem*. It should be noted, however, that *emission reductions* need to be distinguished from *emission reduction units* (“carbon credits”) issued into a registry. While legislative guidance (beyond the consolidated draft of the Forestry Code 2016) and pertinent case law are yet missing, it is expected that the courts of the Republic of the Congo will take a similar approach as the one taken by US and European courts, namely to recognize property rights to allowances or emission reduction units issued into a registry.

While the law does not grant the right to emission reductions the status as a right *in rem*, it does not mean that holders of land titles and rights of use were defenseless against the government or a third party restricting the scope of their title. This includes the right of the owner of an object to enjoy and/or dispose of it as it pleases (subject to certain prohibition as applied by law); the right of the holder of a logging permit to cut the wood; and the land-related *right of use* (based on a constitutional guarantee) of indigenous people and local communities (see above on Article 6 FC 2016). These rights are guaranteed by law – including by the Republic of the Congo’s land law [52] and notably by the Law on the Promotion and Protection of Indigenous Populations[53] (Article 42) – and any REDD+ development with the objective of restricting a certain form of legal usage requires the *voluntary consent* of the right holder concerned and a *contractual arrangement concerning his or her contribution and*

[51] For an interpretation of the term “forest product” in the context of the Forestry Code, see above.

[52] Article 31 of Land Law No 10/2004: “In addition to the rights under modern law, the land tenure regime recognizes pre-existing customary tenure rights, which are not contrary or incompatible with duly issued and registered titles… In case of conflict… the recognition of property rights over lands located in proximity to a village must be debated and approved by the populations and the relevant local authorities.”

[53] See above footnote **Error! Bookmark not defined.**.

compensation.

Also, the laws of the Republic of the Congo recognizes the principles of unjust enrichment ("*enrichement sans cause*", Article 252 Code civil III) and similar institutes (such as "*gestion d'affaires*", Articles 248 et seqq. Code civil III). Under the principle of unjust enrichment an individual, a group of individuals or any entity capable of holding rights which has created and asset or a work of any kind, has the right to claim compensation from the person which has benefited – without legal cause – from such asset or work. This right is a claim for compensation, it is not a claim *in rem* and it does not imply the creation of an encumbrance of whatever sort.

Carbon as a New Right in rem: REDD+ and the Forest Code 2016

Under the revised Forest Code (for formal adoption in 2016), REDD+ is a recognized forest management policy of the Republic, and the State assumes the task of developing appropriate measures to promote payments for REDD+ "environmental services" (Article 178 FC 2016). The revised code includes provisions on both "carbon credits" and "carbon rights". Any person, whether a natural person or a legal entity, may "generate carbon credits", it being understood that actors other than the State must be specifically authorized as "project proponent" (*promoteur de projets*) in order to be eligible for carbon credit generation (Article 179 FC 2016).

The State generates carbon credits by default, i.e. without specific authorization, for both the Permanent Forest Estate and the Non-Permanent Forest Estate (*ibid.*). However, the classifications made for the Permanent Forest Estate, have a bearing on the ownership of the carbon credits in question: The central government has a direct claim to carbon credits generated from Private State Holdings; communities have a direct claim to carbon credits generated from forests that belong to them; and the relevant public entities have a direct claim to the carbon credits generated from Forests in Public Ownership (Article 180 FC 2016).[54] As shown above in chapter 4.4.1, the Forest Code 2016 adds to the types of forests within the Permanent Forest Estate the so called "communal forests" ("*forêts communautaires*") as a category distinct from the "local community forests" ("*forêts des collectivités locales*"). Communal forests will be established as part of the community development series under a concession (Article 28 FC 2016). Local community forests, by contrast, retain their definition from the Forest Code 2000: they are not linked to a concession; instead they are established through independent decree of the Council of Ministers (Article 24 FC 2016). To date, no such decree has been adopted. Thus, with the adoption of the new Forest Code, community holdings within concessions will immediately be eligible for the status as "communal forests"; "local community forests" will only come into being with the elaboration of future implementing legislation. For the purpose of carbon credit generation, both communal forests and local community forests will become direct credit holders.

If (third party) project proponents have been authorized to implement a project, they will

[54] For privately held forests, the same logic applies: Forest plantation owners (Article 182 FC 2014) and forest land owners (Article 183 FC 2014) are given the direct claim to carbon credits generated from the land in question.

become co-owners of the relevant carbon credits together with the primary owners (Article 180 FC 2016).

Whatever the title to any particular carbon credits, holders of customer rights (*droits d'usage*) are deemed "beneficiaries of carbon rights" by law (*ibid.*). By contrast, except if specifically stated otherwise, the rights granted under a concession do not include any carbon related rights (Article 181 FC 2016). Details on the exact definition of REDD+ environmental services, on project authorization, on carbon credit commercialization and on benefit sharing will be enacted by way of executive regulation (Article 178.2; Article 179.2; Article 184; and Article 187 FC 2016). The relevant regulations are currently under elaboration. [55]

The revised code does not provide a definition of either "carbon credits" or "carbon rights". However, the legal differentiation (rights, on the one hand; credits, on the other hand) makes clear *first* that "carbon credit" points to the commodified carbon unit held or for issuance in a registry, while "carbon right" represents the underlying title that flows from (i) ownership, (ii) special project authorization, or (iii) customary law; and *second* that the existence of an underlying title does not necessary give a direct claim to the commodified product (the carbon credits). Rather, direct and primary access to credits is given to land owner only, i.e. the central government for Private State Holdings in the Permanent Forest Estate and for the Non-Permanent Forest Estate, the communities for community forests, the relevant public entities for Forests in Public Ownership; and private owners for privately held forests.

Project proponents are given a direct claim to carbon credits only on the condition that their projects have been approved by the government; and they are given co-ownership status only. Customary right holders are not given a direct claim to carbon credits, but their status as carbon right holders guarantees that they benefit from any form of commercialization.

Administrative carbon generation permits and other agreements (public law)

Once an executive regulation under Article 179.2 FC 2016 (project authorization) is adopted, an individual carbon title may be granted under administrative law. In the absence of such regulation and/or in the absence of the granting of any administrative title, only the land owners are given the title to carbon credits; customary right holders have a claim to the benefits (see above).

Gaps and Potential Conflicts

The state of the tenure regime presents a number of challenges, which the ER-Program needs to mitigate:

Only 10 out of 17 UFAs present in the Accounting Area have management plans. This means that for seven (7) UFAs the clear allocation of usage zones is outstanding, to the effect that tenure holdings of local communities (*Séries de Développement Communautaires*) are not secured and protection areas (*Séries de Protection*) not recognized.

[55] Décret pris en Conseil des ministres fixant le cadre des droits à la propriété des crédits carbone et les droits aux bénéfices des produits de la vente de ces crédits carbone.

Response by the ER-Program: For all the UFAs, a concise land management plan will be developed, with protection and regeneration zones, sustainable cocoa plantations, and other usage zones. All stakeholders, including the concession holders as well as the roughly 2,000 villages present in the Accounting Area, will be engaged and be given the opportunity to shape and formally consent to the plan. While participation is voluntary, it is estimated that all stakeholders will join the effort, to be formalized in REDD+ Participation Agreements.[56] In any case, the ER-Program will ascertain and further the land tenure positions in all UFAs.

Forest estates are not consistently demarcated both between Permanent and Non-Permanent Forest Estate and even within the Permanent Forest Estate. Forest classification – the formal process of incorporating forest areas in the Permanent Forest Estate and of defining the exact boundaries and the rights and obligations of local communities – has not yet been consistently (if at all) applied.[57] The lack of demarcation and forest classification is felt, in particular, when it comes to the absence of demarcated (and formally adopted) "local community forests" ("*forêts des collectivités locales*"), foreseen both under the current Forest Code and the future Forestry Code 2016, but so far never enacted. This absence diminishes the land use rights of local communities and leaves notably indigenous communities – those outside dedicated areas within concessions – in limbo. It also furthers widespread degradation, as non-demarcated land ('terra nullius') suffers from tragedy-of-the-commons effects. A related concern, in this context, is raised by the practice of government authorities and private stakeholders to identify numerous areas as so called "*zones banales*", degraded areas or soon-to-be wastelands that can be accessed, used and exploited by anyone. The concept is derived from a hunting provision in an older – since repealed – law[58] and has no legal bearing in today's legislation, but the de-facto use is widespread.

Response by the ER-Program: While the ER Program cannot enact "local community forests" in lieu of the government, it will enhance the governance role of local communities and reconfirm their land use rights. The REDD+ Participation Agreements will clearly define rules of usage and exploitation for all areas included in the ER-Program. 'Zones banales' will not be recognized within the ER Program and by its stakeholders.

The zoning ambiguity makes the establishment of the PNAT/SNAT challenging and much needed at the same time. Clear forest demarcation is not the only concern in this respect. The provisional nature of the Non-Permanent Forest Domaine is a risk for long-term forest governance, in general, and the ER-Program, in particular. In addition, the lack of coordination between different land use categories – forestry (and REDD+) vs. mining, forestry (and REDD+) vs. agriculture, and forestry (and REDD+) vs. infrastructure planning – and the lack of institutional capacity to manage the legislative acts and to balance different legal regimes is troubling. A Land Development Plan has been in existence for a decade, yet it is too broad and not effective enough to make a difference.[59] A detailed and concrete PNAT/SNAT – with clear strategic orientation for the different economic sectors, comprehensive zoning and the

[56] On REDD+ Participation Agreements see below chapter 17.

[57] For the regulatory process of classification see Arreté No 6509/MEF/MATD. précisant les modalités de classement de de déclassement des forêts of 19 August 2009.

[58] Law No. 48/83 of 04.21.1983 defines the 'zones banales' as "areas outside of classified areas … [in which] hunting … can be freely exercised in compliance with this Act and its implementing regulations…" (Article 46).

[59] Client Earth, The legal framework for forest conversion in the Republic of Congo (June 2015).

conclusive identification of indigenous peoples' land rights – is needed as a reference document, which would settle zoning disputes and provide for a long-term plan, as well as an institutional framework to coordinate different government agencies as well as the private sector (industries) and civil society. Currently, both functions are not met, the reference document and the institutional framework to inventorize, coordinate, balance, and implement a cross-sectoral development plan.

Response by the ER-Program: The identification of the PNAT/SNAT as a top priority for the Republic of Congo's land policy has been a central piece of the country's REDD+ efforts so far, and the adoption of the Land Law of 2014 has been a strong signal that the Republic of Congo is moving towards enhanced and comprehensive land planning. It is also noted that the creation of an interministerial consultation committee[60] in 2009 to address instances of overlapping usages of ecosystems and – even before, in 2006 – the adoption of a process to settle customary law conflicts[61] has helped facilitate a nucleus institutional framework (albeit incomplete and not yet operational) to address governance conflicts in the future.

The ER Program links, perhaps for the first time in the Congo's modern history, the different economic sectors to set and realize a comprehensive forest governance and to engage a large number of stakeholders across constituencies. CONA-REDD, the high-level body mandated with overseeing ER-Program preparation and implementation is composed of 15 representatives from ministries across sectors, eight representatives from civil society, six from the Indigenous Peoples network, and three from the private sector operating in forestry, agroindustry and mining. All program-related issues, including conflicts or potential conflicts, will be referred to this body. While the PNAT/SNAT is being prepared, the ER-Program, with its institutional basis, is the de facto platform for comprehensive, cross-sectoral planning purposes.

CONA-REDD will guide the design of the REDD+ Participation Agreements and will oversee their negotiation. The details of the REDD+ Participation Agreements will be discussed below.[62] It is vital, in any case, that these agreements will respond directly to comprehensive and inclusive planning needs and that they install principles of engagement as well as a multi-stakeholder process for undertaking any planning-sensitive interventions. Among the principles, it should be agreed that no intervention in the ER-Program Area by any of the contracting partners, including concessionaries of any type (including mining), must undermine the Program in its substance, that all interferences with the Program and/or the Accounting Area and the integrity of its ecosystem should be preceded by a robust impact assessment, and that any interventions not foreseen by the ER Program should minimize harm as much as possible, while (depending on the intensity) CONA-REDD should be consulted at all stages.

While the country as a whole may still for some time lack the capacity to draw up the (five-yearly) PNAT/SNAT – which is to be accompanied by plans at the department-level – the ER-Program and its main horizontal governance tool, the REDD+ Participation Agreements, will

[60] Décret 304/2009 du 31 août 2009 instituant un comité interministériel ce concertation en cas d'usages superposés dans les ecosystèmes naturels.

[61] Décret 256/2006 du 20 juin 2006 portant institution, attribution, composition et fonctionnement d'un organe a hoc de constatation des droits fonciers coutumiers.

[62] See chapters 15 and 17.

assume some of its central functions for the Accounting Area. As a pioneer undertaking, it may also feed into future PNAT/SNAT practice.

Finally, the risk from land conversion in the Non-Permanent Forest Domaine will be effectively lowered through i) the institutional bind that links all stakeholders including relevant central level government agencies and that will add a level of oversight and control, and ii) the concrete assistance the ER-Program will give to local and indigenous communities to register "communal forests" ("*forêts communautaires*"), once this option is provided (entry into force of FC 2016). Such registration will secure long-term inclusion of the areas concerned in the Permanent Forest Domaine.

4.5 Analysis of Laws, Statutes and Other Regulatory Frameworks

The activities of the ER proposed program are consistent with international treaties and covenants ratified by the Republic of Congo as well as relevant domestic legislation.

The Republic of Congo is a party to several conventions and agreements on environmental protection, which can be found in ANNEX 2. LIST OF CONVENTIONS AND AGREEMENTSS ON ENVIRONMENTAL PROTECTION.

Most recently, the Republic of the Congo actively participated in the negotiation of the Paris Agreement. The government submitted its Intended Nationally Determined Contribution (INDC), which will serve as the point of departure for future nationally determined contributions (NDCs). On REDD+, the INDC – an international (albeit voluntary) commitment – contains less ambitious targets than the national REDD+ strategy. Alignment options will be discussed during ratification of the Paris Agreement and, at the latest, as part of the first stock-taking exercise of INDCs/NDCs.

For a specific analysis of private and public law implications for the Accounting Area, see above Chapter 4.4. Below we summarize the main laws of relevance for the existing land tenure regime:

Table 10. Summary of the main laws of relevance for the existing land tenure regime

Statutory basis	Relevant Implementing Acts	Land Tenure Relevance	Relevance for the ER-Program / the Accounting Area
Constitution 2015	National laws and regulations (see below)	• Sovereign guarantee: the inalienable sovereignty over all natural treasures and national resources; • Private tenure rights guarantee; • Rights guarantee for Indigenous Peoples;	• The state is the land owner by default; • Indigenous Peoples rights of use and benefit sharing are recognized;
Law on the Promotion and Protection of		• Guarantees the right of Indigenous Peoples to be consulted before consideration	• Indigenous Peoples present in the Accounting Area need to be fully

Statutory basis	Relevant Implementing Acts	Land Tenure Relevance	Relevance for the ER-Program / the Accounting Area
Indigenous People of 2011		of any measure and/or project that affects them (Art. 3); • Guarantees cultural rights and both a collective and an individual right to property (Art. 31); • Guarantees the delimitation of the lands on the basis of customary tenure (Art. 32); • Guarantees a right to the revenues from the exploitation and utilization of their lands and their natural resources (Art. 41);	integrated in the REDD+ program; • Their involvement and/or the involvement of their lands requires their free, prior and informed consent (FPIC); • Involved Indigenous Peoples have a claim to revenues and benefits from REDD+ involvement;
Land tenure law of 2004 (No 9 and No 10)	Serves as the basis for the issuance of agri-industrial concessions	• Defines key elements of land ownership and rights in rem (droits réels); • Defines the concept of state domain; • Functions as a basic structure and sets the general terms for specific land- and land-use related legislation and regulation, including forestry legislation (Article 13); • Recognizes customary land holding positions (Article 31);	• Under the status quo, carbon rights are not recognized as rights in rem (but under the law of obligations, see below); • Customary rights are guaranteed; • 2% of the Accounting Area are reserved for agri-industrial concessions;
Code civil 1888		• Statutory definition of the law of obligations; • Defines direct contractual rights as well as rights of participation and compensation (including on the basis of unjust enrichment and *gestion d'affaires*);	• Serves as the legal core for REDD+ implementation at the top level of ER-PA execution (unless foreign contract law governs the contract) as well as at all levels below that level, including the level of engagement with concession holders and local communities;
Forestry Code 2002 and 2016*	• Numerous decrees and regulation on, inter alia, industrial transformation concessions, management concessions, etc.;	• Builds on the Land Law 2004 and specifies the structure of state holdings, and their protection status, concerning forest land; • Defines main concession types and requires concessionaries to contribute to the Local	• Main legislative framework to define land tenure within the Accounting Area;

Statutory basis	Relevant Implementing Acts	Land Tenure Relevance	Relevance for the ER-Program / the Accounting Area
	• Ministerial Regulation on the management and exploitation of local community forest concessions (No 25 of 9 February 2016); • Planned under Forestry Code 2016: Implementing legislation for carbon rights and credit generation and allocation;	Development Fund ("*Fonds de Developpement Locale*"); • Clarifies customary rights of local and Indigenous Peoples; • Creates specific community concessions (cf. Regulation No 25 of 2016); • The Forest Code 2016* introduces the new concepts of carbon rights and carbon credits; • The new Forest Code 2016* reconfirms that concessions;	
Mining Code 2005	• Numerous regulations adopted on its basis;	• Mining concessions give a right to raw materials only, excluding REDD+ related benefits or rights;	• Several mining concessions are given out or are about to be given out;
Planning Law 2014[63]	• In development;	• Demonstration of the Congo's commitment to sectoral harmonization of activities insuring participation, coordination and concertation across governance levels; • Enshrines the principle of sustainable management of natural resources (Art. 36); • All utilization of natural resources including forests requires the existence of a particular land management plan agreed in consultation with all relevant stakeholders (Art. 37);	• Act will serve as the basis for the National Land Allocation Plan (NLAP) • Act will facilitate implementation of the REDD+ program; • New plans, concessions, urban developments, and infrastructure projects must be developed in line with the Act;
Regulation REDD+ Institutional Design 2015[64]	• Enacted on the basis of the ratification acts of the UNFCCC and the Kyoto Protocol	• Sets an institutional structure for REDD+ governance	• Will facilitate and guide REDD+ implementation;
Various protection laws, including the Law on Environmental		• Lays down the need for an environmental impact assessment for all development projects;	• Will facilitate REDD+ implementation;

[63] Law No 43-2014 of 10 October 2014 for Planning and Development of the National Territory (PNAT).

[64] Décret n° 2015-260 du 27 février 2015 portant création, organisation, attributions et fonctionnement des organes de gestion de la mise en oeuvre du processus de réduction des émissions de gaz à effet de serre liées à la déforestation, à la degradation des forêts avec inclusion de la gestion forestière durable, de la conservation de la biodiversité et de l'accroissement des stocks de carbone.

Statutory basis	Relevant Implementing Acts	Land Tenure Relevance	Relevance for the ER-Program / the Accounting Area
Protection 1991[65], the Elephant Protection Act 1991[66], and the Law on Wildlife and Protected Areas 2008[67]		• Provides specific protection status for species and designated protection areas;	

*Revision approved at government level but not yet adopted by Parliament; foreseen for 2016.

Gaps. The SESA process instigated a policy development dedicated to more comprehensive and cross-sectoral analysis and law-making. As noted in chapter 4.4, the Planning Law of 2014 and the future establishment of PNAT/SNAT will be important tools in addressing structural land tenure issues – including conflicts between different types of concessionaries

(logging and mining, in particular, between licensed customary forest users, and generally among different groups of forest users; discrepancies between formal delineation and customary rights; as well as strategic orientation concerning zoning, land conversion, and infrastructure planning – and mitigating deforestation and the depletion of forest resources in the long-run.

The 2011 act promoting the rights of Indigenous Peoples lays down clear and concrete guarantees regarding customary rights of use, mandatory consultation rights, and the prevailing nature of those rights vis-à-vis statutory norms. The act has not yet removed de-facto institutional weaknesses and disadvantages local communities and, in particular, Indigenous Peoples, face in terms of access to natural resources, access to justice, and legal and administrative aid. It is also noted that much of the law is of a general and declaratory, rather than of an instrumental, ready-to-implement nature. Article 10, for instance, guarantees access to justice; Article 32.2 confirms that the land rights of indigenous populations pre-exist formal recognition and are indefeasible and inalienable; Article 33 bans any form of displacement (except in instances of ordre public); Article 38 states a right of consultation concerning any project, which has effects on indigenous lands and/or resources; Article 41 states the principle that indigenous populations have a right to the profit from commercial exploitation and utilization of their lands; and Article 42 installs a right of reparation for any violation of their land rights and right to natural resources. Yet, the law falls short of providing specific procedures to claim these rights and specific rules of participation (on consultation, planning, etc.). It also includes few, if any, mandates to adopt specific implementing legislation.[68]

[65] Law No 3/91 of 23 April 1991

[66] Act No 114 of 24 June 1991.

[67] Law No 37/2008 of 28 November 2008.

[68] See, however, Article 44, which mandates the establishment of “programs”; Article 45, which establishes an interministerial committee; and Article 47, which generally mandates the cabinet to “set out modalities for the application of the law”.

However, the 2011 law is rightly perceived as a regulatory milestone. It has heavily influenced a range of legislative acts and proposals, e.g. the Planning Law of 2014 and the new forest code (FC 2016), ready for adoption. The FC 2016, in particular, puts in practice real guarantees of customary usage (direct and indirect guarantees) and participation (including in REDD+ benefits.

The ER-Program will further introduce a layer of concrete guarantees in re land use planning (see chapter 4.4 above) and the protection of indigenous rights. It will, in particular, translate the constitutional and legislative guarantees into concrete contractual arrangements that define the terms of engagement as well as specific revenue distribution and benefit sharing formulas. Effective representation of local and indigenous communities will be a key feature, it being understood that the ER-Program will not only be subject to a consultative process with indigenous communities, but to the principle of free, prior and informed consent (FPIC). The relevant contractual arrangements – based on the concept of REDD+ Participation Agreements will be further discussed in detail in chapter 17.

4.6 Expected lifetime of the proposed ER-Program

The program will start implementation in 2017 thanks to the different up-front funding (see Section 6.2). It will be implemented with a long-term perspective of 20 years, which extends beyond the ER-PA period with the FCPF Carbon Fund (2017 – 2022) The financial calculation, presented in ANNEX 1. Summary of financial plan, has been designed for 10 years.

5 STAKEHOLDER CONSULTATION, AND PARTICIPATION

5.1 Description of the Stakeholder Consultation Process

REDD + process in Congo - that the ER- Program is part of - must be transparent, inclusive and broadly participatory. These are the three fundamental principles that guide the consultation process.

In line with those principles, consultation and provision of information to stakeholders rely on fundamental documents such as the RPP communication plan established which was designed to: (i) inform stakeholders about the purpose and content of the ER-Program proposed for Northern Congo; (ii) support stakeholders involved in the exercise and measurement of best practices for forest and landscape management; and (iii) learn what these various actors are already thinking and doing with regard to REDD+ best practices.

The consultation process relies also on SESA and benefit sharing plan development.

Information and Consultation during the Preparatory Phase

Consultation and dissemination of information during the preparatory phase of the Emissions Reduction Program took place at different levels. This included active consultation among various stakeholders based in Brazzaville in the specific context of preparation for the REDD+. The objective was to get and collect maximum feedbacks from maximum stakeholders to meet the 3 principles named above. That's the reason why a large number of organizations on various issues through a number of working groups have been mobilized.

Consultation Framework: CN-REDD, ministry focal persons, and CACO-REDD. CN-REDD maintains an ongoing dialogue with Government authorities through focal persons in each of the key ministries involved in the REDD+ process. These focal persons are established within the ministries responsible for: (i) Forestry, (ii) Environment, (iii) Agriculture, (iv) Mines, (v) Energy, (vi) Planning, (vii) Finance, (viii) Local Administration, (ix) Land Affairs, (x) Health, and (xi) Scientific Research. It also maintains constant dialogue with the consultation platform for civil society and Indigenous Peoples (CACO-REDD). The objective of this consultation framework is to provide wide (national) ownership. These discussions also enable to define possible political engagement in each key sectors.

High-level panels. Each of the key ministries has designated an internal group of experts to work on specific questions relating to REDD+. The objective is to coordinate with the sectoral strategies.

CACO-REDD: Focus on NGOs and Indigenous Peoples. This consultation platform for civil society and Indigenous Peoples has established ten thematic working groups since 2014 and has just created a new group on Process Management. The ten thematic groups are: (i) safeguards, (ii) other forest use, (iii) legal aspects, (iv) MRV and reference level, (v) information, education, and communication, (vi) projects, (vii) benefit sharing, (viii) lobbying, (ix) national strategy, and (x) REDD+ process management. The objective of this consultation framework is to provide ownership and to ensure transparency involving LCIP's representatives in the process design.

Technical working groups: Panels of experts. These panels bring together experts in specific thematic areas to discuss, exchange, and gather comments and ideas for improvement on specific issues and problems. They are also an opportunity to share and learn from the experience of each of these members. These panels focus on the technical chapters of the Emissions Reduction Program Document (ER-PD), including: (i) the SESA, (ii) the PCI, and (iii) the Feedback and Grievance Redress Mechanism.

Working groups at departmental level: CODEPA-REDD. These committees (which comprise the Government, the private sector, and the local LCIPs) play an important role in coordinating and disseminating information and are in the process of establishing working groups. The members of the CODEPAs underwent a facilitated training course last December on regular communication and consultation over the ER-Program. This began the consultation process in the form of focus groups at local government level, district heads and their offices, civil society, and Indigenous Peoples in the villages. In the course of the preparation phase of the ER-PD, which extends to August 2016, the principal working groups created by the CODEPA will focus on the following areas: (i) information, education, and communication; (ii) monitoring systems (emissions and absorption MRV, together with impacts and benefits of the REDD); (iii) baseline scenario and baseline level; (iv) specific implementation of strategic REDD+ options and monitoring of REDD+ pilot projects; (v) REDD+ funding, and (vi) legal aspects of the REDD+ process.

Delivery of information in the field: Decentralized units. The decentralized units depend directly on the CN-REDD. Their purpose is to coordinate REDD processes at the *département* level. To this end, they facilitate data gathering, organize consultations, and pending the establishment of thematic groups, support the CODEPA, prefectures, and local councils in explaining technical aspects of REDD+ to as many stakeholders as possible. The head of the decentralized unit is familiar with all the stakeholders in the *département* as well as all the issues involved.

High-level consultation: REDD+ National Committee. The CONA-REDD is the high-level platform for REDD+, bringing together all stakeholders. Ordinary and extraordinary sessions have been held and scheduled following its inaugural session in November 2015, highlighting the high-level commitment of the Republic of the Congo to supporting the implementation of the ER-Program. At the ER-PD consolidation workshop, the President of CONAREDD proposed holding special sessions in the context of benefits sharing.

Inter-donor working group: Environment and Sustainable Development Group. The Environment and Sustainable Development Group, which brings together donors and financial partners in order to discuss the various programs each implements in the field of the environment and sustainable development. This is an opportunity for dialogue on potential synergies between the various programs and for avoiding duplication.

Targeted consultations better adapted to business schedules and prior involvement by the private sector. During a field mission in September 2015, businesses were consulted on a case-by-case basis and in the field to present the details of the ER-Program but also to receive their comments concerning the implementation of such a program as well as their potential involvement and participation. It was following this mission that most of these businesses sent emails to express their firm interest in taking part in the program.

It is important to emphasize that the consultation phase will continue until the official submission to the Carbon Fund (for the program preparation phase) and will continue throughout the implementation phase of the program (see 5.1.2).

It should also be noted that the preparation of the program is based on studies and programs developed at the national level, including the National REDD Strategy, SESA, the Benefit Sharing Mechanism, and the National Reference Level, which have been subjected to a lengthy process of consultation and dissemination of information. The FIP and CAFI have also enabled dialogues and consultations at a high level, specifically by highlighting synergies with the initiatives aiming to contribute to the successful implementation of the ER-Program.

Finally, the involvement of local communities and Indigenous Peoples is an integral part of the early stages of program implementation. To this end, all sectoral activities will be initiated through Local Sustainable Development Plans based on Simple Management Plans in the series of community development initiatives that are part of the process of implementation by the FEDP. These plans will be approved by the chieftainships, territories, and *départements*. The FPIC process will be fully integrated into the activities of the program and the communities will have full freedom in their choice to participate or not. These consultation phases will be crucial to the success of the program and for respect for the rights of the LCIPs.

Significant efforts have thus been made since the submission of the ER-PIN to inform and consult stakeholders from Sangha and Likouala (LCIP, civil society, and local government) by means of meetings and workshops at all levels. The table below summarizes the principal stages of consultation and validation within the framework of the ER-PD.

Table 11. Consultations that have already taken place

Stage	Target group	Dates	Objectives and comments
Awareness-raising campaign on the ER-Program in the departments	Representatives of the LCIPs, local government units, and private sector	September–December 2015	Formation of CODEPAs to disseminate information on the ER-Program at the local level Presentation and explanation of the program to local authorities and LCIPs, presentation of the benefits sharing principles to the LCIPs to identify their needs, and dialogue with the private sector.
Sharing of the draft ER-PD document and distribution to local stakeholders by decentralized units	Civil society and representatives of Indigenous Peoples (CACOREDD), local government units, key ministries, private sector, NGOs, and technical and financial partners	January–March 2016	Comments on the draft ER-PD welcome between January and March to enrich and consolidate the draft document
Consolidation workshop for the ER-PD in Brazzaville	Civil society and representatives of Indigenous Peoples (CACOREDD), local government units, key ministries, private sector, NGOs, and technical and financial partners	February 2016	Present the key points of the document, define the following stages and reframe the way forward to enrich the draft ER-PD as far as possible before submission to the TAP
Consolidation of comments by CN-REDD and CNIAF on the reference level	CNIAF, FAO, CN-REDD	February 19–26, 2016	Technical validation of maps, reference level, and sampling plan
Consultations in the two *départements*	Representatives of LCIP and local government units	February–March 2016	Disseminate and present the strategy, implementation of arrangements, and principles of benefits sharing to gather comments on the ER-PD
Organization of targeted consultations in Brazzaville	Civil society and representatives of Indigenous Peoples (CACO-REDD), key ministries in the REDD+ process, and private sector	February–March 2016	Organization of high-level sessions with stakeholders in the REDD+ process (civil society and key ministries involved in REDD+) to gather comments on the ER-PD. Dialogue with the private sector facilitated by the CONA-REDD and the CN-REDD

Consultations will continue until the signature of the ER-PA.

Table 12. Consultations planned before the signature of the ER-PA

Stage		Target group	Dates	Objectives and comments
A transparent, inclusive and widely participative process	Consultations with all stakeholders within the framework of the R-Package	All stakeholders	March–December 2016	Continuation of consultations (government, civil society, private sector) with a view to maximizing synergies with participatory self-evaluation on the Preparatory Dossier
	CACO-REDD thematic groups	Civil society	Once a month / thematic group	Ensure continuous dialogue with civil society
	High level panel meetings	Experts from key ministries involved in REDD+	Once a month / ministry	Ensure continuous dialogue with key ministries
	EDD group meetings	Financial partners	Once a month	Keep donors informed of ER-Program progress during scheduled meetings.
	CONA-REDD ordinary session	CONA-REDD members	Spring 2016	
	CONA-REDD special session on benefit sharing	CONA-REDD members and experts on Benefit sharing from CN-REDD and technical panel	Spring 2016	
Implement relevant tools	Consultations on SESA tailored to the ER-Program Area, test of PCIs	All stakeholders	April–June 2016	Confirm safeguards arrangements.
	Consultations on land and resource tenure	Local government, LCIPs	April–June 2016	Confirm findings of preliminary land and resource tenure assessment
	Consultations on benefits sharing plan	All stakeholders	April–December 2016	Refine benefit sharing plan
Ensure program success thanks to strong engagement	Marketing of the ER-Program	Potential participants	April–July 2016	Specification of concrete commitments by program partners
	High-level dialogue	Government, CONA-REDD	April–August 2016	Affirm political commitment to the success of ER-Program
	Validation workshop in Brazzaville	Representatives of all stakeholders	August 2016	Validate final modifications emerging from FCPF review processes before official submission to the Carbon Fund.

Information and Consultation during the Implementation Phase

The program will dedicate resources to the program manager and to local agencies involved in implementation to ensure the dissemination of information to stakeholders together with regular consultation. The methodology for the deployment of program activities is based on consultations at village level held as part of the development of land use cartography and associated with the sustainable development plans. A major communication campaign will be launched following commencement of activities (anticipated for 2017). In particular, the program will make use of community-based radio stations, religious groups, and liaison agents identified and trained during the preparation phase.

Throughout the lifetime of the program, regular consultations will be organized by the decentralized departmental body (the CODEPA) and the program management unit, as well as at the national level in order to adjust program activities and investments to meet the shared interests of all stakeholders. The population will also have the opportunity to submit grievances and seek redress as set out in Chapter 14 through the permanent consultation platform that will meet once a quarter.

For more information please refer to ANNEX 3. Consultations during the implementation phase of the ER-Program, that summarizes how consultations will be held during the implementation phase of the ER-Program and ANNEX 4. Tableau récapitulatif des consultations menées dans le cadre de l'élaboration du document du Programme de Réduction des Emissions (ER-P) Sangha-Likouala Nationale REDD+ en 2016.

5.2 Summary of Comments Received and How These Various Points of View Were Taken into Account in the Conception and Implementation of the ER-Program

During recent months, CN-REDD has gathered a number of comments that express the various points of view and concerns held by program stakeholders. These comments have been summarized and compiled in the following table (Table 13. Summary of comments received and how these comments will be integrated into the preparation of the program), which also sets out how these comments will be incorporated into the preparation of the program.

Table 13. Summary of comments received and how these comments will be integrated into the preparation of the program

Principal issue	Target group	Issues / risks raised	Comments / proposed solution by target groups	Incorporation
Institutional arrangements	Government	***Unity of program management must be sound***	The structure of this management unit will constitute the Steering Committee	The exact nature of the management entity is still being finalized. Possible options are presented in Chapter 6. The listed stakeholder groups are part of the governance arrangements.
	Civil society		This unit must comprise: (i) the government (public sector); (ii) civil society; (iii) the private sector, and (iv) LCIPs	
	Private sector	***Need for transparency and rigor in texts***	It is essential that texts be clear, sound, transparent, and subject to review by a third party or specialist agency. It would also be a good idea to have a financial auditing system in place since it continues to be difficult to obtain payments from the State. Today, for example, land taxes are not automatically redistributed to departmental administrations even though these are supposed to be the primary beneficiaries.	The final ER-PD will clearly define the institutional arrangements. An audit of the management entity will be mandatory.
	Government (Ministry of Land Affairs and Public Domain)	***When will the National Land Use Plan (PNAT) be ready so as to guarantee and secure investments?***	The Ministry of Land Affairs and Public Domain prepared the national land policy document in partnership with the UNDP. This document promised, among other actions, the preparation of the PNAT. To date, this has not begun because it is dependent on the action plan for this land use policy, which has not yet been prepared.	The government has expressed its desire to finance the development and roll-out of the National Land Use Plan using CAFI funds.
	Government (Ministry of Tourism)	***When will the law on the environment be ready so as to support implementation of the ER-Program?***	The framework law on environmental management is in the process of discussion between the Ministry of Forest Economy and Sustainable Development and the Ministry of the Environment, and is expected to be passed in 2017.	Given the preparation timeline for the law, the ER-Program cannot integrate it into its design. However, et can be adjusted during implementation, and REDD+ considerations can be integrated into the new law.
	Government (Ministry of Mines and Geology)	***When will the new mining code be ready so as to impose practices in line with the demands of the ER-Program?***	With regard to the Mining Code, a ministerial committee was set up and has almost completed the drafting stage. The final document is awaiting approval by the Commission.	Given the preparation timeline for the law, the ER-Program cannot integrate it into its design. However, et can be adjusted during implementation, and REDD+ considerations can be integrated into the new law.
Benefits sharing	Civil society	***Taking into account all strata of stakeholders in the redistribution of benefits***	Local communities and Indigenous Peoples must receive carbon benefits	The revenue-sharing program stipulates that a portion be reserved for LCIPs.

Principal issue	Target group	Issues / risks raised	Comments / proposed solution by target groups	Incorporation
	Government	***The body responsible for distributing benefits must be neutral and trustworthy***	Public-private entity	The benefit sharing mechanism will be managed by the management entity, which is being designed so as to operate independently and neutrally, and which will undergo regular audits.
	Civil society		CODEPA	
	Government	***The beneficiaries of the ER-Program must be clearly defined***	The beneficiaries of the ER-Program will be all those stakeholders that contribute to reducing emissions of greenhouse gases	The benefit-sharing plan defines beneficiaries and flow of funds. The incentives described are part of the ER-Program design.
	Civil society		Landowners, Recipients of usufruct rights, Investors; Concerns that the State never pays the portion owed to the Departmental Councils especially given that there already exists a problem of skills transfer	
	Civil society, Private sector	***Create incentives for stakeholders***	Create alternative activities for the communities concerned so as to provide incentives to change practices; Create micro-projects; Encourage payments for environmental services	
Strategy and activities	Government	***What will happen if for some reason the CIB-OLAM decides to discontinue the selling of cocoa?***	The Ministry of Agriculture and local authorities should support farmers in the production of nurseries and the Ministry of Commerce in identifying private traders to sell cocoa	The different funding sources of the ER-Program (FIP, GEF) and associated projects (NDP-Cocoa, AFD) will reduce this risk.
	Civil society		• Liberalization of the cocoa market • Encouragement by the State to the creation of a value chain for the cocoa sector that takes into account production, preservation, processing, and marketing • Creation of synergies in the sale of cocoa	The different funding sources of the ER-Program (FIP, GEF) and associated projects (NDP-Cocoa, AFD) will serve to organize the value chain, among others.
	Local governments	***Support for small farmers***	Villagers must be involved in new agricultural techniques through seminars; The National Reforestation Service (SNR) must be operationalized within logging companies.	Training of LCIPs is included in the ER-Program.
	Civil society		• Regular maintenance of rural roads by departmental councils • Capacity-building for producers: facilitating access to land, training, support with equipment and inputs, access to loans, and	The portion of carbon revenues that local administrations and LCIPs will receive could be used to maintain roads. Capacity building is a key component of the ER-Program.

Principal issue	Target group	Issues / risks raised	Comments / proposed solution by target groups	Incorporation
			guarantees for the sustainability of the activity	
	Private sector	***Ambivalent strategy and activities lacking in sufficient incentives***	• Either not enough development takes place due to too many environmental restrictions or too much development leads to deforestation. • Risk that the carbon income will not be enough to arouse the interest of actors in getting involved	The ER-Program gives to each actor the choice of whether to participate, and to determine the extent of their involvement. Business plans are being developed to determine the financial interest of participation in the Program.
Communication	Civil society	***Reinforcing communication strategies***	• Organize meetings to share and exchange experiences; door-to-door awareness raising; training workshops; press conferences; use of community radio; distribute simple illustrated flyers and posters, create information slots (town criers, opinion leaders, community leaders, etc.) • Organize seminars and focus groups	A consultation plan has been created within the framework of the ER-Program, and the CODEPAs have received training in distributing and continually relaying this information
	Private sector	***Generating unrealistic expectations on the part of stakeholders***	Risk of communicating too much on income from carbon and not enough on the real goal of the program, which is to fight climate change. Communication must therefore be oriented much more toward climate change and less toward its financial aspects to avoid creating overly high expectations.	The benefit sharing plan will provide details on what can be gained from the ER-Program. Communications activities will be tightly linked to this plan once it is finalized.
Safeguards	Civil society	***Monitoring and evaluation of the ER-Program***		MRV and the SIS will ensure monitoring and evaluation of the ER-Program, and will be financed through the program.
	Private sector	***Being aware of the sociology of the Congo***	Effectively include minorities in the program	The ER-Program is based on consultations to ensure that LCIPs' points of view are taken into account. Several activities (agroforestry), and non-carbon benefits (NTFPs, increased incomes) are specifically designed to include the interests of minorities.

Principal issue	Target group	Issues / risks raised	Comments / proposed solution by target groups	Incorporation
Level of reference and MRV	**FAO and CNIAF partners**	***Gathering and validation of data***	There is a general lack of national ownership of work carried out by international consulting firms. Take care to ensure that the two reference levels (national and regional) are coordinated.	A validation of the reference level was held with the support of a mapping expert from the FAO. The data were adjusted, validated, and integrated into the program document.
	Civil society	***Avoiding double counting of benefits***	How to ensure that the benefits are properly distributed and no counting errors occur?	The benefits sharing plan and the MRV system define the methodologies that will ensure a direct link between an emissions reductions activity and the benefits to be distributed.

Further consultations on risks to the program will be conducted according to the consultation strategy for the program.

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6 OPERATIONAL AND FINANCIAL PLANNING

6.1 Institutional and Implementation Arrangements

National Oversight and Supervision

The Government of the Republic of Congo will be the signatory of the ER-PA represented through the Ministry of Finance, which is the legal ER-Program Entity. As such, it may authorize another organization, i.e. a REDD+ Management Entity (RME), to administer and manage the ER-Program. The overall responsibility for REDD+ development in the country falls under MEFDDE (Decree 1155/2012). The Ministry of Finance may therefore designate the MEFDDE as the entity implementing the ER-Program operationally, but also vis-à-vis the international partner (the Carbon Fund).

The governance of the ER-Program in terms of policy guidance and supervision at the national level is defined by the Decree No 260/2015 of 27 February 2015. It establishes, among others, the National REDD+ Committee (CONA-REDD) and the National REDD+ Coordination (CN-REDD), which are both fully operational.

CONA-REDD is a multi-stakeholder committee responsible for national REDD+ development composed of 15 representatives from ministries across sectors, eight representatives from civil society, six from the Indigenous Peoples network, and three from the private sector operating in forestry, agroindustry and mining. CONA-REDD will be restructured to have two chambers and, thus, ensure high-level inter-sectoral dialogue: One at technical level and one at ministerial level. The Decree on REDD+ institutions will be revised, accordingly. Based on its mandate, the role of CONA-REDD for the ER-Program, inter alia, is to:

- Decide on strategic options for the ER-Program and confirm alignment with the national REDD+ strategy;
- Coordinate policy decisions among the concerned ministries;
- Mediate potential conflicts if elevated up to national level;
- Approve the work plan of CN-REDD;
- Assume oversight of the ER-Program.

Once the Government installs an RME, CONA-REDD will also:

- Approve the annual implementation plans and budgets prepared by the RME and mandate sectoral Ministries to implement ER-Program activities;
- Assess and review monitoring reports from RME.

CONA-REDD will fulfill these functions mainly through its five permanent Standing Committees responsible for:

1) REDD + projects;

2) Reference Emission Levels and MRV;
3) Legal affairs, social and environmental assessment;
4) Information, education and communication;
5) Marketing and mobilization of funds.

CN-REDD is an operational unit under MEFDDE responsible for the day-to-day management and implementation of REDD+. It is composed of a technical team based in Brazzaville and decentralized units in the departments Sangha and Likouala. Under the guidance of CONA-REDD, the CN-REDD is responsible for the following tasks related to the ER-Program:

- Complete the REDD+ readiness components, such as national REDD+ strategy, SESA and ESMF, FGRM, reference level and MRV;
- Allocate management tasks to public and/or private entities;
- Ensure the day-to-day management of the REDD+ and ER-Program process;
- Prepare intervention proposals for MEFDDE and ensure the mobilization of national and international experts;
- Serve as a technical secretariat for CONA-REDD;
- Assess the alignment of the ER-Program implementation plan with the national REDD+ strategy:
- Assist with operationalization of the RME (including the preparation of necessary governmental approvals).

CN-REDD will be operational until the end of 2017 with readiness finance provided through the FCPF Readiness Fund. It is currently under discussion that technical experts could thereafter be integrated into MEFDDE to assist the CONA-REDD technical chamber on technical REDD+ issues.

Finally, the CN-REDD together with CACO-REDD and support from the European Forest Institute (EFI) are discussing the establishment of an Independent Observer for REDD+ building on the experiences with the Independent Observer for FLEG. If international finance can be mobilized to establish an Independent Observer for REDD+, it could play an important role to promote transparency and strengthen the involvement of civil society in checking on ER-Program implementation.

ER-Program Management and Administration

Program management throughout implementation will include aspects of *operations* (e.g. purchases of material, training, stakeholder engagement, marketing of the program), *contract management and compliance* (e.g. REDD+ Participation Agreement implementation, management of the benefit sharing plan), as well as *monitoring, audit and follow-up* (e.g. monitoring reports, supervision of safeguards), and the *management of program funds*.

The overall responsibility for the program will remain with CONA-REDD, in particular as regards substantial decisions, such as program expansion (new partners) or funding decisions.

On the day-to-day basis, the ER-Program will be managed and administered by a REDD+ Management Entity (RME). The RME's role – at least in the short and mid-term (5-10 years) – will be assumed by an external service provider to be selected through international tender. It will be staffed with both international and domestic experts located in a central office (Brazzaville) as well as in two decentralized offices (probably in Ouesso and Impfondo). The RME will report directly to CONA-REDD, with the National REDD+ Coordinator acting as the focal point and gateway between the two.

The Terms of Reference – prepared in consultation with CONA-REDD – will provide details on the expert profiles, RME governance and oversight issues, including with respect to the annual implementation plans and budgets as well as monitoring plans. While the RME will report to CONA-REDD (ex ante and ex post), the RME shall be given a broad mandate and a high degree of autonomy when pursuing its activities. The RME's mandate will bundle aspects of operations, contract management and compliance, monitoring, audit and follow-up, as well as fund management. In particular, the RME will be responsible to:

- Carry out the ER-Program in accordance with the ER-PD;
- Develop annual implementation plans and budgets for ER-Program activities;
- Fulfill all fiduciary functions including development of financial plans, management of cash flows for the ER-Program and fiscal reporting;
- Implement stakeholder engagement plan;
- Monitor the implementation of ER-Program activities;
- Perform carbon monitoring (MRV) in coordination with CNIAF;
- Develop, negotiate, execute, administer and monitor REDD+ Participation Agreements with all program participants;
- Carry out the benefit sharing plan, including measuring results for direct and indirect benefits, and administrating payments;
- Support the design and development of structures to manage benefits for participating LCIPs;
- Ensure robust serializing, tracking and transacting of emission reductions generated from Program;
- Leverage, rationalize and integrate non-ER sources of REDD+ funding in the ER-Program Area;
- Mediate potential conflicts at program level;
- Identify and attract additional sources of funds required for the ER-Program;
- Conduct communication and marketing of ER-Program;
- Prepare progress reports on ER-Program implementation for review by CONA-REDD;
- Fulfill all reporting requirements of the ER-Program (e.g. GHG emissions, safeguards, benefit sharing implementation to ensure transparency.

The RME will be given contract execution power for the negotiation and execution of REDD+ Participation Agreements.

Implementation Arrangements

The ER-Program activities will be implemented by government agencies, the private sector and communities based on REDD+ Participation Agreements.

The ER-Program will use contractual agreements with participating stakeholders to define roles, responsibilities, activities, budget and benefit sharing arrangements. The agreements, developed by the RME in accordance with the ER-PD, implementation plans, budgets and benefit sharing plan are called "REDD+ Participation Agreements". They will be signed with all implementers involved in the Program. Each agreement will be customized to reflect the specific support and financial terms that govern activities between the ER-Program and its implementing participants. They will also include details of how benefits will be distributed, the specific terms and conditions, such as requirements for activity implementation and generation of emission reductions, reporting and monitoring requirements and other requirements under the Program, including notably exclusivity terms and carbon rights transfers.

Table 14 below describes the role of **government agencies** in implementing one or more the ER-Program measures.

Table 14. Implementation responsibilities of government agencies

Government agency	Implementation roles within ER-Program
MEFDDE	• Establish laws, policies and enabling conditions to support biodiversity and environment conservation and protection (i.e. for protected areas) • Support Protected Areas management • Develop incentives to promote protection and management of protected area • Establish polices, laws and enabling conditions to promote RIL • Develop incentives and promote adoption for concessioners to convert to RIL • Engage private sector to participate in RIL • Enforce forestry laws • Attract/provide sources of funds to finance the conversion to RIL and improved governance of concessions in ER-Program Area • Improve EIA processes
Ministry of Finance	• Signature or ER-PA • Approve major financial decisions
Ministry of Planning	• Establish policies, laws and enabling conditions to develop the ER-Program • Facilitate and ensure synergies between the ER-Program and other national initiatives and programs • Develop incentives to attract stakeholders to join the program
Ministry of Agriculture and Husbandry	• Establish polices, laws, national strategies and enabling conditions to support smallholder cocoa, HCV asides for industrial oil palm and outgrower oil palm • Engage private sector to participate and structure terms of PPPs • Promote improved capacity of NGOs in ER-Program Area • Develop program activities and provide funding to promote sustainable conservation agriculture in ER-Program Area to increase productivity and crop diversification

Government agency	Implementation roles within ER-Program
	• Promote value chain development for crops produced in the program area • Attract/provide sources of funds to finance the building of sustainable cocoa and palm oil production in the ER-Program Area
Ministry of Mining and Geology	• Establish polices, laws and enabling conditions to promote improved mining practices • Develop mitigation programs to mitigation impact of mines • Evaluate and predict impact on forest cover from artisanal mining • Attract/provide sources of funds to finance to support green mining in ER-Program area
CNIAF	• Provide technical support to the ER-Program for GHG Quantification • Ensure consistency of methods and techniques between national REDD+ at national level and the ER-Program • Coordinate/leverage acquisition of remote and field based data required for monitoring • Coordinate with the RME on MRV • Support the development of community management plans

In addition to these governmental agencies, the **departmental-level CODEPA in Sangha and Likouala** will play a role in the implementation of the program. The departmental committees are multi-stakeholder committees, each composed of 10 representatives from public administration, eight from civil society, five from Indigenous Peoples and three from the private sector. The CODEPA-REDD in Sangha and Likouala will be responsible for:

- Supporting the RME in developing the annual implementation plans and budgets, e.g. regarding the design and prioritization of ER-Program measures;
- Mobilizing implementation support from government agencies for ER-Program activities;
- Supporting social and environmental assessment processes and identification of local partners that can support the ER-Program implementation;
- Mediating potential conflicts at departmental level;
- Providing logistical support to the RME in the departments;
- Facilitating implementation at departmental level of decisions made by CONA-REDD;
- Support the implementation of the stakeholder engagement plan.

Furthermore, **private sector companies** are important implementing partners for the ER-Program, as they manage over 60% of the total ER-Program Area. Their specific roles are summarized in Table 15.

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Table 15. Implementation responsibilities of the private sector

Private sector	Implementation Roles within ER-Program
Forest Concession Holders	• Adopt RIL/LtPF techniques in production areas • Promote alternative livelihoods within LCIPs in and around concession areas • Co-invest with government in building productive activities within concessions • As appropriate and feasible, invest in infrastructure in the ER-Program Area according to their "Cahiers des charges"
Agribusiness	• Support rebuilding of cocoa sector including but not limited to: ➢ Identification of prioritized production areas ➢ Production and distribution of seedlings (cocoa and other agroforestry crops) ➢ Technical support and inputs to LCIPs for planting and maintenance of cocoa degraded forest areas and establishment of agroforestry systems ➢ Tracking of production, including ensuring forest cover is not negatively impacted by the expansion of the sector ➢ Promotion of cooperatives ➢ Purchase and export of crops • Co-invest with government in building productive activities within concessions • As appropriate and feasible, invest in infrastructure in the ER-Program Area according to their "Cahiers des charges"
Palm Oil Companies	• Adopt practices that identify and protect HCV areas within concessions • Secure RSPO, where possible • Promote outgrower oil palm in non-forest areas including but not limited to: • Identification of prioritized production areas • Production and distribution of seedlings • Technical support and inputs for LCIPs to establish smallholder oil palm in non-forest areas in which they have tenure • Tracking of production, including ensuring forest cover is not negatively impacted by the expansion of ougrower oil palm • Promotion of cooperatives • Purchase and processing of crops • Co-invest with government in building productive activities within concessions • As appropriate and feasible, invest in infrastructure in the ER-Program Area according to their "Cahiers des charges".
Mining Companies	• Adopt good practices in planning and management practices for exploitation to minimize forest lost • Voluntarily participate in program mitigation schemes in cooperation with the government • Apply improved land-use planning techniques to design location of mine related infrastructure • Create trust funds during mining operation to ensure remediation occurs when mine is decommissioned • As appropriate and feasible, invest in infrastructure in the ER-Program Area according to their "Cahiers des charges"

Some ER-Program activities will be implemented by **NGOs**. In particular, the management of protected areas in the ER-Program Area is outsourced to international NGOs on a contractual basis with MEFDDE. In addition, NGOs can play a role in promoting other ER-Program activities.

Table 16. Implementation responsibilities of NGOs

NGOs	Implementation Roles within ER-Program
Protected Area Managers	• Protected area governance and patrolling • Management plans with LCIPs in and around protected areas • Promotion of livelihood incomes and improved agricultural activities • Attract financing to support protected area management, such as eco-tourism
International NGOs	• Provide technical support in areas of conservation and sustainable landscape management • Build capacity of local actors • Support key implementation components of the ER-Program • Facilitate data collection required for ER-Program monitoring • Attract financing to support protected area management
NGOs with local offices in ER-Program area (limited capacities at the moment)	• Support stakeholder engagement in the ER-Program • Promote cooperatives to increase LCIPs' ability to engage in new productive activities • Facilitate data collection required for ER-Program monitoring • Build capacity of local actors • Attract financing to support ER-Program's implementation

Finally, **LCIPs** will implement ER-program activities related to improved management of the forest concession's non-production areas, protected areas and unattributed in the ER-Program Area.

Table 17. Implementation responsibilities of LCIPs

Implementer	Implementation Roles within ER-Program
LCIPs *(within and outside of CDZs)*	• Where not in place, collaboratively develop management plans • Manage forest areas in accordance with management plans • Adopt opportunities, as appropriate, to establish new crops (cocoa, agroforestry, oil palm and conservation agriculture) • Promote LCIP cooperatives to maximize effectiveness participation in agricultural opportunities • Participate in implementation of key components of ER-Program implementation, including design and governance of the community development funds management REDD+ benefits • Provide feedback and input through the ER-Program's stakeholder engagement process

6.2 ER-Program Budget

The finance plan for the ER-Program to deliver ERs based on the set of activities identified to address main drivers of deforestation and forest degradation is comprised of the following components:[69]

(i) Secured pledged or committed investment programs that will target ER-Program activities, including GEF (World Bank / UNDP), FIP, FIP DGM, AFD, AfDB and DFID;

(ii) Mobilization of additional investments including CAFI and a new World Bank IDA project on commercial agriculture;

(iii) Private investments from interested companies;

(iv) Advance payment of the FCPF Carbon Fund for activities not covered from investment sources.

These investment finance sources are being coordinated in a programmatic approach to complement each other, fund different types of activities, or scale up tested practices. A preliminary summary of the estimated finance sources is provided in Table 18.

Table 18. Summary of the estimated finance sources of the ER-Program

Finance source		Estimated amount in million USD directly supporting ER-Program activities
Secured sources (pledged or committed)	GEF (WB and UNDP)	8.08
	FIP	16,000,000
	FIP DGM	4.50
	DFID	6.17
	AfDB (PACIGOF)	20.76
	AFD	14.46
To be mobilized	CAFI	8.00
	WB IDA project on commercial agriculture (PDARP2)	tbc
Private investments (expressions of interest)	Companies and investors	30.1
Advance payment	FCPF Carbon Fund	6.00
Total		**114.07**

[69] For details, please refer to ANNEX 5. Complementary programs

Out of the estimated budget of USD 114.07 million from the finance sources listed in Table 18. Summary of the estimated finance sources of the ER-Program (excluding carbon revenue), the following ER-Program activities will be supported:

Table 19. Financing of ER-Program activities

	ER Program Activities	**Total funding allocation (in million USD)**
Sectorial activities	Reduced Impact Logging (RIL)	12.30
	Logged to Protected Forest (LtPF)	5.98
	Reduction of Forest Conversion from Industrial Palm (HCVPalm)	1.82
	Smallholder shade cocoa in Community Development Zones (SH Cocoa)	15.25
	Palm Outgrower Schemes in Community Development Zones (SH Palm)	10.00
	Sustainable agriculture and others livelihoods activities (SH SustainAgr)	9.40
	Smallholders conservation payments (SH Cons)	4.00
Enabling activities	Biodiversity and protected area management	6.69
	Community level governance	3.90
	Land-use planning	8.00
	Forest sector governance	29.73
	Support for developing a sustainable cocoa production	2.00
	Support for developing a sustainable palm oil production	2.00
	Reduced-Impact Mining	2.00
	TOTAL	**114.07**

The detailed finance plan for the ER-Program is presented in ANNEX 1. Summary of financial plan. It is based on a detailed analysis of management and administration costs, business plans for each activities, funding sources and benefit sharing assumptions as discussed in Chapter 15. The finance plan foresees MRV three times (2018, 2020 and 2022) and an advance payment of 10% upon ER-PA signature.

The allocation of investment to the different ER-Program activities is based on the prioritized drivers of deforestation and forest degradation, the potential for ERs, up-front finance needs, incentive structures, benefit sharing arrangements, as well as delivery capacity.

Furthermore, the ER-Program presents an opportunity to build a sustainable commodity sector from the ground up aiming to improve the livelihoods of local communities while reducing emissions from land use. The financing plan is built on a Cost-Benefit Analysis for the individual mitigation activities. The figure below illustrates results demonstrating that the potential revenues including the ER-Program payments/investments result in income, which exceeds the revenues from shifting cultivation. Opportunity costs arising from the net income from shifting cultivation are represented by the blue line and are considered to be constant. The average revenues (i.e. from sustainable cocoa cultivation, sustainable palm oil production and from sustainable agriculture) including ER-Program Payments are represented by the green line. It is concluded that the potential revenues exceed the farmers costs and increase further over time.

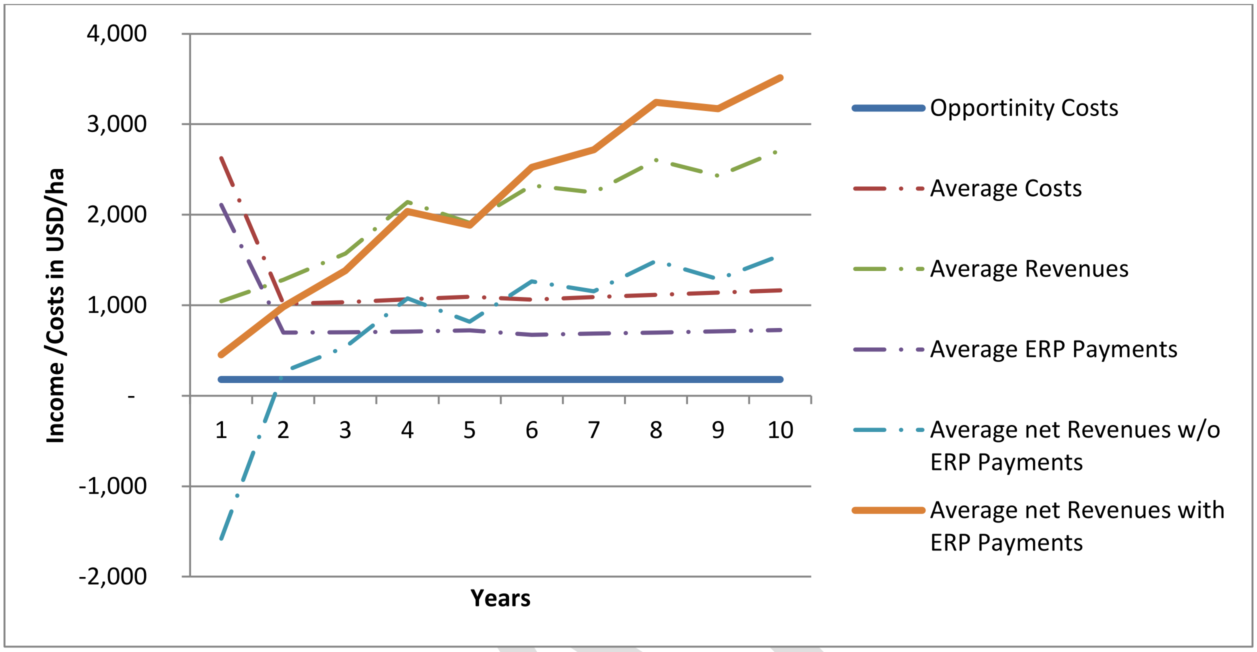


Figure 8. Results demonstrating that the potential revenues including the ER-Program payments/investments result in income which exceeds the revenues from shifting cultivation.

Moreover the ER Program aims to leverage private sector finance. CIB-OLAM is interested to turn the ER-Program area and the country more broadly in a source for sustainable cocoa. The company has already provided the “proof of concept” for the commercialization of cocoa from the program area that meets international quality standards. If the government can provide the necessary support infrastructure, including through aid flows, significant private sector investment in the cocoa sector is expected. Eco-Oil is also committed to contribute significantly to the implementation of smallolder oil palm activity as they intend to cover the plantation implementation costs (they'll provide seedlings, material and technical support) and will be the main buyer for clusters production (they are organizing to collect clusters right onto the fields and transport them to their processing factory).

Finally, an important feature of the program’s financial strategy over 10 years is to reinvest a substantial share of the carbon revenues in program activities in order to complement the initial public investment funding. Emission Reduction revenues are thus considered as a way to ensure sustainable financing of activities during a 10-year period and maximize the delivery chances of the ER Program (prevent the risk of financial shortfalls). Both the reinvestments as well as the distribution revenues to program beneficiaries are captured in the benefit sharing plan (see Section 15).

7 CARBON POOLS, SOURCES AND SINKS

7.1 Description of Sources and Sinks Selected

Table 20. Descriptions of Sources and Sinks Associated with REDD+ Activities

Sources/Sinks	Included?	Justification / Explanation
Emissions from deforestation	**Yes**	The ER-Program accounts for emissions from deforestation as required by Indicator 3.1 of the Methodological Framework. **In line with the terminology used in the national Reference Emission Level / Forest Reference Level submitted to the UNFCCC**[70] and the ER-PIN presented to the Carbon Fund Participants, emissions from deforestation are disaggregated in emissions from **planned deforestation** (defined as permitted, sanctioned, or zoned to be deforested) and **unplanned deforestation** (not permitted, sanctioned, or zoned to be deforested). • Planned deforestation: The ER-Program accounts for emissions from planned deforestation, which includes emissions due to land clearing for agro-industry, and exploitive mining, road developments are that considered planned deforestation and are spatially explicit. Planned deforestation accounts for **20% of total forest related emissions** in the Reference Period. • Unplanned deforestation: The ER-Program accounts for emissions from unplanned degradation, which includes emissions due to the conversion of forest to non-forest and which does not fit in the previous category. Unplanned deforestation accounts for **43% of total forest related emissions** in the Reference Period.

[70] http://redd.unfccc.int/files/2016_submission_frel_republicofcongo.pdf

Sources/Sinks	Included?	Justification / Explanation
Emissions from forest degradation	**Yes**	Here, forest degradation refers to the long-term reduction of the carbon stocks in a natural forest due to the impact of human activities where forest cover reduces from original value to a limit of > 30% within the minimum mapping unit of 0.5 ha. Emissions from degradation are accounted for as these are significant (>10% of all forest-related emission in the reference period). Emissions from degradation account for approx. **36% of all forest-related emissions in the reference period**. In line with the terminology used in the national Reference Emission Level / Forest Reference Level submitted to the UNFCCC, ER-Program accounts for emissions from degradation, and these are disaggregated in emissions from **planned degradation** (identified as industrial logging) and **unplanned degradation** (not sanctioned, or zoned to be degraded). • <u>Planned degradation</u>: The ER-Program accounts for emissions from planned degradation, which includes emissions due to logging in production areas. Planned degradation accounts for **16% of total forest related emissions** in the Reference Period. • <u>Unplanned degradation:</u> The ER-Program accounts for emissions from unplanned degradation, which includes emissions due degradation in forests which do not fit in the previous category. Unplanned degradation accounts for **22% of total forest related emissions** in the Reference
Removals from conservation of carbon stocks	**No**	**In line with the terminology used in the national Reference Emission Level / Forest Reference Level submitted to the UNFCCC**, emissions or removals from Conservation of carbon stocks are not accounted for in the ER-Program as a separate REDD+ activity as these are already accounted in the previous REDD+ activities.
Emissions from Sustainable management of forest	**No**	**In line with the terminology used in the national Reference Emission Level / Forest Reference Level submitted to the UNFCCC**, emissions or removals from Sustainable management of forests are not accounted for in the ER-Program as a separate REDD+ activity as these are already accounted in the previous REDD+ activities.

7.2 Description of Carbon Pools and Greenhouse Gases Selected

Table 21. Carbon Pools, Justification, and Comments Related to Carbon Pools Included in the Program

Carbon Pool	Included	Justification / Explanation
Aboveground biomass	Yes	Aboveground biomass is a major carbon pool affected by ER-Program Activities. Aboveground tree biomass is estimated using measurements of tree diameter (DBH), height, and identifying wood density and traditional allometric equations (e.g., Chave et al. 2014)[71] and it considers all trees >1 cm of DBH. Non-tree biomass is not included as it constitutes an insignificant proportion of total carbon stocks as indicated by KOSSI DITSOUGA (2011)[72] who shows that non-tree biomass for similar forests is 0.123 t d.m/ha (95% confidence interval of 0.095−0.175 t d.m./ha) which is less than 0.07% of the estimates of aboveground biomass of all forest types considered in the Accounting Area. GHG emissions from this component are then obviously lower than 10% of total forest related GHG emissions.
Belowground biomass	Yes	A significant form of biomass quantified using a root-to-shoot relationship from aboveground tree biomass. According to Following the FCPF Methodological Framework, the emissions from belowground biomass can be significant (> 20%) of the total emission and mist be included as part of the carbon pools.
Deadwood	No	Existing deadwood within forests in and around the Accounting Area is not a significant component of the total carbon stocks. According to the estimates of the NFI in Republic of Congo[73] the dead wool pool constitutes 0.28% of total stocks (Aboveground, Belowground and Deadwood stocks). Considering that dead wood stocks in non-forest land use categories is expected to be lower in relative terms (over total stocks) than in forests, it is expected that GHG emissions from this pool is less than 10% of total forest related emissions and its omission will be conservative. Hence, following indicator 4.2 of the FCPF Methodological framework this carbon pool is excluded.
Litter	No	The litter layer contains a small amount of carbon and therefore is not measured. Studies in South Cameroon, with similar forests as in the Accounting Area found that litter represents 1.7-1.9% of the total aboveground biomass stocks[74]. Considering that litter stocks in non-forest land use categories is expected to be lower in relative terms (over total stocks) than in forests, it is expected that GHG emissions from this pool is less than 10% of total forest related emissions and its omission will be conservative. Hence, following indicator 4.2 of the FCPF Methodological framework this carbon pool is excluded. Moreover, its exclusion is in line with the national REL/FRL submitted to the UNFCCC.

[71] Chave, J., Réjou Méchain, M., Búrquez, A., Chidumayo, E., Colgan, M. S., Delitti, W. B., & Vieilledent, G. et al. (2014). Improved allometric models to estimate the aboveground biomass of tropical trees. Global change biology.

[72] Alain Franck KOSSI DITSOUGA. 2011. ESTIMATION DE LA BIOMASSE VEGETALE DU SOUS-BOIS. Master 1 de Biologie des Populations et des Ecosystèmes (MBPE) OPTION : VEGETALE

[73] CN-REDD. 2016. REL/FRL submitted to the UNFCCC. page 34 http://redd.unfccc.int/files/2016_submission_frel_republicofcongo.pdf,

[74] A. Ibrahima, P. Schmidt, P. Ketner, G.J.M. Mohren. 2002. Phytomasse et cycle des nutriments dans la forêt tropicale dense humide du sud Cameroun. Tropenbos-Cameroon Documents 9. The Tropenbos-Cameroon Programme. Kribi, Cameroon

Carbon Pool	Included	Justification / Explanation
Soil organic carbon	No	In areas subject to forest degradation, it is assumed under the 2006 IPCC GL that forest soil carbon stocks do not change with management[75], so GHG emissions due to degradation would be zero. In terms of deforestation, deforestation occurs for conversion of annual crops (bare areas) or conversion to tree crops or perennial crops (agroforestry). In areas converted from forestland to perennial tree cropland (palm oil), 2006 IPCC GL indicate that the soil carbon stocks would remain constant[76]. However, in areas converted to annual cropland, the 2006 IPCC GL[77] indicate that the soil carbon stocks would decrease by 50%. Therefore, it is clear that the exclusion of the SOC would be conservative as it would underestimate GHG emission reductions. Hence, following indicator 4.2 of the FCPF Methodological framework this carbon pool is excluded. Moreover, its exclusion is in line with the national REL/FRL submitted to the UNFCCC.

Included Greenhouse Gases

The quantification of the emission sources performed by including all activities and inputs associated with the program.

In accordance with Methodological Framework and the applicability criteria, GHG emissions of CO_2, N_2O and CH_4 are accounted for if found to be significant within Accounting Area, both for Reference Level setting and Measurement, Monitoring and reporting (MMR). The following GHGs were included in carbon emissions.

Table 22. GHG Emissions Included in Accounting

Gas	Included?	Justification/Explanation
CO_2	Yes	The emissions are related to changes in carbon pools including emissions from forest degradation.
CH_4	No	CH_4 emissions from burning woody biomass are not included within the scope. The implementation of the ER-Program activities will reduce the number of fires as slash-and-burn agriculture, the main source of fires, will be reduced and replaced by other permanent crops. Therefore, its exclusion would be conservative. In addition, the FIRMS Archive Database from MODIS shows Fire Occurrences Between 2005-2015 are extremely limited to non-forest areas (Figure 25), so GHG emissions from forestland remaining forestland is expected to be very low.
N_2O	No	N_2O emissions from burning woody biomass are not included within the scope. The implementation of the ER-Program activities will reduce the number of fires as slash-and-burn agriculture, the main source of fires, will be reduced and replaced by other permanent crops. Therefore, its exclusion would be conservative. In addition, the FIRMS Archive Database from MODIS shows Fire Occurrences Between 2005-2015 are extremely limited to non-forest areas (Figure 25), so GHG emissions from forestland remaining forestland is expected to be very low..

[75] Tier 1 assumption in Section 4.2.3.1 - Chapter 4 – Volume 4 – 2006 IPCC GL

[76] Assumed tropical moist/wet climate, perennial/tree crops, full tillage at time of plantation, medium inputs - Relative stock change factors in Table 5.5 - Chapter 5 – Volume 4 – 2006 IPCC GL

[77] Assumed tropical moist/wet climate, long-term cultivated land use, full tillage, medium inputs - Relative stock change factors in Table 5.5 - Chapter 5 – Volume 4 – 2006 IPCC GL

8 REFERENCE LEVEL

8.1 Reference Period

The reference period is defined as the period over which the historical rate of deforestation and degradation is analyzed. According to the Carbon Fund Methodological Framework (MF) of the FCPF, Indicator 11.1: *The end-date for the Reference Period is the most recent date prior to 2013 for which forest-cover data is available to enable IPCC Approach 3. An alternative end-date could be allowed only with convincing justification, e.g., to maintain consistency of dates with a Forest Reference Emission Level or Forest Reference Level, other relevant REDD+ programs, national communications, national ER program or climate change strategy.*

Following the MF guidelines, we chose the end date of the reference period to be December 2012, consistent with the national reference level. The start-date for the Reference Period is about 10 years before the end-date. The program reference period is set between 2003-2012.

The ER-Program makes use of the cover change products developed based on a Landsat time series over the period of more than 10 years prior to the start date. The Landsat imagery is analyzed at 30 m spatial resolution over the reference region (Sangha and Likouala provinces) at three points in time to quantify the historical deforestation and degradation. During this period, average annual deforestation rates are calculated for the ER-Program Area, and each Management.

As part of the process of developing the national reference level (REL/FRL), the CNIAF with the support of FAO selected the period of 2000-2012 for estimating the changes of land use at the national level. The national land use changes included only the activity data associated with deforestation and did not include the forest degradation. These differences inspired a series of discussions between the national and jurisdictional programs in coordination with the Technical Advisory Panel (TAP) for developing consistent REL/FRL at both scales. Furthermore, the end date of the reference period was approximately 4-5 years before the start date of ER program at both jurisdictional and national level. These resulted in a number of technical decisions that are summarized below:

1. Reference period include approximately 10 years from 2003-2012 to comply with the MF guidance. Both deforestation and degradation are considered in the historical land use change. The calculations of historical transitions include only changes between 2003 and 2012 period and the transition to 2007 is not included in the final products. However, the 2007 data are available for any future need more detailed information on land use transitions.
2. The land cover and land use change is extended to 2015 to quantify any changes that occurred after 2012 to a date closer to the start of the ERPA term. Any significant changes of land use transitions are used as adjustments but not in the calculation of the average historical emissions, being subject to the adjustment cap.

3. Consistent with this, CNIAF with the support of FAO and as part of a national project finance with the FCPF Readiness grant, agreed to update the national REL/FRL to match with the jurisdictional products by using 2003-2012 as the reference period and extending the analysis to 2015 so as to make any adjustments at the national level. Furthermore, CNIAF also made the decision to include forest degradation as part of the land use change during the reference period. This will ensure full alignment between the national and regional level in the mid-term (end 2017).

8.2 Forest Definition Used in the Construction of the Reference Level

The forest definition used for the ER Program follows available guidance from UNFCCC decision 12/CP.17 and the FCFP Methodological Framework (indicator 12.1) suggesting the use of definitions adopted for the national greenhouse inventory for reporting to international organizations. The ER Program adopts Congo's formal definition of a forest that was agreed and endorsed by the stakeholder's workshop in March 2014. The workshop was supported by UN-REDD to assist the Republic of the Congo with defining forests and associated allometric equations for the purpose of the establishment of the national Reference Level. The work was further supported by the French Development Agency, Forêts d'Afrique Centrale Evaluées par Télédétection (FACET) and Observatoire Satellital des Forêts d'Afrique Centrale (OSFAC). The Republic of the Congo defines forests as all land with woody vegetation covering a minimum area of 0.5 ha, with at least 30% tree cover of the average height of 3 meters.

The forest definition used at the national level and the ER program is based on land cover and land use types. In this context all forests that meet the national forest definition will be combined as a forest class. Based on this definition, post-deforestation young secondary forests, regenerations along the forest-savanna boundaries, and low density mixed swamp forests and shrubs can be defined and included in the historical LULC assessments.

Table 23. Definition of forests in Republic of Congo.

Forest Definition of Republic of the Congo adopted March 2014 by stakeholders	
Minimum Land Area	0.5 ha
Minimum Crown Cover	30%
Minimum Height	3 m

The land use and land cover (LULC) may be stratified into categories based on their type and anthropogenic impacts. The 2006 IPCC GL define this as a good practice in order to improve the accuracy and precision of the estimates. In the case of the ER program, the disaggregation of the forest class was found to be necessary due to a number of reasons:

1. By examining the activity data, the program found a bias in areas where changes of forest cover associated with deforestation and degradation are occurring. There are significant areas of the state of Likouala and to some extent Sangha covered by swamp forests. To a

large extent the forest wetlands remain intact over the reference period and majority of deforestation and degradation occur predominantly outside wetlands. However, the analysis of forest inventory data shows that swamp forests have different carbon stocks than the upland or terra firme forests and by combining them together, the emissions over the ER program will be significantly biased.

2. The southern region of Sangha is covered by large patches of naturally open semi-deciduous and marantaceae forests with significantly lower carbon density. These forests remain largely intact or have different intensity and patterns of deforestations and degradation over the reference period. By separating these forests from the wetland and terra firme forests, the calculation of emissions from land use change will be significantly improved.

As a result, the forestland category was dissagregated in terra firme forests, swamp forests, and open/marantacea forests.

The estimation of deforestation over the program area is affected by the definition of forests versus nonforest that vary widely in terms of tree size, area, and canopy density. The definition of forest adopted at the national level with the defined thresholds under the condition of no change of use in the forest. If the dominant use of forest changes, then the forest changes to other land use category of deforested or degraded. Under Decision 11/CP.7, the UNFCCC defined deforestation as the direct, human-induced conversion of forested land to non-forested land. Effectively, this definition means that the crown cover of forestland is reduced below the threshold of 30%, or the tree height changes to below 3 m threshold. In the case of RoC, we introduced two categories of deforestation: 1) nonforest lands that included the forest clearing or conversion to settlements and grasslands, and 2) nonforest lands that included conversion of forests to agricultural systems including annual and perennial crops and agroforestry systems.

The definition of forest degradation is often varied based on the national conditions, forest types, and other historical land use characteristics. At the national level, although emissions from forest degradation were estimated for the RL submitted to the UNFCCC, a definition of forest degradation was not adopted which could be used for the ER program. The IPCC special report on Definitions and Methodological Options to Inventory Emissions from Direct Human-Induced Degradation of Forests and Devegetation of Other Vegetation Types (2003) presents five different potential definitions for degradation along with their pros and cons. The report suggests the following definition for degradation:

"A direct, human-induced, long-term loss (persisting for X years or more) or at least Y% of forest carbon stocks [and forest values] since time T and not qualifying as deforestation".

The threshold for carbon loss and minimum area affected as well as long term use need to be specified to operationalize the definition. By using the national definition of forest, we used changes in forest use that changed the forest cover from its original state of 75-100% to less than 75% but remaining above 30% as the definition of degraded or secondary forests. In terms of changes in carbon stocks, degradation, therefore would represent a human-induced decrease in carbon stocks, with change in land use. In general, degradation may present a much broader land cover change than deforestation. In reality, monitoring of degradation will be limited by the technical capacity to sense and record the change in canopy cover because small changes will likely not be apparent unless they produce a systematic pattern in the imagery. We define forest degradation with specific characteristics associated with the activities in the ER program in Table 24. Description of LULC Types with the ER-Program Area.

The land cover and land use in the ER program area includes: Terra firme forests, secondary/degraded forests, wetlands or swamp forests, semi-deciduous and Maranthasae forests, non-forests (including bare, settlements , grassland savanna, pasture, and all other non-forest classes), non-forest wetlands (including open and herbaceous or any non-forest cover wetlands), agricultural systems (including tree crops in agroforestry systems, and all non-forests covered by annual and perennial crops). As part of the national process, the cocoa plantations, predominantly under smallholders, but with the potential of expanding under sustainable agroforestry systems are categorized under degraded forests. This is mainly due to the fact that the cocoa plantations are established within the forest, by removing the understory and using the large canopy trees as shades (as of today there are no cocoa plantations with no overstorey and this is not expected to occur as it happens in similar areas such as South Cameroon), and the fact that cocoa is woody. These forests, often do not lose their canopy cover significantly compared with the intact forest but has lost its carbon stock and is part of the land use activities. On the contrary, palm oil plantations are considered to be non-forest regardless on whether they comply with the thresholds of the forest definition.

As there were no existing maps to provide the above classification at the time of the ER-PD development, a new map based on satellite data have been developed for the two departments of Sangha and Likouala that successfully separates the degraded forests from logging and other activities in the region. Experts and analysts trained to identify the spectral and contextual characteristics of cover types and cover changes at the national and particularly at the sub-national scale conducted a series of manual and visual interpretation of Landsat time series imagery. The spectral and contextual information based on the definitions were used as rules in a decision tree approach to classify Landsat imagery at different time periods. The methodology was discussed exhaustively during the ER program with CNIAF and FAO experts and are provided in enclosed reports and computer programs (see ANNEX 13. Uncertainty Evaluation of Mapping Products). These methods are currently being implemented at the national level as part of a national project financed with FCPF readiness grant.

The land cover classification was developed by GeoEcoMap and was validated independently by FAO and CNIAF analysts and experts. The accuracy of the land cover and land use classification was quantified through multiple steps including the accuracy assessments based on the Olofsson et al. (2014) good practice guidance.

The national assessment of LULC changes during the reference period did not include forest degradation and did not separate the crops and agroforestry systems from other types of non-forest. After discussions with CNIAF and the national ER program, decisions were made to make the national classification compatible with the jurisdictional classification used in the ER program. An effort, supported by CNIAF, FAO, and GeoEcomap has been initiated to improve the national LULC maps.

Table 24 describes the land cover and land use types used in the ER program and provides the canopy cover thresholds used in the classification and changes of the land use. The percentage of canopy cover cannot be readily quantified in automatic classification. However, by using high resolution imagery from the Google Earth Engine, the analysts were capable to develop the spectral library associated with the forest cover that can be used in the classification process.

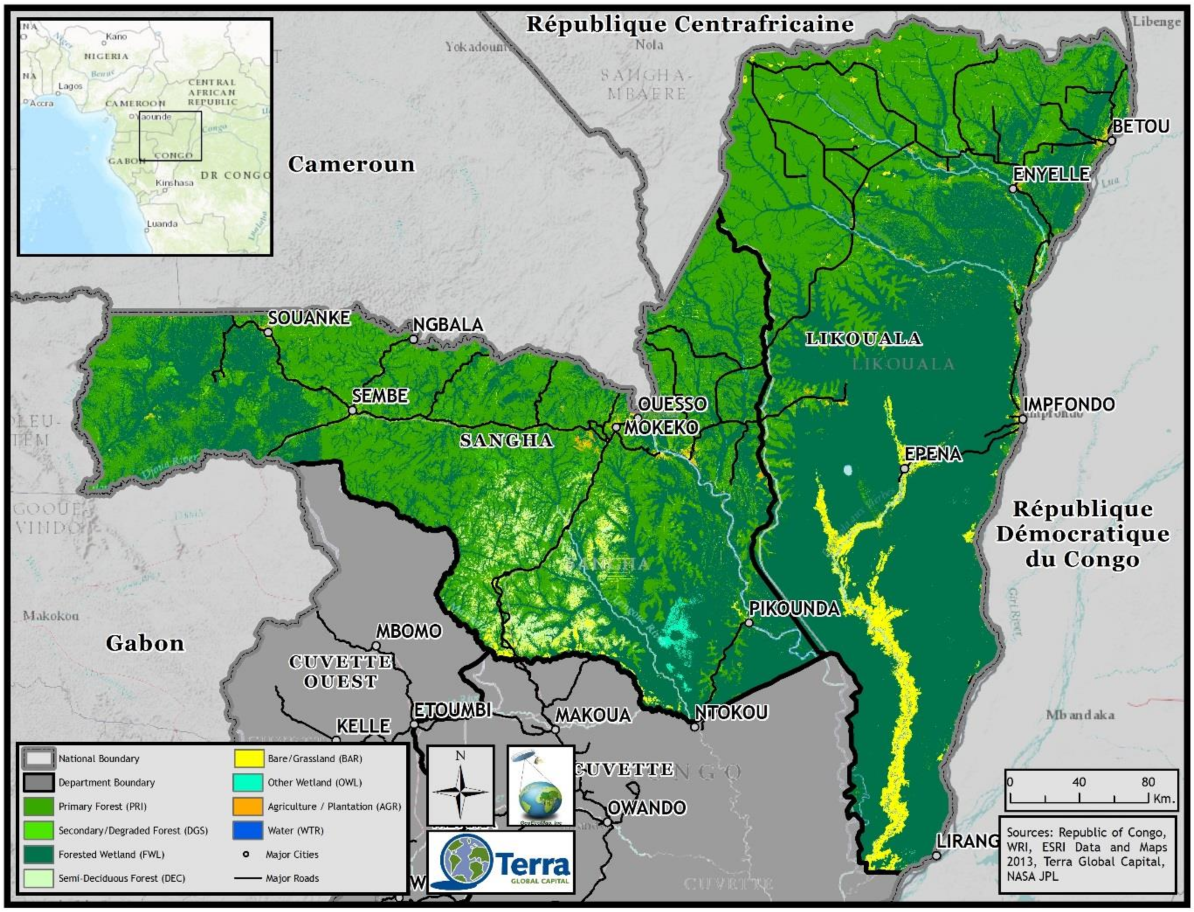


Figure 9. Classification of the ER-Program area into dominant land cover and land use (LULC) types with the potential of aggregating into LULC classes as described in table 8.2 for historical analysis of REL.

Table 24. Description of LULC Types with the ER-Program Area

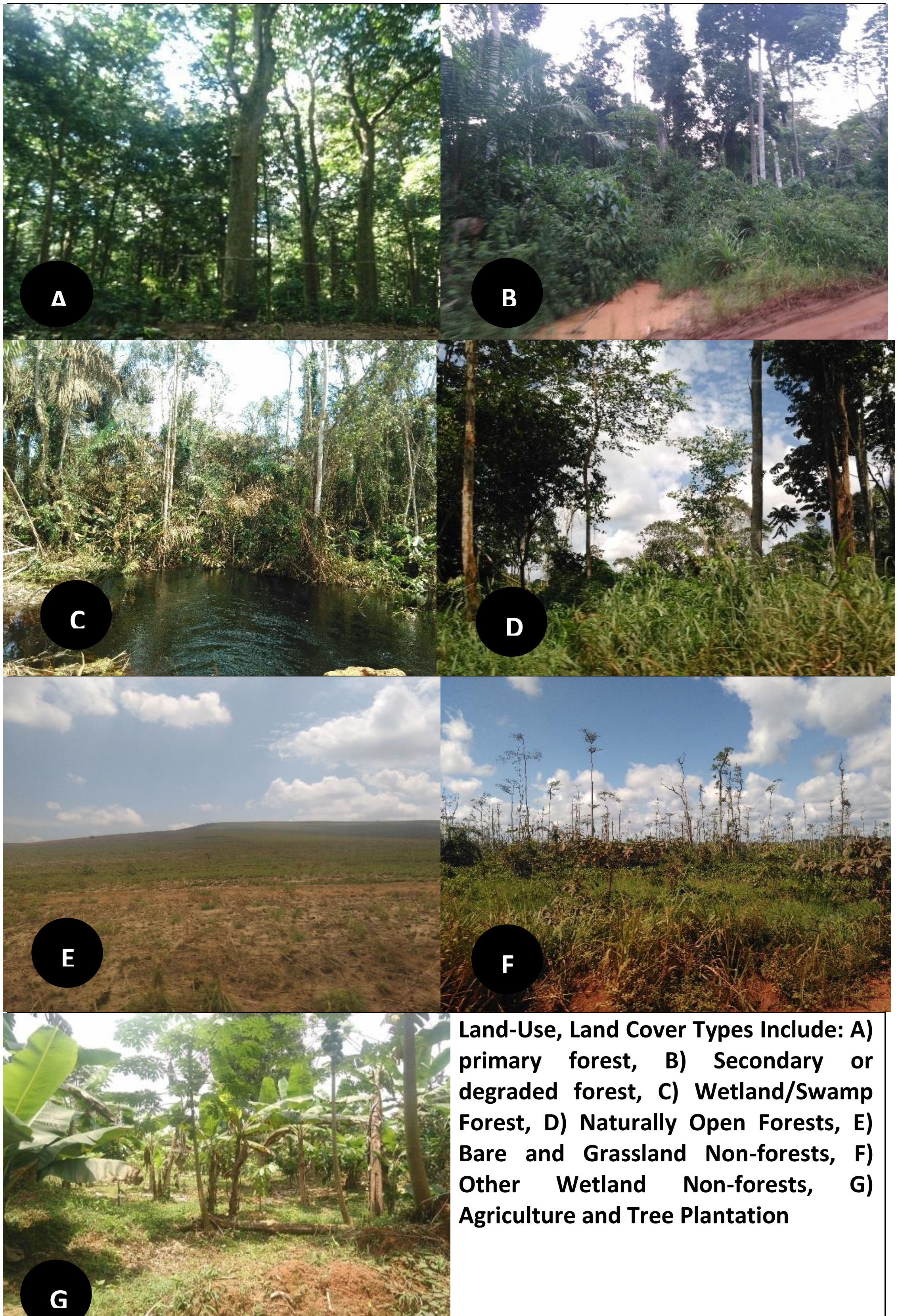
LULC Type	Definition
Primary Forest (PRI)	This category consists of all forests > 75% canopy cover including old growth terra firme forest, and semi-deciduous forests in the ER-Program area. The threshold of canopy cover is consistent with thresholds used to define forest land in the national GHG inventory. The definition of forest includes minimum area of 30 m pixel resolution in the case of Landsat and 25 meters in the case of radar analysis, both being within the IPCC requirement of (0.05-1.0 ha). The minimum height of forest is 3 meters and the minimum canopy cover of 30% was adopted by THE REPUBLIC OF THE CONGO Stakeholder's workshop in March 2014 as definition of forest in ROC. From a phytogeography point of view, this forest class varies from humid evergreen to almost semi-evergreen, which are formations of transition between forest Evergreen to semi-deciduous forest (Gillet *and Al*, 2008). The physiognomy of the forest is very heterogeneous. Generally, the canopy is discontinuous and the crowns of trees are often separated. The understory is usually dense herbaceous lianas (e.g. *Haumania*) and large herbaceous mainly belonging to the families of the *Marantaceae* (e.g. *Megaphrynium*), *Zingiberaceae* (e.g. *Amomum, Costus*, etc.) and *Commelinaceae* (e.g. *storey*). These forests have a gradient of structure, particulalry in height, and diversity of species extending from dense forest, woodland, and forest to *Marantaceae.* These various formations are often difficult to delimit, on the ground or by remote sensing and they are all combined in one class of primary or old growth forest.
Degraded and Secondary Forests (DGS)	This category includes all forests with canopy cover in the range of 30-74.99%. We used the definition of forests changing from its original cover to a forest cover below 75% at the minimum mapping unit of 0.5 ha associated with approximately 5 Landsat 30 m pixels. The degraded forest class has a clear signal of canopy opening at the pixel level. High-resolution data were used to train this class along with time series Landsat image analysis. The secondary forest has a similar definition as the degraded forests with the additional characteristics of being regenerated after the last forest clearing or forest degradation. The secondary forest attribution was separated from degraded forests only through LULC (land use and land cover) historical analysis with remote sensing data. Cocoa plantations that are cultivated in forests by clearing the understory are considered degraded forests. The plantation often includes a significant number of original large trees that are used as shades in the plantation. The cocoa plantations may be classified as intact forests if the changes of canopy cover are small and cannot be detected by remote sensing sensors.
Wetland/Swamp Forests (FWL)	The swamp forests are found along major rivers that are temporally or permanently inundated and characterized by soils with poor drainage. These forests cover large areas along rivers in and low elevation sites particularly in the northeastern part of the Republic of Congo in the province of Likouala, but also parts of Sangha. This category includes land that is covered or saturated by water for all or part of the year (e.g., peatland) and that does not fall into the cropland, grassland or settlements categories. Here, we separate the swamp forest from other non-forest wetland areas. These edaphic forests flooded all or part of the year occupy large areas on the edge of watercourses. There are primarily (1) swamp forests flooded continuously open canopy, (2) riparian forests, along streams, to canopy closed and (3) forests periodically flooded alluvial plains, more or less closed with some emergent trees canopy. Trees height varies between 15 and 30 m. There are also Limbali forests that consist of monodominante forests, composed of limbalis *Gilbertiodendron dewevrei* (*Caesalpiniaceae*) in almost pure stands. These forests occur in flooded areas along waterways (riparian to limbali forests) and sometimes on terra firme uplands (land limbali forests). In this type of forest, the canopy is very closed and the undergrowth is generally open.

LULC Type	Definition
Naturally Open Forests (DEC)	The open canopy forests of Ngombe and Ndoki region of southern and western Sangha department are dominated by marantaceae and zingiberaceae species in the understory and has an open canopy with distinct features in the satellite imagery as in degraded or secondary forests. Marantaceae forest is thought to be a stage in the succession of the forest recolonization of the savanna. This forms a thick carpet, up to 3-4m deep, giving the impression of a giant 'lawn' through which tree seedlings must grow to reach the light. In the open Marantaceae forests, the middle-sized trees are much less common than in a closed-canopy forest.
Bare and Grassland Non-forests (BAR)	This category includes all area cleared or were originally in the non-forest category and has the canopy cover in the range of 0%-29.99%. The non-forest category includes rangelands, pasture land, settlements, all arable and tillage land, and agroforestry systems where vegetation falls below the thresholds used for the forest land category and consistent with the selection of national definitions. This category also includes non-forest herbaceous wetlands. Remote sensing image contextual analysis, signal ratios, and time series analysis can separate this class from bare and grasslands or forest cover if required by the project. In our current analysis, we only use one category of non-forest.
Other Wetland Nonforests (OWL)	This category includes land that is covered or saturated by water for all or part of the year (e.g., peatland) and that does not fall into the forest land, cropland, grassland or settlement categories. All natural herbaceous and peatlands are categorized under the wetland class, referring to vegetation characterized by adapting to water saturated soils, anaerobic conditions and frequent flooding. This category can be readily separated from the forest wetlands due a clear signal in radar and Landsat imagery.[78]
Agriculture and Tree Plantations (AGR)	This category includes arable and tillage land where vegetation falls below the thresholds used for the forest land category, consistent with the selection of national definitions. Agro-forestry systems such as palm oil plantations and other tree plantations in the ER program resulted from clearing the land before establishing the plantation are included in this category. We used image contextual analysis, signal ratios, and time series changes, to separate this class from bare and grasslands or other forest type.

Table 25. Area of LULC Types in Each Province and in the Entire ER Project Area

LULC Types	Sangha	Likouala	Total Program [ha]
	Area (ha)	Area (ha)	Area (ha)
NoData (NOD)	383	228	611
Primary Forest (PRI)	2,704,910	2,067,810	4,772,720
Secondary/Degraded Forest (DGS)	210,818	81,786	292,604
Wetland/Swamp Forest (FWL)	2,470,150	4,023,280	6,493,430
Naturally Open Forest (DEC)	171,218	-	171,218
Bare/grassland Nonforest (BAR)	107,393	308,614	416,007
Other wetland Nonforest (OWL)	38,689	26,365	65,054
Agriculture/Tree Plantation (AGR)	58,692	58,077	116,769
Water (WTR)	22,854	20,470	43,324
Total	**5,785,107**	**6,586,630**	**12,371,737**

[78] Bwangoy, J-B, Hansem, M., Roy, D. Justice, C.O., (2010), Wetland mapping in the Congo Basin using optical and radar remotely sensed data and derived topographical indices, Remote Sensing of Environment, 114:73-86.



Land-Use, Land Cover Types Include: A) primary forest, B) Secondary or degraded forest, C) Wetland/Swamp Forest, D) Naturally Open Forests, E) Bare and Grassland Non-forests, F) Other Wetland Non-forests, G) Agriculture and Tree Plantation

Figure 10. Example of LULC Classes

8.3 Average Annual Historical Emissions over the Reference Period

Description of Method Used for Calculating the Average Annual Historical Emissions over the Reference Period

Stratification and Definition of Activities

Stratification and disaggregation

Average annual historical emissions over the Reference Period are calculated for deforestation and degradation, which are the two GHG sources included within the Accounting Area as indicated in Chapter 7.1. GHG emissions from deforestation and degradation have been estimated following the guidance set in the 2006 IPCC GL[79] for estimating changes in carbon stocks in Forestland to Other Land (Deforestation) and Forestland remaining Forestland (Degradation).

Following the good practices set in the 2006 IPCC GL[80] the two IPCC Land Use change categories have been disaggregated in different strata based on different cropland classes and forest types which have been described in the form of a decision tree (Fig. 1.2 of Chapter 1, of 2006 IPCC GL) and outlined in details in Chapter 4 of 2006 IPCC GL. This will allow an increase accuracy in the quantification of GHG emissions. Moreover, in line with the guidance set by the GFOI MGD[81], an additional stratification into 'Management Strata' has been made for quantification (only for the adjustment), and monitoring purposes. This stratification will reduce the uncertainty of estimating the emissions and will allow a direct link of the attributions of the RL to activities on the ground at different scales from the ER-Program to concessions and community levels. This also supports the development of spatially explicit baselines, which are needed to drive fair and equitable benefit sharing mechanisms. The stratification follows general characteristics of being delineated clearly and without any overlap with other Management Strata during the historical reference period and are not expected to change in the ERPA term.

The Management Strata will serve mainly for reporting purposes and for the documentation and quantification of the adjustment, as the same IPCC methods will be applied across these Management Strata. More information on management strata is found later in this Chapter.

[79] Generic guidance set in Chapter 2 - Volume 4, and specific guidance set in Forestland remaining Forestland – Chapter 4 – Volume 4 and Forestland to Other Land set in Chapters 5,6,7 – Volume 4

[80] Section 3.4 – Chapter 3 – Volume 4, 2006 IPCC GL

[81] "*Countries may wish also to stratify according to drivers of deforestation since this may help develop understanding of causal relationships between drivers and deforestation rates*" - Section E.1.1 – GFOI (2015) - Integrating remote-sensing and ground based observations for estimation of emissions and removals of greenhouse gases in forests

Table 26. REDD+ activities and their relation to the IPCC representation of lands and specific Management Stata where they will be applied

REDD+ Activity	Sub-activities	IPCC Land use Change category	Management strata
Reducing emissions from deforestation	Planned Deforestation	Forestland to Other Land	• Designated Oil Palm Areas Plantations *(PalmA)* • Mining Concession Areas *(MinA)* • Forest Concession Production Areas *(FCProdA)*
	Unplanned Deforestation		• Forest Concessions Non Production Areas *(FCNonProdA)* • Protected Areas *(ProtA)* • Undesignated Areas *(UnDisA)* • Designated Oil Palm Area Plantations (PalmA)
Reducing emissions from degradation	Planned degradation	Forestland remaining Forestland	• Forest Concession Production Areas *(FCProdA)*
	Unplanned degradation		• Forest Concessions Non-Production Areas *(FCNonProdA)* • Protected Area *(ProtA)* • Undesignated Areas *(UnDisA)* • Designated Oil Palm Areas Plantations *(PalmA)* • Mining Concession Areas *(MinA)* • Forest Concession Production Areas *(FCProdA)*

Definition of Activities

The following table provides the definition of the different Sources that are included within the scope of the ER-Program.

Table 27. Definitions of the Sources and Sinks found within in ER-Program Area

Sources	Definition
Deforestation (DF)	Deforestation is defined as the direct human-induced conversion of forest land to non-forest land. (IPCC 2003) What constitutes forest land is defined by a country's forest definition. The Congo's forest definition approved by the stakeholder's meeting in March 2014 and submitted to the UNFCCC and used in the ER-PIN includes a minimum crown cover of 30%, a minimum land area of 0.5 ha and a minimum tree height of 3m.
Degradation (DG)	Forest degradation is defined as a human-induced loss in forest biomass on forest land remaining forest land.
Unplanned Deforestation	Unplanned deforestation is defined as the process of administratively unplanned conversion of forest land to non-forest land at the scale of the jurisdiction. In contrary to planned deforestation which can be more or less accurately tracked by administrative or private sector plans (infrastructure, plantations, mining, etc.), the precise location of unplanned deforestation is difficult to predict. Unplanned deforestation is the major type of deforestation in both the Likouala and Sangha departments.

Sources	Definition
Unplanned Degradation	Unplanned degradation is defined as the process of a) informal, unauthorized or illegal industrial and artisanal timber extraction, for which the timber/wood extracting company/individual does not hold a valid (concession) license or permit to operate in the production areas of the forestry concessions; and b) removal of woody biomass for fuel wood and charcoal production on forest land remaining forest land. It is important to note that anyone of these activities may also constitute unplanned deforestation, if the biomass removal leads to a reduction of crown cover or area below the threshold used in the national forest definition. Congo did not conduct any calculations for the preliminary RL for the ER-PIN. The ER-PD has conducted surveys and included remote sensing data to allow detecting the unplanned degradation.
Planned Deforestation	Planned deforestation is defined as the process of planned conversion of forest land to non-forest land. Planned deforestation usually occurs primarily as a result of infrastructure development (roads, hydropower, other industrial complexes, urban spread), commercial agriculture, tree plantations and mining. This activity is monitored through remote sensing.
Planned Degradation	Planned degradation is defined as the process of planned industrial timber extraction on forest land remaining forest land, for which the timber extracting company holds a valid forest concession license contract. Planned degradation includes the temporary conversion of forest to non-forest land for the purpose of constructing timber harvesting infrastructure, such as e.g. forest roads and logging decks Planned degradation happens within the Forestry Concession Production Areas.
Enhancement of Carbon Stocks (Afforestation/ Reforestation)	Enhancement of carbon stocks is defined as the human-induced conversion of non-forest land to forest land, i.e. the purposeful planting of trees or protection of non-forest areas with the aim to support natural regeneration of forests.

The land-use change activities include the planned and unplanned deforestation and degradation. The planned deforestation (conversion of forest to non-forest) is an activity on forestlands that are legally authorized and documented. The unplanned deforestation must not include planned deforestation and the two will be separated reasonably at the landscapes by identifying any major authorized forest conversion activities through consultation with local authorities and spatial land-use tenure data. Planned and unplanned degradation will also be accounted separately, by Management Strata. Planned degradation activities are authorized and defined as extraction of timber that lower carbon stocks. Unplanned degradation is unsanctioned and is caused by non-renewable fuel-wood collection and illegal logging that reduces forest biomass outside of Forest Concession Production Areas. Natural disturbances causing deforestation or degradation such as non-anthropogenic fire or extreme weather events are not considered as part of this analysis.

Management strata

Spatially defined Management Strata used for calculating the historic emissions over the reference period may be found in the following map.

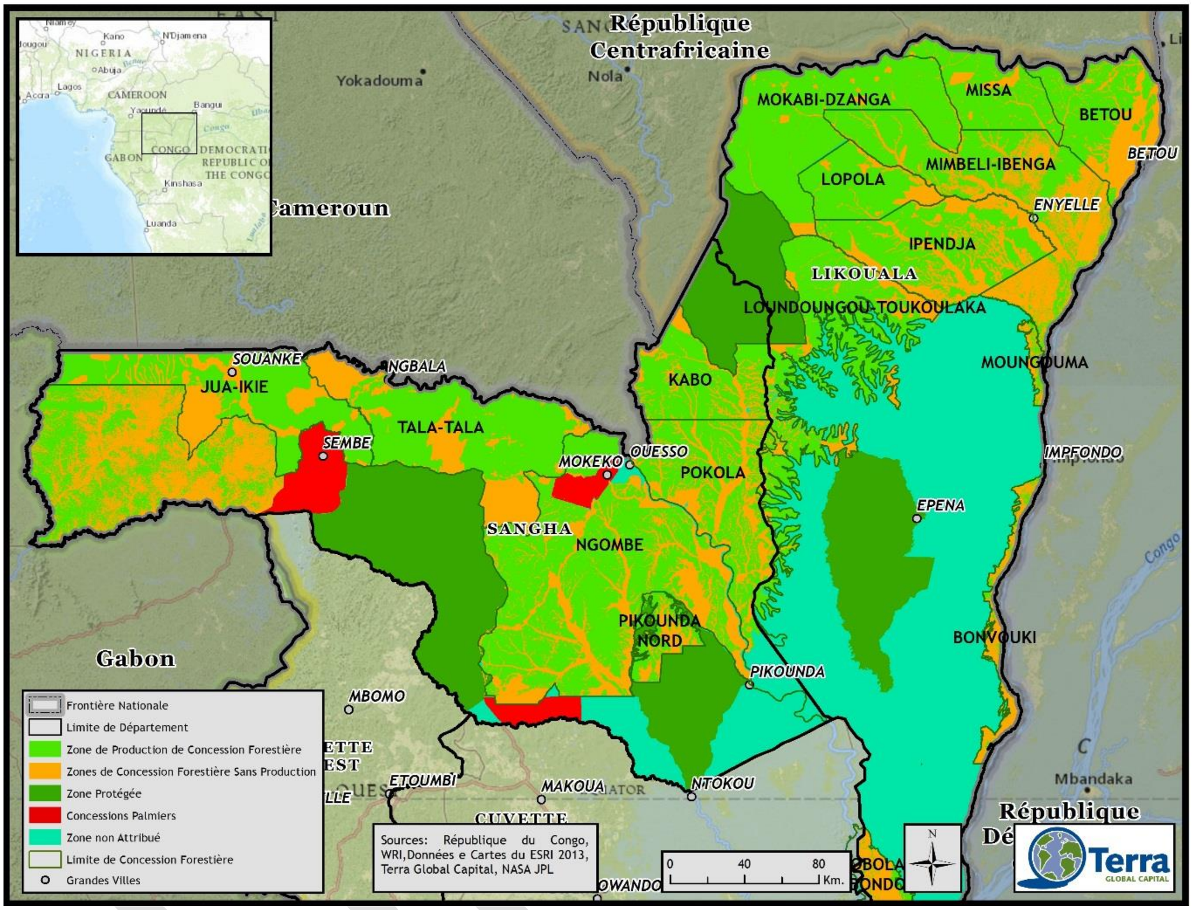


Figure 11. Map with the attribution of lands to the different Management Strata

As indicated above, in line with the guidance set by the GFOI MGD[82], an additional stratification into 'Management Strata' has been made for quantification (only for the adjustment), and monitoring purposes. This stratification will reduce the uncertainty of estimating the emissions and will allow a direct link of the attributions of the RL to activities on the ground at different scales from the ER-Program to concessions and community levels. This also supports the development of spatially explicit baselines, which are needed to drive fair and equitable benefit sharing mechanisms. The stratification follows general characteristics of being delineated clearly and without any overlap with other Management Strata during the historical reference period. The areas included in each Management Strata are provided in Table 28.

[82] "*Countries may wish also to stratify according to drivers of deforestation since this may help develop understanding of causal relationships between drivers and deforestation rates*" - Section E.1.1 – GFOI (2015) - Integrating remote-sensing and ground based observations for estimation of emissions and removals of greenhouse gases in forests

Table 28. Management Strata used for Activity Data (excluding WTR and OWL)

Management Strata/ SubStrata	Description	Area at 2013 (ha), excluding WTR and OWL)
Areas Subject to Unplanned DF and DG • Forest Concessions NonProduction Areas ***(FCNonProdA)*** • Protected Area ***(ProtA)*** • Undesignated Areas ***(UnDisA)***	These are areas which are subject to unplanned DF and DG that are divided into three Management Strata (substrata) to reflect different drivers, agents and underlying causes.	2,578,363 1,835,356 3,070,714
Forest Concession Production Areas ***(FCProdA)***	These are the timber production areas in the forest concessions	4,654,894
Designated Oil Palm Areas Plantations ***(PalmA)***	These are areas designated by the government as allowable for cultivation of oil palm; these areas are subject to **both** planned and unplanned deforestation and degradation; planned via harvesting for oil palm plantations, and unplanned via cities located within the plantations	232,410*
Mining Concession Areas ***(MinA)***	These are the areas in which mining concessions are granted that are expected to be converted when they reach the exploitation stage	Spatially explicit data is not available
Total		**12,371,737**

**this only represents the areas that are currently spatially delineated*

In order to delineate these management strata, information from the Congo Atlas produced by World Resource Institute was used. However, the concession area was not disaggregated in production areas (subject to logging and therefore to planned degradation) and other areas within the concession areas (i.e. subject to unplanned deforestation and degradation). Therefore, a delineation of the areas that are subject to extraction was done.

IPCC methods use to estimate GHG emissions

This section intends to identify the equations needed in order to estimate the GHG emissions. As indicated previously, the RL will be an aggregation of the RLs of different REDD+ activities selected in Chapter 7 which have been estimated for the purposes of the RL in separate strata named as Management Strata. Following the equations provided in the Chapter 2, Volume 4 of the 2006 IPCC Guidelines and adapting them to the REDD+ context, the annual changes in carbon stocks in the Accounting Area ($\Delta \boldsymbol{C_{LU}}$) are equal to the sum of annual change in carbon stocks for each of the $\boldsymbol{i}$ REDD+ activities ($\Delta \boldsymbol{C_{LU_i}}$).

$$\Delta \boldsymbol{C_{LU}} = \frac{\mathbf{44}}{\mathbf{12}} \times \sum_{\boldsymbol{i}} \Delta \boldsymbol{C_{LU_i}}$$

EQ 1

(Equation 2.2, 2006 IPCC GL)

In order to estimate the changes in carbon stocks in these carbon pools the following IPCC method will be applied:

REDD+ Activity	Sub-activities	IPCC Land use Change category	Management Strata	IPCC Method
Reducing emissions from deforestation	Planned Deforestation	Forestland to Other Land	All strata	Stock-Difference*
	Unplanned Deforestation			
Reducing emissions from degradation	Planned degradation	Forestland remaining Forestland	Forestry Concession Production Areas	Stock-Difference+
	Unplanned degradation		All strata	

* Equation 2.15 2006 IPCC GL + Equation 2.8 2006 IPCC GL

Following the IPCC notation, the sum of annual change in carbon stocks for each of the $\boldsymbol{i}$ REDD+ activities ($\Delta \boldsymbol{C}_{\boldsymbol{LU_i}}$) would be equal to the annual change in carbon stocks in the aboveground biomass carbon pool ($\Delta \boldsymbol{C}_{\boldsymbol{AB}}$) and the annual change in carbon stocks in belowground biomass carbon pool ($\Delta \boldsymbol{C}_{\boldsymbol{BB}}$) accounted as indicated in volume 4, chapter 2.

EQ 2

$$\Delta \boldsymbol{C}_{\boldsymbol{LU_i}} = \Delta \boldsymbol{C}_{\boldsymbol{AB}} + \Delta \boldsymbol{C}_{\boldsymbol{BB}} = \Delta \boldsymbol{C}_{\boldsymbol{B}}$$

(Equation 2.3, 2006 IPCC GL)

The equations for the different methods are provided below.

Reducing emissions from deforestation (Forestland to Other Land)

Following the 2006 IPCC Guidelines the annual change in carbon stocks in biomass on forestland converted to other land-use category ($\Delta \boldsymbol{C}_{\boldsymbol{B}}$) would be estimated through the following equation:

EQ 3

$$\Delta \boldsymbol{C}_{\boldsymbol{B}} = \Delta \boldsymbol{C}_{\boldsymbol{G}} + \Delta \boldsymbol{C}_{\boldsymbol{CONVERSION}} - \Delta \boldsymbol{C}_{\boldsymbol{L}}$$

(Equation 2.15, 2006 IPCC GL)

Where:

$\Delta \boldsymbol{C}_{\boldsymbol{B}}$	=	Annual change in carbon stocks in biomass on land converted to other land-use category, in tons C yr^{-1}
$\Delta \boldsymbol{C}_{\boldsymbol{G}}$	=	Annual increase in carbon stocks in biomass due to growth on land converted to another land-use category, in tons C yr^{-1}
$\Delta \boldsymbol{C}_{\boldsymbol{CONVERSION}}$	=	Initial change in carbon stocks in biomass on land converted to other land-use category, in tons C yr^{-1}
$\Delta \boldsymbol{C}_{\boldsymbol{L}}$	=	Annual decrease in biomass carbon stocks due to losses from harvesting, fuel wood gathering and disturbances on land converted to other land-use category, in tons C yr^{-1}

Following the recommendations set in Chapter 2.2 of the GFOI Methods Guidance Document[83] for applying IPCC Guidelines and guidance in the context of REDD+, the above equation will be simplified and it will be assumed that: a) the annual change in carbon stocks in biomass ($\Delta \boldsymbol{C_B}$) is equal to the initial change in carbon stocks ($\Delta \boldsymbol{C_{CONVERSION}}$); b) it is assumed that the biomass stocks immediately after conversion is the biomass stocks of the resulting land-use. Therefore, the annual change in carbon stocks would be estimated as follows:

$$\Delta \boldsymbol{C_B} = \Delta \boldsymbol{C_{CONVERSION}}$$

EQ 4

$$\Delta \boldsymbol{C_{CONVERSION}} = \sum_{j} \left\{ \left(\boldsymbol{B_{AFTER,j}} - \boldsymbol{B_{BEFORE,j}} \right) \times \Delta \boldsymbol{A_j} \right\} \times \boldsymbol{CF}$$

(Equation 2.15, 2006 IPCC GL)

Where:

$\boldsymbol{B_{AFTER,j}}$ = biomass stocks on land use transition j immediately after the conversion, tons DM. ha^{-1}. This will be discussed in Section Activity **data and Emission Factors used for Calculating the Average Annual Historical Emissions over the Reference Period** below.

$\boldsymbol{B_{BEFORE,j}}$ = biomass stocks on land use transition j before the conversion, tons d.m. ha^{-1}. This will be discussed in Section Activity **data and Emission Factors used for Calculating the Average Annual Historical Emissions over the Reference Period** below.

$\Delta \boldsymbol{A_j}$ = Area of Land Use subcategory / stratum converted to another Land Use subcategory / stratum (transition denoted by j) in a certain year, ha yr-1. This will be discussed in Section Activity data and Emission Factors used for Calculating the Average Annual Historical Emissions over the Reference Period below.

$\boldsymbol{CF}$ = Carbon fraction of dry matter, ton C (ton d.m.)$^{-1}$. This is equal to 0.49 as defined in Table 4.3 of the 2006 IPCC GL for wood in tropical forests. This is consistent with the value defined in the national REL/FRL submitted to the UNFCCC.

Reducing emissions from forest degradation (Forestland remaining Forestland)

Total carbon biomass is estimated with equation 2.8 (b) of the 2006 IPCC GL, which could also be expressed as an area multiplied by a carbon density. Inserting this equation in equation 2.8 (a) the annual change in carbon stocks in biomass could be expressed with the following equation:

$$\Delta \boldsymbol{C_B} = \boldsymbol{A_j} \times \frac{(\boldsymbol{CD_{t_2}} - \boldsymbol{CD_{t_1}})}{(\boldsymbol{t_2} - \boldsymbol{t_1})}$$

EQ 5

[83] Page 44, GFOI (2013) Integrating remote-sensing and ground-based observations for estimation of emissions and removals of greenhouse gases in forests: Methods and Guidance from the Global Forest Observations Initiative: Pub: Group on Earth Observations, Geneva, Switzerland, 2014.

$$\Delta C_B = \sum_j \{(CD_{t_2,j} - CD_{t_1,j}) \times \Delta A_j\}$$

$$= \sum_j \{(B_{AFTER,j} - B_{BEFORE,j}) \times \Delta A_j\} \times CF \qquad \textbf{EQ 6}$$

Where:

$B_{AFTER,j}$ = Biomass stocks on land use transition j immediately after the conversion, tons d.m. ha^{-1}. This will be discussed in Section Activity data and Emission Factors used for Calculating the Average Annual Historical Emissions over the Reference Period

$B_{BEFORE,j}$ = Biomass stocks on land use transition j before the conversion, tons d.m. ha^{-1}. This will be discussed in Activity data and Emission Factors used for Calculating the Average Annual Historical Emissions over the Reference Period below.

ΔA_j = Area of Land Use subcategory / stratum converted to another Land Use subcategory / stratum (transition denoted by j) in a certain year, ha yr-1. This will be discussed in Activity data and Emission Factors used for Calculating the Average Annual Historical Emissions over the Reference Period below.

CF = Carbon fraction of dry matter, ton C (ton d.m.)$^{-1}$. This is equal to 0.49 as defined in Table 4.3 of the 2006 IPCC GL for wood in tropical forests. This is consistent with the value defined in the national REL/FRL submitted to the UNFCCC.

Activity data and Emission Factors used for Calculating the Average Annual Historical Emissions over the Reference Period

Activity data

As shown in the previous Chapter, Activity Data is described below and have been estimated across the Reference Period in order to estimate GHG emissions following the equations set in the previous Chapter..

Table 29. Activity Data considered in the ER-Program

Activity Data		REDD+ Activity	Geographical Boundaries
ΔA_j	Area of Land Use subcategory/ stratum converted to another Land Use subcategory/ stratum (transition denoted by j) in a certain year which would be estimated through remote sensing techniques.	• Reducing emissions from deforestation • Reducing emissions from degradation	All the Accounting Area

Reducing emissions from deforestation (Forestland to Other Land) and unplanned degradation (Forestland remaining Forestland)

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):	ΔA_j - Area of Land Use subcategory / stratum converted to another Land Use subcategory/ stratum (transition denoted by j) in a certain year
Explanation for which sources or sinks the parameter is used (e.g deforestation or forest degradation):	Deforestation and degradation
Data unit (e.g. ha/yr):	ha yr^{-1}
Value for the parameter:	See table below. For values per management strata see Chapter 8.3.3
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):	Remote sensing procedures described in this chapter.

	Planned	Unplanned
From PRI to BAR	974	2,364
From DGS to BAR	2,031	2,839
From FWL to BAR	29	180
From DEC to BAR	453	424
From PRI to AGR	1,311	3,930
From DGS to AGR	28	44
From FWL to AGR	142	406
From DEC to AGR	0	0
Total deforestation	4,969	10,188
From PRI to DGS	7,283	9,944
From FWL to DGS	29	71
From DEC to DGS	126	118
Total degradation	7,438	10,132

For values per management strata see Chapter 8.3.3

Spatial level (local, regional, national or international):	Regional. IPCC Approach 3.
Discussion of key uncertainties for this parameter:	Refer to Chapter 0
Estimation of accuracy, precision, and/or confidence level, as applicable and an explanation of assumptions/methodology in the estimation:	Further described in Chapter 0

Land use categories vs REDD+ activities

Table 30. Allowable Land-Use Transitions in the ER-Program Area

#	From Class	To Class	Transition Type	Allowable
1	PRI	BAR	Deforestation	Yes
2	DGS	BAR	Deforestation	Yes
3	FWL	BAR	Deforestation	Yes
4	DEC	BAR	Deforestation	Yes
5	PRI	AGR	Deforestation	Yes
6	DGS	AGR	Deforestation	Yes
7	FWL	AGR	Deforestation	Yes
8	DEC	AGR	Deforestation	Yes
9	PRI	DGS	Degradation	Yes
10	FWL	DGS	Degradation	Yes
11	DEC	DGS	Degradation	Calculated by EF conservatively set to zero since it was yielded negative emissions

Source of data

Spatial information on the location of deforestation, degradation, and other changes attributed to the LULC transitions are used to develop the transition matrix, which will be the activity data on which the carbon accounting is based. The RoC, as part of the Congo Forest Basin, has established research activities within the CNIAF and other agencies to conduct studies on its forest ecosystems and changes occurring as a result of human activities. There are several sources available to use to draw the activity data. There are variations among these sources because studies have used different spatial information (e.g. type of satellite imagery with variations in spatial resolution), definition of land use classes, and methodologies to extract thematic information on land use change. Here, we have access to three data sets:

- FACET (Forêts d'Afrique Centrale Evaluées par Télédétection). Conducted by OSFAC in collaboration with the University of Maryland in DRC and funded by CARPE (Central Africa Regional Program for Environment). The FACET data provides LULC for two periods of 2000-2005 and 2005-2010 based on Landsat imagery at 60 m spatial resolution. FACET data separates primary, secondary, and swamp forests and provides forest cover change in each category between the two periods.
- UMD Forest Cover Change (Hansen et al. 2013). University of Maryland developed forest cover change from time-series analysis of Landsat images characterizing forest extent and changes at spatial resolution of 30 m over a period of 2000-2014. The forest is defined by the minimum height of 5m, different from the definition adopted by The Republic of the Congo at 3m height. The time series data provides the "Forest Cover Loss' as a stand-replacement disturbance, or a change from a forest to non-forest state, during the period 2000–2014. Spatial data includes the year the forest loss has occurred, allowing for selection of different reference periods for analysis. The data also includes secondary forests as the 'Forest Cover Gain', defined as the inverse of loss, or a non-forest to forest change entirely within the period 2000–2014. Both forest cover loss and gain can be used in studying the LULC change transitions for historical REL. However, the numbers must be used with caution. Both the loss and gain terms may not always reflect deforestation and secondary regeneration. Particularly, in the case of gain, the products do not provide any disaggregation to annual time series and only provide the change from a non-forest state to a forest state according to the definition of forest (30% forest cover), a onetime map of forest gain at the end of the reference period. The forest gain must be interpreted with aid of other historical data sets to be attributed as secondary forests from human activities. We expect the definition of tree height threshold may not have a major impact on estimating the changes of forest cover as Landsat spectral data may not be able to unambiguously separate the 3 and 5 m height tree covers.
- FAO/CNIAF Product. As part of the CN-REDD program in the Republic of the Congo and the National Forest Monitoring System (NFMS), FAO is working closely with the National Centre for Assessment and Management of Forest Resources and Wildlife (CNIAF) to provide the activity data on LULC and forest reference emission levels (FREL). A map was released at the end of September, 2015 and was provided to the ER-PD team a month later. The map builds on three existing products that are combined to comply with the national forest definition. This map has been developed to serve as a basis for the REDD+ process, including the calculation of the Reference Emission Level (REL) at the national level, the National Land Use Plan (NLUP) and other uses that require forest mapping. The map provides the forest cover change from 2000-2012 separating: Primary Forest, Secondary Forest, Primary Swamp Forest, Loss of Primary Forest, Loss of Secondary Forest, Loss of Primary Swamp Forest, and Loss of Primary to Roads. These classes are complementary to the map produced for the ER-Program.

Since these maps were not suitable for the purposes of the program, new maps that filled the identified gaps (period, classification of degradation) were produced.

Processing Methods

Though remote sensing can be the most cost-effective for this ER-Program, there is limited high-resolution remote sensing data for the Program Area that can accurately detect degradation and capture historical degradation. The ER-Program used the medium resolution Landsat time series data, performed manual classification of the satellite imagery, classified maps were overlaid by analysts to compare the changes of the LULC in different points in time, and historical transitions were identified and quantified over the reference period. The process of classifying satellite imagery is discussed below and the validation and the uncertainty analysis is discussed in chapter 0 of this document.

A total of 36 scenes from Landsat 5 and 7, and 8 were downloaded from the United States Geological Survey (USGS), covering the period 2003-2012. 2015 datasets were included as these data serve to understand changes in national circumstances and will be used for adjustment purposes (c.f. Chapter 8.4). Most images from Landsat 7 scenes were downloaded for the 2003 and 2007 time periods because of extensive cloud cover and gaps resulting from missing scan lines in Landsat 7 data after 2003. Landsat mosaics for 2000, 2012, 2013, and 2014 from global forest cover change data sets from University of Maryland were included to allow detecting changes that may have occurred but were obscured by clouds or missing scan lines. These images had only four bands and were processed to remove the cloud pixels as much as possible. For 2015, Landsat 8 imagery was included and the data processed by replacing the cloudy pixels with other pixels within the same year. In general, all Landsat imagery had extensive cloud cover and had to be used in tandem to create LULC maps. The combined imagery improved the three-period images and reduced cloud cover to less than 20% for the region as required by the methodology.

In addition to Landsat data, we acquired ALOS PALSAR data for the period of 2007, 2008, 2009, and 2010. These images were processed and co-registered with Landsat imagery at 30 m spatial resolution. ALOS PALSAR data had two polarizations of HH and HV allowing for detecting inundated forests and herbaceous areas. ALOS data was used only for mapping wetlands along with the digital elevation data at 30 m resolution from SRTM imagery.

The methodology includes the following steps.

1. Landsat imagery at 30m spatial resolution was collected, pre-processed and processed for the period of 2000-2012 to perform LULC classification. The imagery included cloud free Landsat imagery for 2000 (4 bands) to allow for LULC classification for initial conditions. The 2000 and 2012 Landsat mosaic images were downloaded from the University of Maryland and Google Engine archive (Hansen et al. 2013) for a relatively cloud free (< 5%) and orthorectified imagery over the ER-Program area. Landsat 7 and Landsat 5 imagery for 2003 (with the last image in late October), for 2007 (with the last image in November) and 2012, and Landsat 8 imagery for 2015 (last image November 2015) was also downloaded. The use of multiple images collected over one year helped to improve the quality of the images by replacing the pixels contaminated by clouds or impacted by missing scan lines with cloud free pixels. This process reduced the number of cloud free pixels for 2003, 2007, and 2012 images to less than 20%.
2. The Landsat images were classified by using a combination of image segmentation, unsupervised classification, and decision rule classification to develop LULC for each

period. The image segmentation was particularly designed to separate the open degraded forests from deforestation (forest clearing), crops and agroforestry plantations and dense forests. The segmentation approach was designed using all four bands but significantly depended on the near-infrared Landsat band. The segmentation was performed for each imagery separately and were mosaicked for each year and the results were combined in a decision rule program to develop the final LULC classification for each year.

3. The historical classified maps from the decision rule program were developed for the years 2000, 2003, 2007 and 2012 (+ 2015). In the process of developing the maps, the pixels contaminated by clouds or missing data kept the classes of the earlier cloud free pixels. This process ensured that the classified maps did not have missing pixels due to cloud effects and the estimates of deforestation and degradation activities were conservative.
4. ALOS PALSAR radar imagery at 25 m resolution for the period of 2007 -2010 (four annual mosaic imagery) were downloaded from the Japanese Space Agency (JAXA) over the ER-Program area. These images were resampled to 30m resolution and used together to segment and classify the flooded or swamp forests only.
5. Following the completion of the 30 m resolution historical classified maps, the data were post-processed using a nearest-neighbor majority filter, selecting for each pixel the majority value among a 7-pixel window(~0.54 ha); this process was necessary to match the minimum mapping unit required under the definition of a forest within the region, as defined above in Chapter 8.2, as well as minimizing unlikely isolated pixels. The filtering methodology was performed by using a moving window over the image along with a decision rule to reclassify the image into the forest, degraded forest, or non-forest depending on how the ensemble of pixels compare with the forest definition (See ANNEX 10. Estimation of Carbon Stocks).
6. The maps were used to calculate the transitional statistics of LULC changes over the accounting area for Sangha and Likouala departments, sub-jurisdiction areas, concessions, and community levels to be included in the ER-PD for the reference period.
7. Reference data for validation of the maps and uncertainty analysis were collected during the field survey, from reports and maps of concessions, roads, local vegetation types, and Google Earth high-resolution imagery and visual interpretation. The uncertainty analysis is discussed in Chapter 0. The validation process was performed with the support of CNIAF and FAO during a workshop in Brazzaville. The accuracy assessment of the 2003-2012 change map was performed using Olofsson et al. (2014) and resulted in the estimation of post-stratified estimators of deforestation and degradation using the reference data obtained via sampling. These estimates have not been used for estimating the average historical emissions as they result in very high statistical precision which could compromise seriously the monitoring of the ER program (i.e. the relative margin of error of the adjusted area of deforestation is 45%, meaning that the truth could be anywhere 45% above or below the estimate), which would not occur using consistent methods to provide wall-to-wall maps.

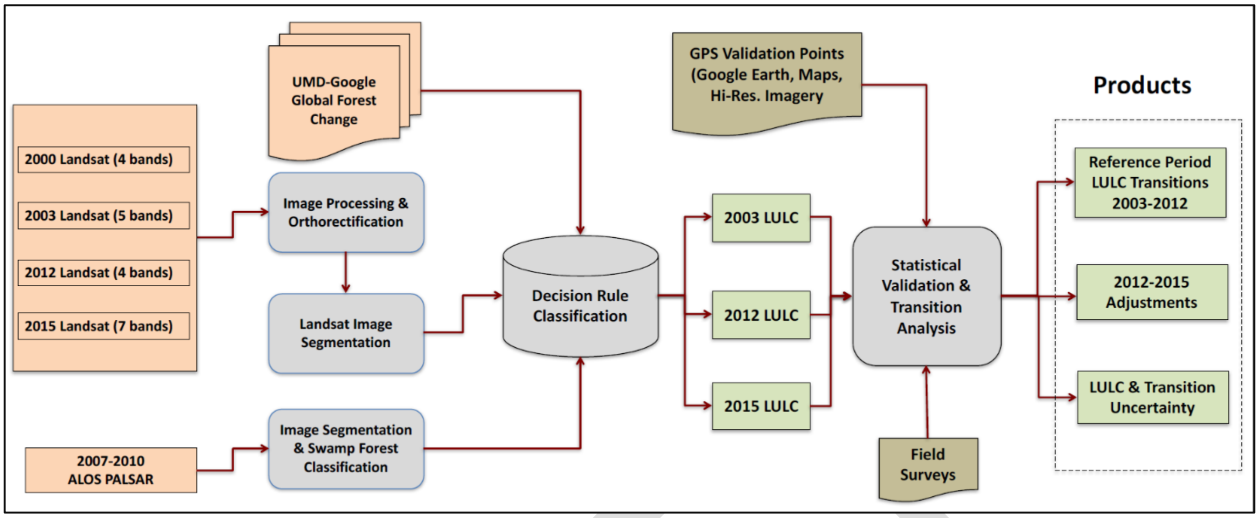


Figure 12. Methodology for Classification of Land Use Activities and Transitions During the Reference Period

Examples of land use and land cover classification for separating degraded and deforested areas are shown in Figure 13. The degraded forests and the transitions were combined with the field survey data and reports from concessions to allow separating the planned and unplanned degradation. The planned degradation areas were delineated using the GIS digital boundary of concessions and the sub-concession productive regions. The unplanned degradation is assumed to be all forest degradation outside the areas sanctioned for logging or degradation by the forestry and other concessions.

Site 1 represents the degradation of the primary forest from 2003 to 2015 by development of logging roads and wood extractions around the roads. Site 2 demonstrates a combination of deforestation and degradation around settlements in northern Likouala around rivers. In the above figure, swamp forest is represented by yellow, dense primary forest by dark green, degraded forest by light green, red as bare and grassland non-forest, and orange as agriculture and tree plantation.

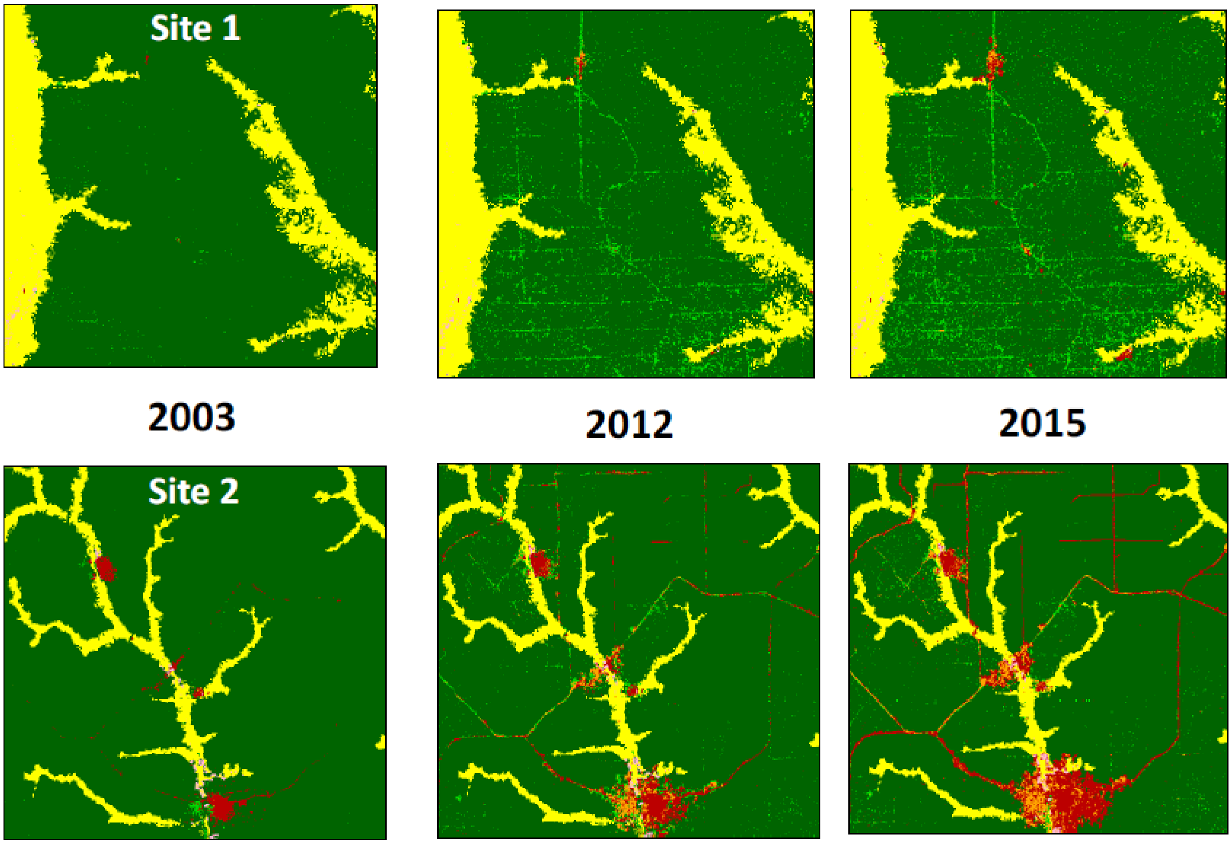


Figure 13. Examples of LULC Transitions during the Reference Period and the Adjustment Before the Start of the Program

Table 31. Land Cover and Land Use Areas in the ER-Program Area of Departments of Sangha and Likouala for the Reference and the Adjustment Periods. *Year 2015 was estimated for the adjustment.

Year	PRI	DGS	FWL	DEC	BAR	OWL	AGR
Likouala							
2015 *	2,067, 810	81,787	4,023,280	-	308,614	26,365	58,077
2012	2,102,470	71,844	4,031,490	-	282,166	25,012	52.949
2003	2,067, 810	81,787	4,023,280	-	308,614	26,365	58,077
Sangha							
2015 *	2,704,910	210,818	2,470,150	171,218	107,393	38,689	58,692
2012	2,772,480	156,361	2,466,420	185,143	90,190	38,235	53,047
2003	2,704,910	210,818	2,470,150	171,218	107,393	38,689	58,692

Emission Factors

The emission factors used to estimate average annual GHG emissions in the Reference Period are provided in the following table:

Activity Data		REDD+ activity	Geographical boundaries
$B_{AFTER,j}$ $B_{BEFORE,j}$	Biomass stocks on land use transition j immediately after the conversion, tons d.m. ha^{-1} Biomass stocks on land use transition j before the conversion, tons d.m. ha^{-1}	• Reducing emissions from deforestation • Reducing emissions from degradation	All the Accounting Area

Reducing emissions from deforestation (Forestland to Other Land) and unplanned degradation (Forestland remaining Forestland)

Description of the parameter including the forest class if applicable:	$B_{AFTER,j}$ - Biomass stocks on land use transition j immediately after the conversion $B_{BEFORE,j}$- Biomass stocks on land use transition j before the conversion
Data unit (e.g. t CO_2/ha):	Mg DM ha^{-1}
Value for the parameter:	Values displayed as transitions in Table 32. Mean Above and Below Ground Biomass and Carbon Stock in Each Stratified Vegetation Type in the Northern Republic of Congo.
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:	Carbon stock densities are derived from several data sources including the National Forest Inventory (NFI) data provided by CNIAF and satellite LIDAR processes are described below.
Spatial level (local, regional, national or international):	National Level data with procedures described below.
Discussion of key uncertainties for this parameter:	Uncertainties with remote sensing are described in detail in Chapter 0.
Estimation of accuracy, precision, and/or confidence level, as applicable and an explanation of	Estimation of uncertainties with remote sensing are described in detail in Chapter 0.

assumptions/methodology in the estimation:	

Source of data and methods for estimating EF

Emissions factors were calculated for the carbon pools identified in the ER-Program to compute emissions from activities in the accounting area. Carbon stock densities are derived from several data sources including the national forest inventory data provided by CNIAF, satellite LIDAR (Light Detection and Ranging) forest structure samples converted to forest biomass, and the forest biomass mapping approach as outlined in Saatchi et al. (2011). The emission factors were chosen in order to represent the variability and characteristics of forest structure and biomass of the accounting area in northern Congo.

The data and methodology for estimating the carbon stocks are:

1. National Forest Inventory (IFN) data for the two provinces of Sangha and Likouala were delivered to the ER-Program for developing emission factors. The IFN data were processed by GEOECOMAP at the tree level measurements to quantify the aboveground biomass at the plot level. This process included:
    a. Data in the plots included measurements of all trees with diameter at breast height DBH > 20 cm for four 0.5 ha plots at each location See IFN Methodology Document[84]. Measurements of trees with DBH < 20 cm in smaller nested plots.
    b. Aboveground biomass was calculated using Chave, et al. (2014) equation by including tree height. We used the tree height measurements in the field to develop local relationships between tree height and diameter to estimate height for all trees without height measurements. Species of trees were used to derive the wood density from the global wood density data. The measurements of diameter, height and wood density were used in Chave et al. (2014) equation to estimate forest biomass at each plot for all trees > 20 cm. The equation below provides the estimate of aboveground biomass (AGB) from summation of individual trees (i) in the plot and the measurements of wood density (WD), diameter (D) and the total height of trees (H).

$$AGB = \sum_{i=1}^{N} 0.0673 \times (WD_i \times D_i^2 \times H_i)^{0.976}$$

    c. A relationship between biomass of trees > 20 cm and trees > 10 cm were developed using the ground data and plots elsewhere in the region and used to adjust the biomass for all trees > 10 cm for each plot. We did not find the data in the nested plots for trees > 10 cm satisfactory and therefore was not used. The alternative process allowed reliable estimate of biomass for all trees between 10 to 20 cm in the plot (approximately 11% on the average). The equation below

[84] FAO and CNIAF, National Forest Inventory, Standard Operating Procedure

converts the AGB estimates for trees > 20 cm ($AGB_{>20cm}$) to AGB estimate for all trees with DBH > 10 cm ($AGB_{>10cm}$).

$$AGB_{>10cm} = 2.246 \times AGB_{>20cm}^{0.8726}$$

d. The aboveground biomass was further augmented for all trees with DBH < 10 cm. Trees < 10 cm in diameter and height > 1.3 m were also measured as part of the IFN nested plot data. However, the data provided to the ER team did not include a complete set with all trees < 10 cm. We used an equation developed from plots in DRC and Gabon where trees with DBH > 1cm have been measured in the field. Small trees will add approximately 3-7% on the average to the aboveground biomass values. The equation below converts the AGB estimates for trees > 10 cm ($AGB_{>10cm}$) to AGB estimate for all trees with DBH > 1 cm ($AGB_{>1cm}$).

$$AGB_{>1cm} = 2.246 \times AGB_{>10cm}^{0.8726}$$

e. The aboveground biomass was further augmented for all trees with DBH < 10 cm by using an equation developed from plots in DRC and Gabon where trees with DBH > 1cm has been measured in the field. Small trees will add approximately 3-7% on the average to the aboveground biomass values. The equation below converts the AGB estimates for trees > 10 cm ($AGB_{>10cm}$) to AGB estimate for all trees with DBH > 1 cm ($AGB_{>1cm}$).

$$AGB_{>1cm} = 1.872 \times AGB_{>10cm}^{0.906}$$

f. The mean carbon stock in belowground tree biomass per unit area is estimated based on field measurements of aboveground parameters in sample plots. Root to shoot ratios are coupled with the Allometric Equations method to calculate belowground from aboveground biomass. It is not practical to measure below ground biomass in most tropical forests on a routine basis. It is also very difficult to develop an appropriate, country-specific allometric equation for root biomass. Instead below-ground biomass is estimated from a well-accepted ratio for moist tropical forests, developed by Mokany et al. (2006; also reported in the IPCC 2006 GL), which reliably predicts root biomass based on shoot biomass. The equations below shows how the belowground biomass (BGB) can be estimated from AGB.

$$BGB = 0.235 \times AGB \;\; if \; AGB > 125 \; Mg \; ha^{-1}$$

$$BGB = 0.205 \times AGB \; if \; AGB \; \leq 125 \; Mg \; ha^{-1}$$

2. The IFN plot estimate of AGB could provide estimates of forest biomass in only two classes over the ER region because of the sparse geographical location of plots and the very low density of the plots in degraded, secondary, or non-forest plots. We could not use IFN plots alone to estimate the emission factors in the region. Therefore, an alternative approach was adopted as part of the ER-Program to estimate carbon stocks in different vegetation classes available in the ER region and to improve the emission factors for final estimation of emissions from deforestation and degradation activities.
3. The IFN plot data and the satellite LIDAR sampling of the forests the ER-Program region were combined to develop new estimates of forest biomass for all LULC classes and to develop a map of forest biomass in the region at 100 m spatial resolution. The

methodology follows the approach as outlined in Saatchi et al. (2011). All LIDAR samples from the satellite ICESAT GLAS sensor were estimated using a model developed by ground plots in forests of Central Africa and adjusted by the IFN plots in primary and wetland forests in both Sangha and Likouala departments. The AGB derived from LIDAR samples provided additional estimates of the forest biomass in the region that were aggregated to provide the mean and variance of estimates. In this approach, the LIDAR samples will work similar to the inventory data located in each LULC classes and will be used to estimate the mean carbon density of the class. As LIDAR samples are calibrated with IFN data, the mean AGB estimates for primary and swamp forest remain approximately the same as the estimates provided by the IFN data. However, LIDAR samples allow us to have improved estimate over all LULC classes with improved standard errors for developing the emission factors.

4. The final map of forest biomass (AGB) is calibrated with the National Forest Inventory data and provides an unbiased estimate of the regional variations of AGB. Chapter 0 discusses the uncertainty of the map and the process of estimating the standard error of AGB for each LULC classes.

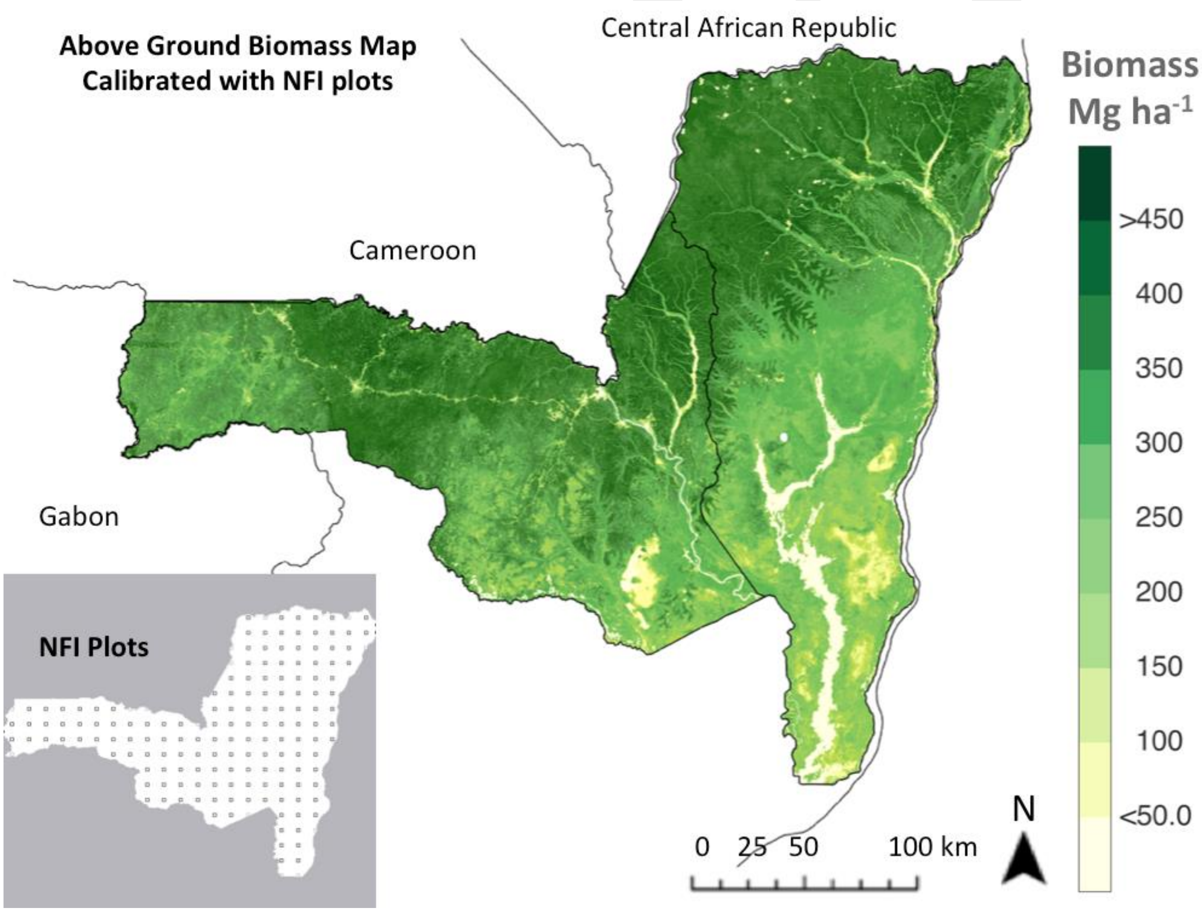


Figure 14. Map of Forest Above Ground Biomass (Mg/ha) Derived From Satellite LiDAR Measurements of Forest Structure and Adjusted for Wood Density and Forest Biomass Variations Derived From the National Inventory plots

Results and comparison

The results are provided in the following table:

Table 32. Mean Above and Below Ground Biomass and Carbon Stock in Each Stratified Vegetation Type in the Northern Republic of Congo

Vegetation Type	Mean AGB (Mg/ha)	SE AGB (Mg/ha)	Mean BGB (Mg/ha)	SE BGB (Mg/ha)	AGC + BGC (MgC/ha)	SE AGC + BGC (MgC/ha)
Primary Forest (PRI)	316.95	6.95	74.49	8.52	195.75	7.73
Secondary/Degraded Forest (DGS)	209.89	7.79	50.02	9.54	131.45	8.67
Wetland/Swamp Forest (FWL)	214.6	7.46	50.44	9.15	132.55	8.31
Naturally Open forest (DEC)	172.56	3.16	40.56	3.87	106.57	3.52
Bare/grassland Non-forest (BAR)	46.88	5.71	9.76	7.01	28.69	6.36
Other wetland Non-forest (OWL)	76.95	6.29	15.86	7.72	46.62	7.01
Agriculture/Tree Plantation (AGR)	103.22	6.42	21.16	7.87	62.19	7.15

These values are in line with other values from the NFI or from studies conducted in similar forests.

Table 33. Comparison of the Forest Carbon Stocks Derived From the National Inventory Data in Congo with Published Results in the Literature.

Forest Cover Type	Aboveground Carbon t C ha^{-1}	Source
Primary Forest (PRI)	162.03	Congo National Forest Inventory (CNIAF) 316 plots at 0.5 ha (AGB only)
Secondary/Degraded Forest (DGS)	114.98	Congo National Forest Inventory (CNIAF) 52 plots at 0.5 ha (AGB only)
Wetland/Swamp Forest (FWL)	113.21	Congo National Forest Inventory (CNIAF) 437 0.5ha Plots (AGB only)
Primary Forest (PRI)	162.00	Saatchi et al. 2011 (AGB+BGB)
	149.05	North Pikounda REDD+ (NPR+) VCS Program Document Inventory (AGB only)
	123.76	Zapfak et al. (2013) (AGB only)
Secondary/Degraded Forest (DGS)	118.60	Zapfak et al. (2013) (AGB only)
Wetland/Swamp Forest (FWL)	88.49	Zapfak et al. (2013) (AGB only)

The method applied above produces emissions factors for each LULC transition on the ER-Program Areas. For the areas subject to deforestation and degradation and the spatially delineated palm oil plantation, these emission factors are applied to the historical LULC transitions to calculate historical emissions. For the Management Strata subject to unplanned deforestation and degradation, these factors are also applied to the projected LULC transitions during the Program life to get the reference emission level. For projected reference emission level for the Areas Designated for Oil Palm Plantations, an emission factor reflecting the difference between the carbon stock for each forest class as presented in above table and the average carbon over a 25 year period for a managed oil palm plantation is used (see details provided in Chapter 8.4).

Table 34. Emissions Factors

From	To	Emission Factor AGB [tCO_2e ha-1]	Emission Factor BGB [tCO_2e ha-1]
PRI	BAR	485.22	116.31
DGS	BAR	292.87	72.34
FWL	BAR	301.33	73.10
DEC	BAR	225.80	55.33
PRI	AGR	384.00	95.83
DGS	AGR	191.66	51.86
FWL	AGR	200.11	52.62
DEC	AGR	124.58	34.85
PRI	DGS	192.35	43.97
FWL	DGS	8.46	0.76
DEC	DGS	0.00	0.00

Table 34 provides the emission factors used for historical and projection emission levels including the carbon pools specified in Table 21. The below ground biomass is assumed to be released at the time of conversion following Tier 1 methods[85].

[85] The glossary of terms of the CF MF define Tier 2 as using the same methods as Tier 1 but using local available data instead.

Calculation of the average annual historical emissions over the Reference Period

Calculations using IPCC methods

Reducing emissions from deforestation (Forestland to Other Land) and unplanned degradation (Forestland remaining Forestland)

The following table provides an overview of the calculations using the equations provided in Chapter 8.3 using the stock-change method:

Table 35. Average Annual Emissions and Emissions during the Historical Reference Period based on Land-use Transition

		Aj - Area of Land Use subcategory / stratum converted to another Land Use subcategory / stratum (transition denoted by j) in a certain year, ha yr-1		B before - biomass stocks on land use transition j before the conversion, tons d.m. ha-1	B after-biomass stocks on land use transition j immediately after the conversion, tons d.m. ha-1	tC year^{-1} in Reference Period**	
		Planned	Unplanned			Planned	Unplanned
Deforestation	From PRI to BAR	974	2,364	391	57	159,812	387,776
	From DGS to BAR	2,031	2,839	260	57	202,307	282,817
	From FWL to BAR	29	180	265	57	2,979	18,401
	From DEC to BAR	453	424	213	57	34,752	32,498
	From PRI to AGR	1,311	3,930	391	124	171,527	514,316
	From DGS to AGR	28	44	260	124	1,869	2,899
	From FWL to AGR	142	406	265	124	9,772	28,013
	From DEC to AGR	0	0	213	124	12	16
	Total Deforestation	4,969	10,188			583,029	1,266,737
Degradation	From PRI to DGS	7,283	9,944	391	260	469,382	640,863
	From FWL to DGS	29	71	265	260	72	178
	From DEC to DGS	126	118	*	*		
	Total Degradation	7,438	10,132			469,454	641,041

** Assumed conservatively to be zero **The **carbon fraction value of 0.49** is sourced from IPCC 2006; Table 4.3 (Wood in Tropical Forests). This is constant with the national reference level.*

Average annual historical emissions over reference period

The overall results per REDD+ activity is provided in the following table:

Table 36. Calculation of Emission Reductions per REDD+ Activity in the Reference Period

REDD+ Activity	Sub-activities	tCO_2/year in RP	%
Reducing emissions from deforestation	Planned Deforestation	2,137,775	20%
	Unplanned Deforestation	4,644,703	43%
Reducing emissions from degradation	Planned degradation	1,721,330	16%
	Unplanned degradation	2,350,483	22%
Changes in carbon stocks in the Accounting Area		10,854,290	100%

It can be confirmed that GHG emissions from forest degradation are significant, as they constitute about 40% of total GHG emissions in the Reference Period.

The results per management strata and per REDD+ Activity are provided in the following table.

Table 37. Average Annual Emissions and Emissions during the Historical Reference Period

	Deforestation		Degradation		Total	
Management Strategy	Average Annual [tCO2e yr-1]	Hist Reference Period Total [tCo2e]	Average Annual [tCO2e yr-1]	Hist Reference Period Total [tCo2e]	Total Avg Annual [tCO2e]	Total DF and DG [tCO2e]
Protected Area	484,981	4,447,211	420,197	3,853,151	905,178	8,300,362
Forest Concession – Non Production	1,691,389	15,509,802	830,672	7,617,145	2,522,060	23,126,947
UA	1,947,804	17,861,097	823,728	7,553,470	2,771,532	25,414,567
Forest Concession – Production	2,137,775	19,603,101	1,721,330	15,784,358	3,859,104	35,387,459
Industrial Palm Oil	520,529	4,773,177	275,887	2,529,844	796,416	7,303,021
Total ER-Program Area	**6,782,477**	**62,194,388**	**4,071,813**	**37,337,968**	**10,854,290**	**99,532,356**

Table 38 provides an estimate of the emissions over the Program Life, if they remained at the same emission level as between 2003 to 2012. There are numerous factors quantified in Chapter 7 as to why this method of quantification is highly inadequate for the ER-Program Area.

Table 38. Estimates Emissions over the ER-Program Life Using the Historical Annual Average

	Emissions Using Historical Annual Average					
YEAR	Forest Conc NonProd	Protected Areas	Unattributed Areas	Forest Conc Production	Industrial Palm Oil (spatially defined)	Total
	[tCO_2e]	[tCO_2e]	[tCO_2e]	[tCO_2e]	[tCO_2e]	
2017	2,522,060	905,178	2,771,532	3,859,104	796,416	10,854,290
2018	2,522,060	905,178	2,771,532	3,859,104	796,416	10,854,290
2019	2,522,060	905,178	2,771,532	3,859,104	796,416	10,854,290
2020	2,522,060	905,178	2,771,532	3,859,104	796,416	10,854,290
2021	2,522,060	905,178	2,771,532	3,859,104	796,416	10,854,290
2022	2,522,060	905,178	2,771,532	3,859,104	796,416	10,854,290
2023	2,522,060	905,178	2,771,532	3,859,104	796,416	10,854,290
2024	2,522,060	905,178	2,771,532	3,859,104	796,416	10,854,290
2025	2,522,060	905,178	2,771,532	3,859,104	796,416	10,854,290
2026	2,522,060	905,178	2,771,532	3,859,104	796,416	10,854,290
Total	**25,220,603**	**9,051,784**	**27,715,318**	**38,591,044**	**7,964,155**	**108,542,904**

8.4 Upward or Downward Adjustments to the Average Annual Historical Emissions over the Reference Period

Justification for Adjustments – Activities Present, but not fully accounted for in the Reference Period

Deforestation and forest degradation in the Accounting Area have been relatively small in the past, however, this pattern is changing as the region develops and integrates with the global economy, and access and population increase as never before. Given such emerging trends, historic baselines were not adequate to capture future risk of forest loss, and an adjustment is proposed. This adjustment reflects the fact that historical averages cannot capture the dynamics in the ER Program Area based on changes due to national and regional circumstances. In particular, areas subject to unplanned deforestation and degradation were adjusted taking into account the following factors: empirical evidence that significant LULC has happened after 2012; population growth of 2.86%; infrastructure and transport that are expected to improve and expand; expansion of the industrial agriculture and mining; and growing global timber and mineral markets. This section presents the necessary evidence that these factors are documented and evident within the Accounting Area, but not fully reflected within the Reference Period, and are quantified.

Compliance with eligibility requirements

The Accounting Area of Sangha and Likouala well represents the Republic of Congo's designation as a high forest cover, low deforestation (HFLD) country (Megevand, 2012). Deforestation and forest degradation in the Accounting Area have been minimal over the past, with studies noting estimates of 0.03% and 0.70% per annum during the periods 1990-2000 and 2000-2005, respectively.[86] The most recent forest cover change map produced at the national level by CNIAF[87] show that the deforestation rate in Republic of Congo in the period 2000-2012 was 0.052% and that forests cover 69% of the national territory. Hence, it is clear that the country would comply with the eligibility requirement set in Indicator 13.2 i), as long-term historical deforestation has been minimal across the entirety of the country, and the country has high forest cover that represents more than 50% of the country's area.

In the period following the end of the reference period in 2012, several trends in the ER-Program Area have accelerated the rate of deforestation over historic trends. These documented trends listed below are quantified in section 8.5:

1. National development programs which were established since 2012[88,89] promoting industrial agriculture, increased mining operations, and major infrastructure developments and improvements, and
2. Changes in national circumstances since 2012 are not fully reflected in the reference period, specifically those that will impact deforestation beyond historical rates. These include:
    - Significant infrastructure growth enabling international transportation via connected new roads and bridges, mainly in the form of the new Brazzaville-Ouesso road, whose construction and pavement commenced in 2012 and finalized in 2015.[90] New road construction and improvements will expand to Bomassa, Enyélé and on to Bangui (Central African Republic). While major parts of Likouala and Sangha were previously very difficult to reach, the expanded infrastructure network opens the region up to substantially higher rates of deforestation than observed before 2012;
    - The global timber market was in a recession in the period from 2008-2012, and has since recovered. Within the Accounting Area, a new concession has been granted, and inactive concessions have been reallocated to operating concession holders.
    - Increasing demand for minerals which will foster the development of mining projects within the Accounting Area. Though mining permits were issued within the

[86]De Wasseige et. al, 2012

[87] CNIAF. 2015. CARTE DE CHANGEMENT DU COUVERT FORESTIER EN REPUBLIQUE DU CONGO POUR LA PERIODE 2000-2012

[88] MEPAI. 2012. Plan National De Développement - Document de Stratégie pour la croissance, l'emploi et la réduction de la pauvreté (DSCERP) 2012-2016. Brazzaville, 2012, 398pp.

[89] MA. 2012. Plan de Développement du Secteur Agricole – PDSA département SANGHA"

[90]http://www.portail242.info/Ouesso-2015-L-axe-Brazzaville-Ouesso-un-couloir-vital-pour-l-economie-congolaise_a208.html

Accounting Area during the historical reference period, mining concession holders were granted rights to clear forest after the historical reference period.

The use of historical rates purely from the historical reference period of 2003-2012 will underestimate future rates of deforestation and forest degradation during the Term of the ER-PA. The result is documented and quantified through remote sensing, which shows that deforestation and forest degradation increased between 2012 and 2015, confirming that the change in national circumstances is accelerating rates beyond the historical baseline. Hence, it is clear that the country complies with the eligibility requirement set in Indicator 13.2 ii) as rates observed in the Reference Period will likely underestimate future rates of deforestation and forest degradation.

Justification of proposed upward or downward adjustment to the average annual historical emissions over the Reference Period

As indicated in Chapter 8.3, average annual GHG emissions in the Reference Period were estimated for the two selected REDD+ activities and these were disaggregated in planned and unplanned in line with the national REL/FRL submitted to the UNFCCC. Moreover, in line with the guidance set by the GFOI MGD,[91] an additional stratification into 'Management Strata', which are related to the drivers of deforestation and degradation, was done for reporting purposes.

For the adjustment justification and its quantification, these will be done separately for each Management Strata as the adjustment is closely related to the type of driver of deforestation and degradation involved, plus the disaggregated reporting will also serve for the purposes of the benefit sharing mechanism. There are four groups of Management Strata that have been defined for the purpose of adjustment justification and quantification:

Table 39. Adjustments made per Management Strata

Adjustment Made	Summary of Method for Adjustment quantification	This Adjustment applies to the following Management Strata
Adjustment considering the rates observed in 2012-2015	This rate adjusts the deforestation/degradation rate forward, calculated through Remote Sensing.	1. Protected Areas ***(PA)*** 2. Unattributed Areas ***(UA)*** 3. Forest Concessions Non-Production Areas ***(FCNonProdA)*** 4. Forest Concession Production Areas ***(FCProdA)*** 5. Industrial Oil Palm Plantations ***(PalmA)***
Adjustment considering Population Growth	This rate adjusts the deforestation/degradation rate by adding population growth.	1. Protected Areas ***(PA)*** 2. Undesignated Areas ***(UA)*** 3. Forest Concession Non-Production Areas ***(FCNonProdA)***

[91] "*Countries may wish also to stratify according to drivers of deforestation since this may help develop understanding of causal relationships between drivers and deforestation rates*" - Section E.1.1 – GFOI (2015) - Integrating remote-sensing and ground based observations for estimation of emissions and removals of gree

		4. Industrial Oil Palm Plantations ***(PalmA)***
Adjustment considering Road Improvements	This adjusts the deforestation/ degradation rate by adding future deforestation/ degradation cause by current existing roads.	1. Protected Areas ***(PA)*** 2. Undesignated Areas ***(UA)*** 3. Forest Concessions Non-Production Areas ***(FCNonProdA)*** 4. Industrial Oil Palm Plantations ***(PalmA)***
Adjustment considering additional Forestry Concessions Karagoua and Mimbelli-Ibenga	This adjusts the deforestation/ degradation rate by adding future deforestation/ degradation cause by inactive concessions becoming active.	1. Forest Concessions Non-Production Areas ***(FCNonProdA)*** 2. Forest Concession Production Areas ***(FCProdA)***
Adjustment considering new oil palm plantations	This adjusts the rate of deforestation by adding deforestation caused by documented future oil palm plantations.	1. Industrial Oil Palm Plantations ***(PalmA)***
Adjustment considering future mining operations	This adjusts the rate of deforestation and degradation rate by adding deforestation and degradation caused by documented future mining operations.	1. Unattributed Areas ***(UA)***

The justification of the adjustment for each of these management strata is provided below.

Adjustment for Acceleration of Trends (All Management Strata)

Deforestation and Degradation were present in the Accounting Area during the historical period (2003-2012), however there is an acceleration of trends over the historical rate. Observed deforestation and degradation rates accelerated between 2003-2012 and 2012-2015. This documentation of acceleration of trends is shown in Table 40 and Figure 15. Historical rates from 2003-2012 are unreflective of current trends and therefore the deforestation and degradation rates was adjusted to capture current rates.

Table 40. Deforestation and Degradation Rates Showing an Acceleration of Trends from 2012-2015

Overall DF and DG Rates for ER-Program Area – Historical & Adjustment Period		
	Historical Period (2003-2012)	Adjustment Period (2012-2015)
DF	0.12%	0.16%
DG	0.35%	0.58%

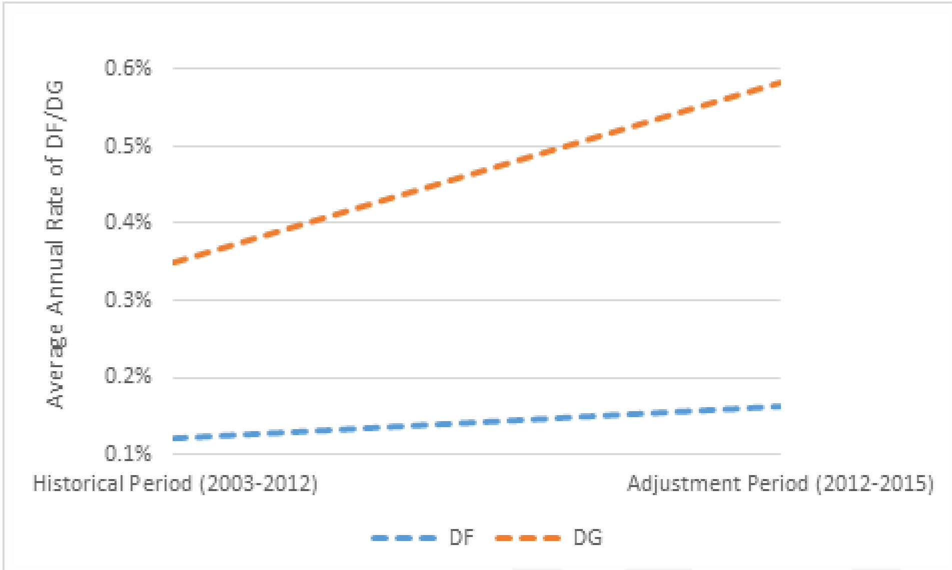


Figure 15. Graphic Display of Acceleration of Trends between 2003-2012 and 2012-2015

Areas Subject to unplanned deforestation caused by new road expansion and road improvements (FCNonProdA, FCNonProdA, PA, UA, PalmA)

While much of the ER-Program Area throughout Likouala and Sangha has historically been untouched by large-scale deforestation pressures due largely to its highly remote location, the development of major infrastructure projects in the region in recent years threaten to cause significant increases in deforestation and degradation. Improvements on existing road networks and the construction of new roads – particularly that connect major population centers – decrease transit times from several days to merely a few hours. While this greater degree of infrastructure connectivity is a step forward for regional development, it represents a significantly larger area accessible to the drivers of deforestation above the historic baseline.

Though infrastructure development is a critical step in facilitating rural development in Likouala and Sangha, it has been identified as a significant driver of deforestation and degradation (Damiana and Wheeler 2015).[92] Specifically, increased access to previously untouched forests and vastly lower transit times have been shown to increase the overall rate of deforestation along road corridors in the Congo Basin (Zhang et al 2006).[93] Field visits to the ER-Program Area confirmed that unplanned mosaic deforestation follows a pattern strongly correlated with distance to the roads. This pattern was confirmed by geospatial analysis of deforestation and degradation transitions between the 2012-2015 classification maps, which demonstrates a

[92] Damiana, Richard; Wheeler, David. (2015). Road Improvement and deforestation in the Congo Basin countries. World Bank. Policy Research Working Paper WPS7274

[93] Zhang, Quanfa; Justice, Christopher; Jiang, Mingxi; Brunner, Jake; Wilke, David. (2006). A GIS-Based Analysis on the Vulnerability and Future Extent of Tropical Forests of the Congo Basin

strong pattern of deforestation nearby road areas compared to the overall ER-Program Area (Table 41).

Table 41: Comparison of Total DF/DG Rates in Entire Management Strata vs Area Proximate to Roads

	Unattributed Area	FCNonProd	Protected Area	FCProduction	Industrial Palm Oil	Area <5 km from Improved Roads
Total DF Rate (All Transitions)	0.14%	0.25%	0.07%	0.06%	0.14%	**0.48%**
Total DG Rate (All Transitions)	0.60%	0.32%	0.31%	0.28%	0.64%	**1.11%**

There is a network of roads spanning across the ER-Program Area, ranging from larger public highways to minor logging roads (Figure 16); these roads have been present for varying times, but the vast majority of them date through the Reference period. During the Reference period, as noted above in Table 41 and in Damiana and Wheeler (2015)**,** roads are a significant driver of deforestation in the Congo Basin, including the ER-Program Area.

Not Fully Reflected during the Reference period: As noted above, roads have existed throughout the Reference period, and are a significant driver of deforestation in the region. While there is an existing system of roads in the ER-Program Area, the road network spanning Likouala and Sangha is not static throughout time. Recent conversion of existing roads to major highways, as well as the construction of new roads connecting major population centers (Figure 16), represents a change over the 'baseline' road network, driving deforestation above that experienced in the reference period (Table 42).

Table 42: Comparison of DF/DG Near Roads - Subject to Improvements in 2012-2015 vs Unimproved

	Area Near Roads (<5km) – TOTAL AREA (Improved and Unimproved)	Area Near Roads (<5km) - Improved in 2012-2015
Total Rate of DF	0.48%	0.85%
Total Rate of DG	1.11%	1.66%

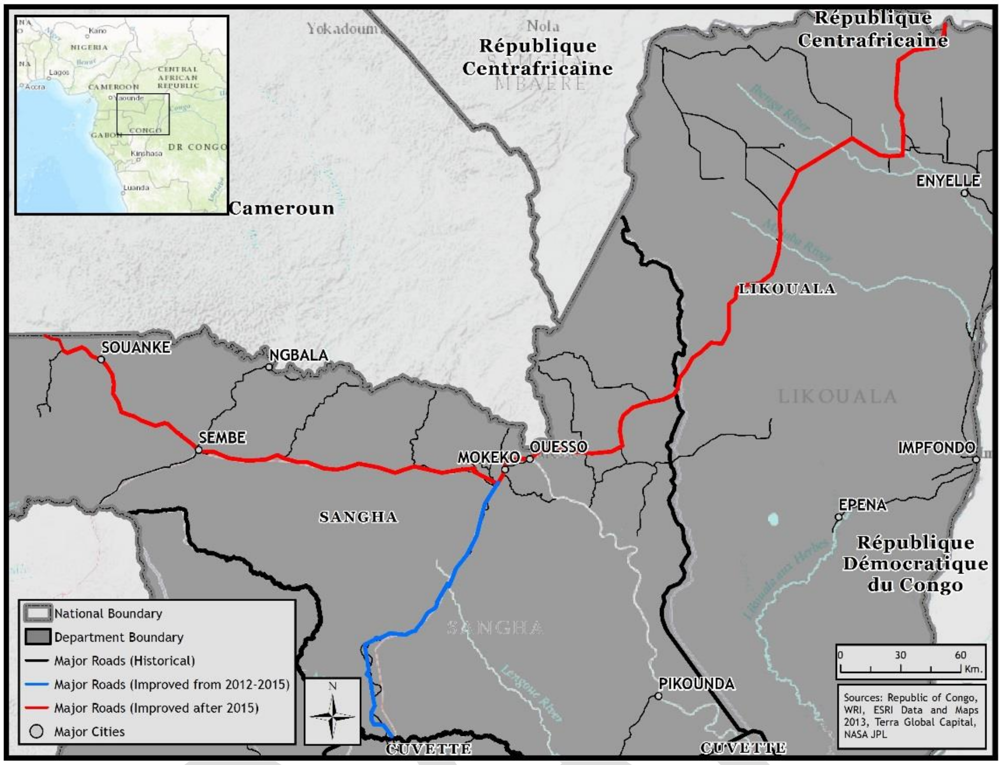


Figure 16: Major Roads and Road Improvements in ER-Program Area

There is a significant body of research regarding the quantification of deforestation and degradation caused by road construction in the Congo Basin using numerous geospatial and multivariate statistical modeling techniques (Zhang et al 2006; Damiana and Wheeler 2015). For the purposes of examining adjusted emissions due to road construction, a frontier-based cost distance model was used to quantify the relative impact of improving a road in the adjusted reference period (2012-2015) on deforestation and degradation within specific distance-strata to the road. The adjusted rate of deforestation and degradation caused by the improved roads was then applied to the area that will undergo road improvements during the crediting period to determine adjusted ex-ante emission; the precise quantification process is described in additional detail below.

Additional Adjustment for Forest Concession Production Areas (FCProdA)

In 2000 forest production in the Congo exceeded 1.5 million cubic meters of wood annually.[94] Significant internationally desirable species produced in the ER-Program in 2013 include Okoumé (449,456 m3), Sapelli (407,283m3), Tali / Kassa (55,379 m3) and the Sipo (52,379 m3).[95] In 2011

[94] FRA 2010 Country Report, Congo

[95] Annual stats 2013

the formal forest sector to employed 0.5% of the Congolese labor force and accounted for USD $149 million contribution to the GDP.[96]

The timber extraction rates are expected to be higher in the future than in the historical reference period due to increased market demand, and increased access to the area and resulting lower operating costs for the timber industry. From 2009 to 2012 the global timber market was depressed, and during this period forest concession holders reduced harvest, reduced mill operation times, and in some cases stopped all harvesting and milling operations for months at a time.[97] During the economic downturn forest concession holders sold off stockpiles of timber and raw logs to stay in operation while reducing their harvest. The population of Pokola decreased significantly as the CIB-Olam mill faced significant layoffs. For these reasons, MFEDDE data is not representative of future trends, but represents depressed timber market conditions.

In 2013 the total imports of tropical hardwood logs from the International Tropical Timber Organization (ITTO) members picked up strongly, driven by the global economic upturn. China, which represents 56% of the share of ITTO tropical logs imports, has increased imports each year over year through 2014. International prices of tropical timber have started to recover and, since 2005, and have increased 33%.[98] Figure 17 provides two-weekly nominal Euro prices/m^3 of acajou, ayous, azobe, belli, bibolo, dibétou, ekki, iroko, kaha, n'gollon, obeche, okan, okoume, maobi, movingui, niove, padouk, sapele, sipo, tali, and utile logs (loyale Merchant/B/BC/C grades) for West Africa Exports (Central Africa time series not available).[99]

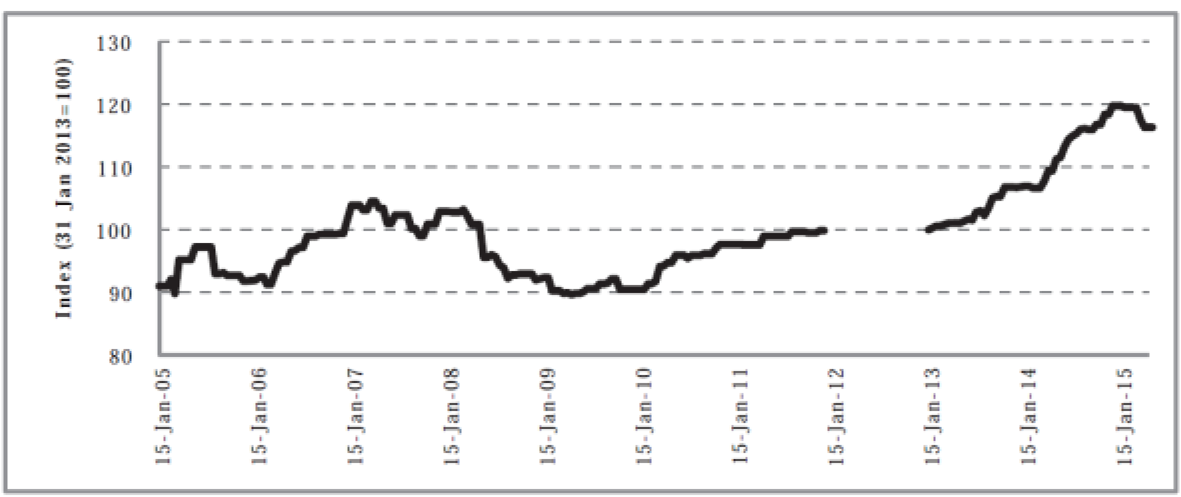


Figure 17. West Africa Roundwood Average Export Prices

[96] FAO FRA State of the World's Forests 2014

[97] Communications with Forest Concession Holders, and other stakeholders in Likouala and Sangha in September October 2015

[98] ITTO Tropical Timber Market Report, 2013-2014

[99] ITTO Tropical Timber Market Report, 2013-2014

There is a significant acceleration of existing trends in the timber industry that is not reflective of the reference period. Tropical Timber extraction rates are expected to increase at 2%.[100] [101] As the international tropical timber market is expected to increase, forest concession holders active in the area during the reference period have now purchased additional concessions. CIB-OLAM, the same company that faced significant layoffs during the reference period, purchased the concession Mimbelli-Ibenga, and SEFYD purchased the newly created Karagoua concession. CIB-OLAM also owns Pikounda Nord concession, which has been delineated, attributed and has a management plan - but has been designated as a VCS carbon project since 2012. As described previously, there are significant new roads and infrastructure improvements causing increases access to the entire Accounting Area and this is also reducing the logistics costs which increases the economic feasibility of harvesting certain species. In addition, the National Development Plan (PND)[102] and PSDA[103] expect strong growth through implementing development strategies of silviculture, logging, and wood processing. Hence, it is expected that this change in national circumstances will cause an increase in the extraction rates over those observed in the Reference Period, so this increase in the extraction rates were not fully reflected in the average annual historical emissions during the Reference Period.

Moreover, it is important to note that forestry concessions Moungouma, Bonvouki, Mimbelli-Ibenga, and Karagoua were either not attributed, totally inactive or nearly inactive in the Reference Period, but are expected to actively harvest due to a growing global demard for timber. Hence, the GHG emissions due to forest degradation of logging operations in these concessions are not fully reflected in the average annual historical emissions during the Reference Period. Concessions Mimbelli-Ibenga and Karagoua were recently assigned active concession holders with histories of engaged forest management in the Accounting Area. As this is clearly document through legal texts or "arrêtés" these new areas will be added to the area subject to planned deforestation and degradation.

This adjustment would comply with the requirements of Indicator 13.3 as it is a documented change in the ER-Program circumstances, evidence before the end-date of the Reference period, but the effects were not fully reflected in the average annual historical emissions during the Reference Period. Because of the reasons stated above, it further strengthens the argument that concessions that were historically inactive will become active in the future.

Additional Adjustment for Designated Areas for Oil Palm Plantations (PalmA)

There are three large industrial oil palm concessions areas geographically delineated in the Accounting Area, there is one concession under negotiation and there are three other areas

[100] http://www.globalwood.org/market/timber_prices_2016/aaw20160301d.htm, accessed 3/3/2016.

[101] http://www.woodworkingnetwork.com/wood/pricing-supply/global-timber-market-prices-continue-decline. Accessed 3/3/2016.

[102] MEPAI. 2012. Plan National De Développement - Document de Stratégie pour la croissance, l'emploi et la réduction de la pauvreté (DSCERP) 2012-2016. Brazzaville, 2012, 398pp.

[103] MA. 2012. Plan de Développement du Secteur Agricole – PDSA département SANGHA

generally identified by the government for oil palm. The promotion of industrial oil palm is a priority for the Congolese government, specifically in the department of Sangha. In Sangha, Eco-Oil and ATAMA have been granted palm concessions in 2013 and December 2010, respectively. Currently, there are no industrial oil palm areas allocated in Likouala. The field visits conducted by the ER-Program consultants in October 2015, identified other areas where oil palm is currently being cultivated outside of these formal concessions. Eco-Oil indicated during the interviews held that they were actively negotiating another concession in the ER-Program Area, but the details have not been provided. In addition, the Sembe Oil Palm and Macro Agricultural zone has been allocated as an industrial plantation, however it has not been granted to any company. The current geographical specific industrial oil palm areas and concession holders are indicated in Figure 18.

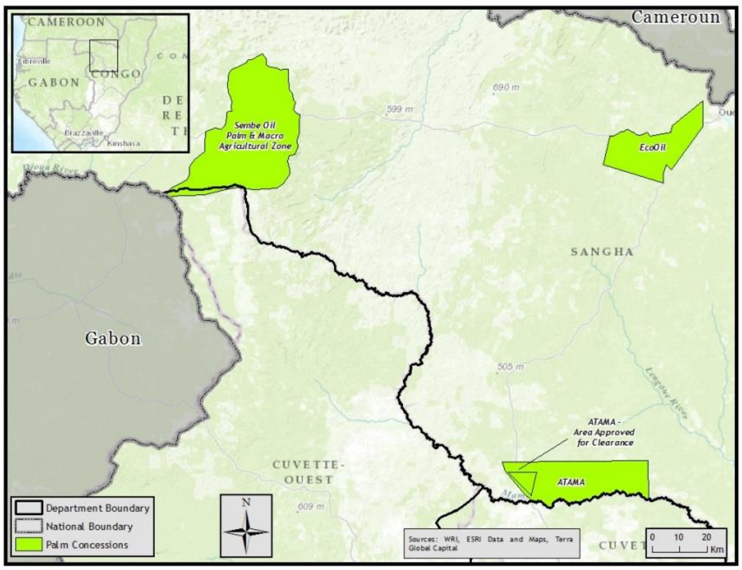


Figure 18. Industrial Oil Palm Plantations with Geographic Delineation in the ER-Program Area

Both the ATAMA and Eco-Oil concessions have been granted in last 5 years. With the Sembe Oil Palm and Macro Agriculture Zone these represent over 250,000 hectares of potential oil palm plantations in the ER-Program Area (**Error! Reference source not found.**) that have been eographically demarcated. Eco-Oil is planning with the national government an additional plantation in Likouala which is expected to be 30,000 hectares.

Table 43. LULC of Geographically Identified Oil Palm Concessions

LULC Class	ATAMA	EcoOil	Sembe	Total
	2017	2017	2017	2017
Primary Forest	11,836	20,096	87,312	119,244
Degraded/Secondary Forest	1,911	6,617	8,536	17,064
Forested Wetlands	19,419	9,249	27,727	56,395
Semi-Deciduous Forest	10,708	-	-	10,708
Bare/Grassland	11,700	2,314	1,417	15,431

LULC Class	ATAMA 2017	EcoOil 2017	Sembe 2017	Total 2017
Other Wetlands	391	62	38	491
Agriculture/Plantation	153	8,982	3,772	12,907
Water	170	-	-	170
Total Hectares	56,288	47,320	128,802	232,410

Forest Areas	ATAMA 2017	EcoOil 2017	Sembe 2017	Total 2017
Forest	43,874	35,962	123,575	203,411
Total Forest Area (excluding FWL)	24,455	26,713	95,848	147,016
Non-Forest	12,414	11,358	5,227	28,999

However, these documented conversions of forests did not occur in the Reference Period so these GHG emissions are not fully reflected in the average annual historical emissions during the Reference Period due to the following conditions:

- Congolese government only started granting concessions in the ER-Program Area in December 2010;
- The companies holding concessions required start-up time before clearing and planting started occurring;
- The government's priority on palm oil cultivation has only emerged as a priority in 2012;
- Evidence of successful business models for oil palm in the ER-Program Area, as required to attract private companies and capital, is just starting to be built through the experiences of Eco-Oil.

Hence, this adjustment would comply with the requirements of Indicator 13.3 as it is a documented change in the ER-Program circumstances, evidence before the end-date of the Reference period, but the effects were not fully reflected in the average annual historical emissions during the Reference Period.

Additional Adjustment for Mining Concessions

Mining concessions will contribute to deforestation in the future in the Accounting Area. No significant mining activities that cleared forest took place in the Accounting Area during the Reference Period.[104] However, gold, diamonds, iron, titanium, and manganese are all found within the ER-Program area, and an increasing number of mining permits are being processed

[104] MEFDD. 2014. Etude de la spatialisation et de la pondération des causes de la déforestation et la dégradation forestière et analyse des options stratégiques, proposées par le r-pp de la République du Congo - rapport final, Section 4.4.2.11

and issued. To properly account for the impact of mines and their related infrastructure a current listing of the following is required:

- Listing of permits with type, start and end date, holder, mineral
- Spatially explicit boundary files to calculate sizes and locate on maps

Updated spatially explicit information does not exist at this time, only an outdated research map (2010) is available; the existing extent of the mining concession in initial stages does not indicate the total potential area subject to deforestation. Given that mines have not been spatially identified, the projected impact on deforestation and degradation from mining was assessed through communications with actors in the area. Congo Iron is the most advanced in actively mining the area, and has stated that their operation in Sangha will become commercially viable when iron ore reaches $65.00 USD per metric ton. In August of 2016, the price of iron ore peaked at $60.57 USD per ton, and although the price is still low, there has been an overall increasing trend since December 2015. When significant mining companies become active in the area it will build infrastructure and set norms in place for other mining operations to follow suit.

Of the 13 permits issued in the Accounting Area only four have been approved for exploitation. The area of exploitation (or area zoned to be cleared) is significantly smaller than the research or exploration permit. Of all the mining companies Congo Iron is the most advanced in actively mining the area, and was approved by the government to clear a total of 1,550 ha in 2015. This is a documented evidence of deforestation that will occur in the future and which effects were not fully reflected in the average annual historical emissions during the Reference Period complying with the requirements of Indicator 13.3. Deforestation caused by mining is documented and evident before the end-date of the Reference period, but the effects were not fully reflected in the average annual historical emissions during the Reference Period. In order to set an appropriate reference level for deforestation and forest degradation caused by mining operations, documented evidence is used to quantify future emissions.

Quantification of the proposed upward or downward adjustment to the average annual historical emissions over the Reference Period

In terms of quantification, it is important to note that the quantification of the adjustment has been done in two steps. A graphical demonstration of the adjustment is in Figure 19.

- Adjustment based on actual data 2012-2015: One which adjusts based on actual observed data in the period 2012-2015 which will reduce the error of any projection made as it will be based on actual data.
- Planned changes in ER-Program circumstances: This factor adjusts each Management Strata specific to documented evidence that observed rates of deforestation and degradation will change during the project crediting period.

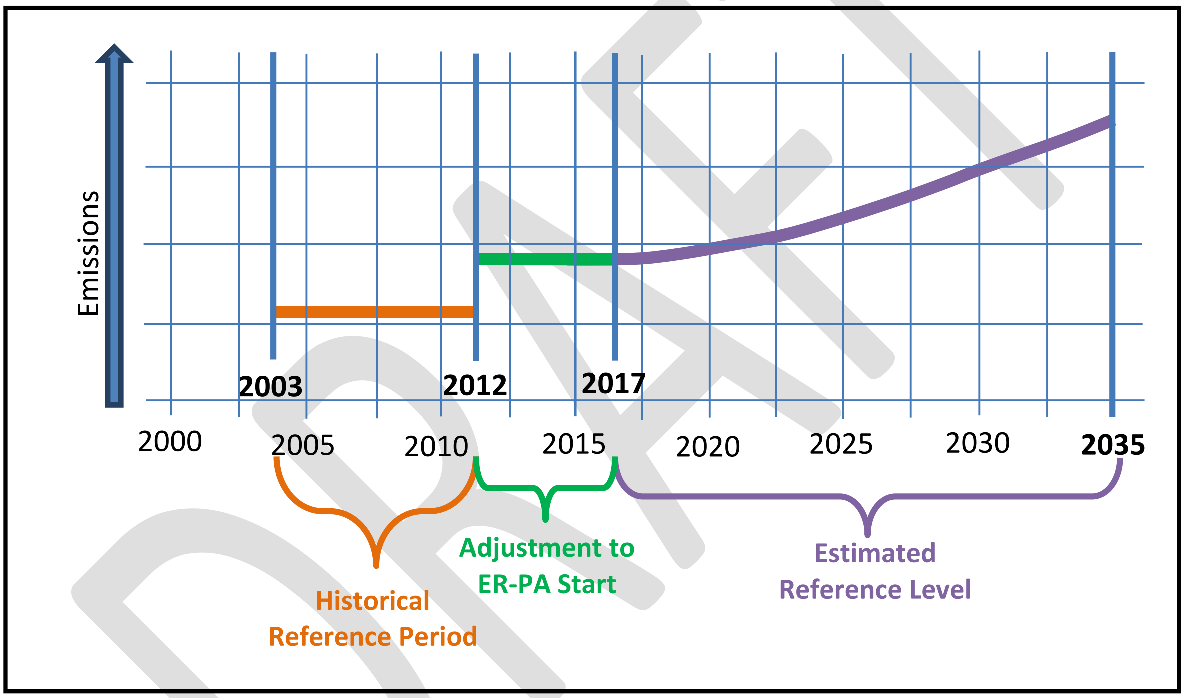


Figure 19. Adjustment to the Historical Reference level

There are four Management Strata that have been defined and geographically demarcated in the ER-Program Area. These four different Management Strata require a different method to properly quantify the adjustment over the ER-Program's lifetime. IPCC methods are used in order to quantify all these assessments. Table 44 provides a summary of how the historical emissions and adjustment have been established for Congo's ER-Program.

Table 44. Summary of Method for quantifying the adjustment

Management Strata	Future Deforestation / Degradation Dynamics (in the absence of the ER-Program)	Summary of Method for Adjustment quantification
Areas subject to Unplanned Deforestation and Degradation: • Protected Areas ***(PA)*** • Unattributed Areas ***(UA)***	The rate of DF and DG in the future as well as the location of DF and DG (which impacts emissions), will be impacted by changes in the population (growth, migrants, access to jobs) and access to forests (roads, rails)	The adjustment includes three components 1) Adjustment considering the rates observed in 2012-2015, 2) including the estimated impact of population increases and 3) infrastructure development in the projection of DF and DG rates. GHG emissions are estimated using the IPCC Stock-Change method as used for the annual average GHG emissions.
Areas subject to Unplanned Deforestation and Degradation: • Forest Concessions Production Areas ***(FCNonProdA)***	The rate of DF and DG in the future as well as the location of DF and DG (which impacts emissions), will be impacted by changes in the population (growth, migrants, access to jobs) and access to forests (roads, rails). In addition, inactive and new concessions that now have documented changes in ownership will become active.	The adjustment includes four components 1) Adjustment considering the rates observed in 2013-2015, 2) including the estimated impact of population increases 3) infrastructure development in the projection of DF and DG rates, and 4) Forestry Concessions non-production areas from Karagoua and Mimbelli-Ibenga now added to the area subject to unplanned deforestation and degradation. GHG emissions are estimated using the IPCC Stock-Change method as used for the annual average GHG emissions.
Areas subject to Planned and Unplanned Deforestation and Degradation: • Forest Concession Production Areas ***(FCProdA)***	The rate of DF and DG in the future as well as the location of DF and DG (which impacts emissions), will be impacted by two concessions (Karagoua and Mimbelli-Ibenga) that were inactive during the reference period, but now have newly assigned active concession holders; and access to forests (roads).	The adjustment includes three components 1) Adjustment considering the rates observed in 2012-2015 and 2) including the estimated impact of infrastructure development (road) in the projection of DF and DG rates and 3) Forestry Concessions production areas from Karagoua and Mimbelli-Ibenga now added to the area subject to planned deforestation and degradation. GHG emissions are estimated using the IPCC Stock-Change method as used for the annual average GHG emissions.
Designated Oil Palm Areas Plantations ***(PalmA)***	The rate of DF and DG in the future as well as the location of DF and DG (which impacts emissions), will be impacted by changes in the population (growth, migrants, access to jobs) and access to forests (roads, rails). In addition the maximum allowable forest	The adjustment includes four components 1) Adjustment considering the rates observed in 2012-2015, 2) including the estimated impact of population increases 3) infrastructure development in the projection of DF and DG rates, 4) Based on the legally

Management Strata	Future Deforestation / Degradation Dynamics (in the absence of the ER-Program)	Summary of Method for Adjustment quantification
	areas in concessions would be cleared and planted with oil palm over a schedule that reflects a typical clearing and harvesting schedule for similar concessions.	allowable clearing amount and suitable locations, deforestation is modelled in the future. GHG emissions are estimated using the IPCC Stock-Change method as used for the annual average GHG emissions.
Mining Concession Areas ***(MinA)***	For a portion of the mine concessions that are able to 1) find proven reserves and 2) raise the investment capital needed to start exploitation, these will clear areas using typical methods that are needed to extract minerals.	The DF areas for the standard mine practices in the country/region are used as a proxy for each type of mine in the ER-Program Area. Based on factors related to the company holding the concession, type of permit, type mineral, and other factors, the probability of these mines coming on line. Deforestation and degradation caused by mining concessions are assumed to take place in unattributed areas. GHG emissions are estimated using the IPCC Stock-Change method as used for the annual average GHG emissions.

Adjustment Based on Observations from 2012-2015

The first Adjustment is based on historical deforestation and forest degradation rates observed from 2012 to 2015 showing an acceleration of trends. This ensures that the adjustment in this period is as accurate as possible as it is based on actual data bridging the end of the reference period and the beginning of the ER-Program, during which the rate of both deforestation and degradation experienced an increase in comparison to 2003-2012. All management strata will be effected by this adjustment.

Table 45 provides the details of deforestation and degradation rates for each of the land-use change transitions. These rates reflect the period between 2012 and 2015, and are the base rates in which the adjustment is made for the impact on deforestation and degradation that population growth and improved roads and bridges will have on the ER-Program Area.

Table 45. DF and DG Rates by Land Use Change Category / Stratum and Management Strata 2012 to 2015

DF Transitions	FC NonProd Rates	PA Rates	UA Rates	Industrial Oil Palm – Unplanned Areas
DF in PRI to BAR	0.41%	0.06%	0.48%	0.08%
DF in DGS to BAR	1.42%	0.37%	1.69%	0.50%
DF in FWL to BAR	0.03%	0.01%	0.03%	0.03%
DF in DEC to BAR	0.29%	0.77%	0.39%	0.43%
DF in PRI to AGR	0.15%	0.01%	0.11%	0.07%

DF Transitions	FC NonProd Rates	PA Rates	UA Rates	Industrial Oil Palm – Unplanned Areas
DF in DGS to AGR	0.87%	0.21%	0.52%	1.44%
DF in FWL to AGR	0.01%	0.00%	0.00%	0.00%
DF in DEC to AGR	0.00%	0.00%	0.00%	0.00%
Total DF	0.25%	0.07%	0.14%	0.14%
DG Transitions				
DG in PRI	1.06%	0.29%	0.55%	0.97%
DG in FWL	0.02%	0.01%	0.01%	0.06%
DG in DEC	0.53%	0.23%	0.05%	0.06%
Total DG	0.32%	0.31%	0.60%	0.64%
RF Transitions				
RF from BAR	0.02%	0.00%	0.00%	0.00%
RF from AGR	0.00%	0.03%	0.00%	0.00%
Total RF	0.01%	0.005%	0.000%	0.00%

Adjustment based on changes in ER-Program circumstances - Population Increases

The projected GHG emissions in the unplanned areas are calculated using a proportional allotment of projected deforestation and degradation transitions in each Land Use change category or Stratum.

Population growth was used for the adjustment to historical rates to project future rates for areas subject to unplanned deforestation and degradation. Population pressure will significantly affect Forestry Concession non-production areas, protected areas, industrial oil palm areas, and unattributed areas.

The population growth adjustment was applied to the average historical deforestation and degradation rates from 2012 to 2015 to get a projected deforestation and degradation rates. The adjustment was based on the historical weighted average population growth in the departments of 2.86% per annum (Table 46).

A projection of land use transitions is provided in Annex 11.

Table 46. Population Growth[105]

	2007			2008			2009			2010			
	Total	Men	Women	Total	Men	Women	Total	Men	Women	Total	Men	Women	Annual Rate
Sangha	85,738	42,992	42,746	87,667	43,998	43,670	89,677	45,024	44,653	91,720	46,227	45,493	1.70%
Likouala	154,115	76,850	77,265	161,209	80,445	80,764	168,559	84,162	84,397	176,545	88,451	88,094	3.46%
												Weighted Rate	2.86%

Adjustment based on changes in ER-Program circumstances - Infrastructure Developments

The projected GHG emissions in the ER-Program Area due to development of infrastructure was quantified using a cost-distance frontier analysis, a common geospatial methodology that examines ‘relative distance’ from an object based on the weighted ‘cost’ to travel across a landscape based on ranked criteria (De Luca 2007; Beier et al 2009)[106]. Variables for the analysis included distance to major population centers, slope, land-use category, and the protected-area status of a pixel. All data layers were clipped to within five kilometers of the road that was improved from 2012-2015 (Figure 16), and hierarchically ranked from 0-10 based on the relative impact of that variable on traveling from the road. The resulting map provided a ‘cost-distance surface’, which measured traveling from the road based on the relative difficulty of crossing the terrain. Each pixel of the ‘cost distance surface’ was divided into quintiles to generate five separate distance ‘strata’ away from the road (Figure 20).

[105] Population: Source ANNUAIRE STATISTIQUE DU CONGO 2010, Centre National de la Statistique et des Etudes Economiques (CNSEE), Tableau 2.1.1 : Evolution des effectifs de la population résidante par département selon le sexe de 2007 à 2010

[106] De Luca, Giacomo Davide. (2007). Roads, Development, and Deforestation: a review. Development Research Group, World Bank; Beier, P., Majka, D.R. & Newell, S.L. (2009) Uncertainty analysis of least-cost modeling for designing wildlife linkages. *Ecological Applications*, 19,2067–2077.

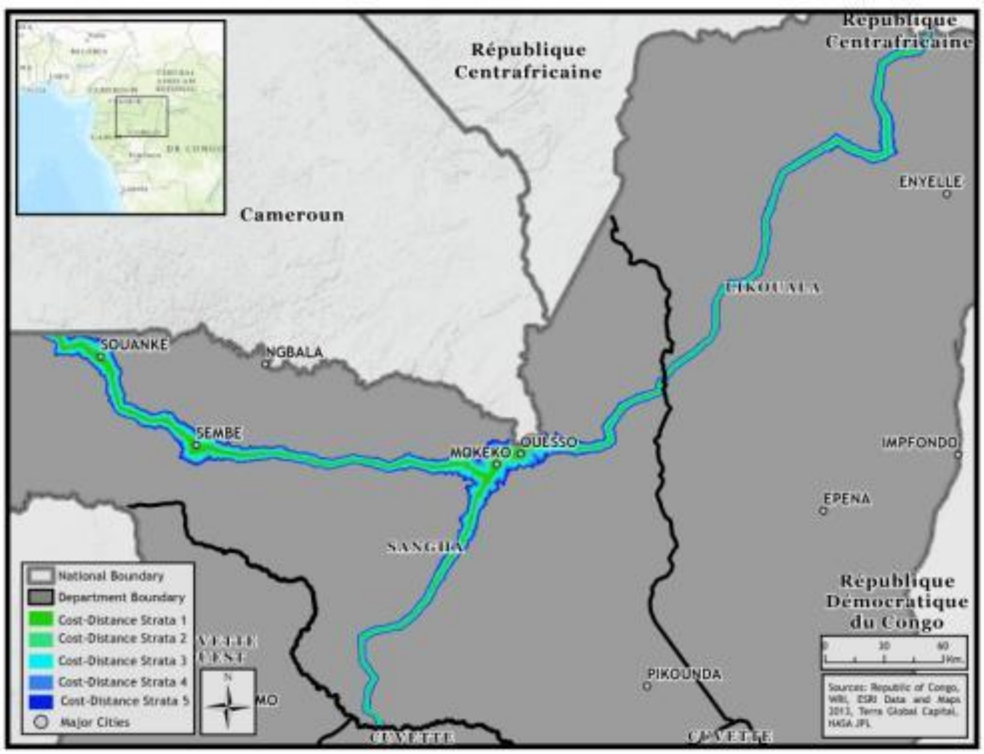


Figure 20: Cost-Distance Strata in the ER-Program Area

The amount of deforestation and degradation in each cost distance strata were assessed in the period of 2012-2015, during which a major road improvement project was conducted between Ouesso and Brazzaville (Table 47). These rates represent the adjusted level of deforestation that was experienced in each cost distance strata during the period of 2012-2015 following the expansion of the Ouesso-Brazzaville road.

Table 47: Deforestation Rates in Each Cost-Distance Strata (2012-2015) from Ouesso-Brazzaville Road Improvement

Cost-Distance Stata	% DG	% DF
1	1.85%	1.68%
2	1.60%	0.93%
3	1.82%	0.68%
4	1.71%	0.49%
5	1.25%	0.40%
Total (All Strata)	**1.66%**	**0.85%**

To project the ex-ante impacts of infrastructure development on the overall emission reductions in project crediting period, the historical rates from (Table 47) were applied to areas identified using a similar cost-distance analysis on two major road construction and improvement projects between Ouesso-Douala and Ouesso-Bangui. Both projects are currently ongoing construction and thus are not represented within either the historical reference period (2003-2012), or the period between 2012-2015. The historical rates from (Table 47) were multiplied by the total forest area in each cost-distance strata in the two ongoing road projects to obtain the total amount of deforestation and degradation that is projected to be generated by the additional road improvements during the project crediting period (Table 48 and Table 49); these were proportionally divided into each management strata.

Table 48: Total ex-ante deforestation within each cost-distance strata from the road improvements (ha)

Year	Strata 1	Strata 2	Strata 3	Strata 4	Strata 5	Total DF
1	11,634	7,577	5,663	4,196	3,340	**32,409**
2	11,438	7,506	5,624	4,175	3,326	**32,070**
3	11,246	7,436	5,586	4,155	3,313	**31,736**
4	11,058	7,366	5,548	4,135	3,300	**31,406**
5	10,872	7,298	5,510	4,114	3,287	**31,081**
6	10,689	7,229	5,473	4,094	3,274	**30,759**
7	10,510	7,162	5,435	4,074	3,261	**30,442**
8	10,333	7,095	5,398	4,054	3,248	**30,129**
9	10,160	7,029	5,362	4,034	3,235	**29,819**
10	9,989	6,963	5,325	4,014	3,222	**29,514**

Table 49: Total ex-ante degradation within each cost-distance strata from the road improvements (ha)

Year	Strata 1	Strata 2	Strata 3	Strata 4	Strata 5	Total DG
1	10,192	11,376	13,902	13,692	9,950	**59,112**
2	10,003	11,195	13,649	13,458	9,825	**58,130**
3	9,818	11,016	13,401	13,227	9,702	**57,164**
4	9,636	10,840	13,157	13,000	9,580	**56,214**
5	9,457	10,668	12,918	12,777	9,460	**55,280**
6	9,282	10,497	12,683	12,558	9,341	**54,362**
7	9,110	10,330	12,452	12,343	9,224	**53,460**
8	8,941	10,165	12,226	12,132	9,109	**52,572**
9	8,775	10,003	12,004	11,924	8,994	**51,700**
10	8,613	9,843	11,785	11,719	8,882	**50,842**

A projection of land use transitions is provided in Annex 11.

Adjustment for Double Accounting

The projection of estimates from non-delineated oil palm, could create a double accounting of emissions because these would likely occur in areas currently accounted for as unplanned deforestation and degradation. The correct method to avoid double counting would be to remove the emission associated with unplanned deforestation and degradation for account for the number of hectares of associated with the conversion of non-spatially delineated oil palm.

This area is ultimately insignificant for the purposes of emission quantification, since the forest area subject to unplanned deforestation and degradation is very large and the area subject to clearing due to non-delineated oil palm accounts for than less than 0.5% of this area.

Adjustment based on new Oil Palm Plantations (PalmA)

Areas for Conversion

Data for defining the areas of conversion was gathered from studies, business plans, government policies documents, interviews with oil palm companies and NGOs to provide evidence for the forward land-use change for industrial oil palm in the ER-Program Area as presented below.

Sangha

The area of forest undergoing a transition to oil palm during each year was estimated based on information provided by Eco-Oil and ATAMA during interviews conducted. Their business plans note issues with the first several years of operation, including with contractors hired to clear land to enable oil palm cultivation, but elaborate that these had been since resolved. According to the plans, ATAMA expects to move forward with establishing plantations under pressure from both the government and the Malaysian holding company. Based on interviews with the company, they are planning in the next five years to establish oil palm plantations of 20,000 hectares. However, as the company establishes a stronger operational platform in the ER-Program Area, this area for conversion could increase, constrained only by the total area of the concession and the ability to produce seedlings and process oil (they currently have an agreement to process at the existing Eco-Oil facility) ATAMA has stated that until it has established at least 20,000 hectares of industrial plantations it will have a limited focus on promoting smallholder outgrowers outside the concession areas. The ATAMA concession is 90% forest (60% excluding forested wetlands). Clearance of forested wetlands would not provide suitable conditions for oil palm plantations due to high soil saturation and poor soil quality.

The Eco-Oil concessions have a different set of conditions related to forest and land-use types. In the Eco-Oil concession, 76% of the concession is forested (56% excluding forested wetlands). 8,848 hectares, or 18% of the total concession area, is classified as existing 30 – 35 year old oil palm plantations. Statements from the CEO of EcoOil indicate that their goal is to plant 30,000 hectares across the three departments where they have concessions, of which 80% of their total concession area is in Sangha. This would likely include promoting smallholder outgrowers schemes, which is a priority for Eco-Oil but will take additional time to scale to higher levels. Meeting these business goals would require that an estimated 24,000 hectares of oil palm be established in the Sangha concession over the next three years, of which a third would be from the clearing and replanting of existing old plantations, and the remaining from the conversion of forests. The expected emissions from the conversion of existing oil palm plantations to newly planted ones is likely to be insignificant, given that the carbon stock would return to the baseline over a 25-30 year time scale.

The Sangha-PDSA shows three oil palm and agro industrial areas, mostly in the western region for future development. These specifically include a former plantation zone totaling 133,707 ha near Sembe whose boundaries are demarcated and identified in the analysis as the Sembe Oil and Macro Agricultural Zone. Additionally, an additional three areas for palm oil production, representing 189,500 hectares have been identified in the southernmost region of the department between the two rivers east near Epoma; these are not currently spatially explicit. Two additional areas of 133,250 and 67,000 hectares are estimated to be available still further west in the in the Souanke mining region.[107]

Overall in Sangha, the government has laid out an aggressive target for oil palm in Sangha's "*Plan de Développement du Secteur Agricole – PDSA département SANGHA*". It plans to expand oil palm plantations that could extend up to about 350,000 hectares by 2035 mostly with industrial plantations, but also with village extensions, particularly in agricultural series left to the villagers for their extensions.[108] The areas that are estimated for oil palm are based on the reaching 300,000 hectares in 20 years, of which approximately 50,000 is developed on non-forest land and 262,000 hectares is forest that is cleared and planted in oil palm.

Likouala

There are currently no delineated industrial oil palm concessions granted in Likouala. However, based on interviews with Eco-Oil, discussions are underway with the government on a 30,000 hectare concession in Likouala. The Likouala Agriculture Sector Development Plan provides details on the department's projected oil palm plantations, and concludes that due to the significant area of Forested Wetlands and the fact that the majority of the department is classified as permanent forest, which without reclassification cannot be allocated to oil palm, there is a maximum of approximately 15,000 hectares for oil palm including agricultural areas, and that the department of Likouala cannot be considered an important driver for the development of oil palm in Congo.

Establishing Future Deforestation Rates

The Area for Conversion from Forest to Oil palm in the ER-Program Area are determined for each of the four industrial oil palm areas 1) ATAMA, 2) Eco-Oil, 3) Sembe Oil and Macro Agricultural Zone and 4) Allocated but Non-Delineated Oil palm Areas.

Based on the following variables, the total forest area for conversion each year was calculated.

- First Year Clearing and Planting
- Target Area of Plantation [ha]
- Total Non-forest Area [ha]
- % Non-Forest Area Eligible for Planting
- Years to Reach Target

[107] PDSA (2012), Sangha, p. 42
[108] PDSA Sangha_SOFRECO-CERAPE_version définitive

Table 50. Inputs to Areas for Conversion for Oil palm Concessions

	ATAMA	EcoOil	Sembe	Total
Variable	2017	2017	2017	2017
First Year Clearing/Planting	1	4	3	10
Target Area of Plantation [ha]	12,888	24,000	50,000	93,112
Total Non-forest Area for Planting [ha]	11,853	11,296	5,189	30,368
% Non-Forest Area Eligible for Planting	30%	90%	50%	40%
Years to Reach Target	3,556	10,166	2,595	12,147
Forest Cleared and Planted per Year [ha]	9,332	13,834	47,406	80,965

Table 51 provides the annual hectares for conversion from forest to oil palm during over the next 10 years in the ER-Program Area.

Table 51. Hectares of Forest for Conversion to Palm Oil during ER-Program Life

Year	ATAMA	EcoOil	Sembe	Total Non-Delineated Oil palm Areas	Total Area (of DF) [ha]
2017	3,111	-	-	-	3,111
2018	3,111	-	-	-	6,221
2019	3,111	-	3,950	-	13,283
2020	-	2,306	3,950	-	19,539
2021	-	2,306	3,950	-	25,795
2022	-	2,306	3,950	-	32,051
2023	-	2,306	3,950	-	38,307
2024	-	2,306	3,950	-	44,563
2025	-	2,306	3,950	-	50,819
2026	-	-	3,950	3,855	58,625

To determine which forest classes will be converted (which impacts emissions), the method first removes the amount of the targeted plantation that can be established on non-forest areas, then allocates the remaining hectares to be converted proportionally across on the areas forest types excluding Forested Wetlands. For the Allocated but Non-Delineated Oil palm Areas, the amount allocated to each forest type for conversion is based on the Land Use category distribution across the three areas that are delineated.

It is important to note that these assumed plans are consistent with the adjustments proposed in the national REL/FRL submitted to the UNFCCC.

Carbon Stock Change per Area for Conversion

To calculate the emissions from the conversion from forest to oil palm plantation, the transitions provided in Table 52 are divided further into each of the three forest types and then multiplied by the carbon stock change per area converted.

The carbon stock change for each forest class to oil palm was applied to the transitions. To be conservative the carbon in oil palm is based on carbon over a 25 year oil palm rotation. The carbon numbers for estimated from the areas with existing old oil palm plantations and then divided in half to reflect the 25 year rotations average carbon stock.

Table 52. Emission Factors for Conversion from Forest to Industrial Oil palm

From	To	Emission Factor Aboveground [tCO2 ha-1]	Emission Factor Belowground [tCO2 ha-1]
PRI	PALMAVG	464.23	106.86
DGS	PALMAVG	267.96	61.99
DEC	PALMAVG	199.52	44.64

Table 53. Annual Emissions from Oil palm Conversion during the ER-Program Life [tCO2e]

Year	ATAMA	Eco-Oil	Sembe Macro	Non-delineated	Unplanned	Total
2017	1,247,139	-	-	-	858,620	2,105,759
2018	1,247,139	-	-	-	854,074	2,101,213
2019	1,247,139	-	2,127,830	-	846,149	4,221,118
2020	-	1,155,423	2,127,830	-	836,496	4,119,749
2021	-	1,155,423	2,127,830	-	826,881	4,110,134
2022	-	1,155,423	2,127,830	-	817,303	4,100,557
2023	-	1,155,423	2,127,830	-	807,762	4,091,016
2024	-	1,155,423	2,127,830	-	798,257	4,081,511
2025	-	1,155,423	2,127,830	-	788,788	4,072,041
2026	-	-	2,127,830	1,962,085	779,347	4,869,262
SUM	3,741,417	6,932,538	17,022,642	1,962,085	8,213,679	37,872,360

Adjustment based on new Mining Concessions

In order to set an appropriate, but conservative reference level for mining in the sector the following was expected:

- Congo Iron will clear their approved 1,550 ha in 2017
- Since the infrastructure costs for industrial iron mining is externally high, only one other iron mine was assumed to come online and start clearing forest over the next four years (2017-2021).
- The mining of other materials is less damaging then iron extraction, and future exploitative permits will allow for a clearance of half that of Congo Iron.
- Starting in 2020, other mines come online continuously, and it takes them about four years to clear the area for extractive mining.
- An additional 20% of the forest is expected to be cleared due to damage to existing forest, infrastructure developments, roads, and associated mining villages.

The impact of active mine clearing in the reference emission level was added to the 'unattributed area' management strata as an annual increase factor, based on the projected clearing from the existing Congo Iron mining concession and the assumption that over the course of the time period, at least one of the existing mines would come online.

Table 54. Projected Hectares Cleared from Mining

Year	Deforestation (ha cleared)
2017	20,667
2018	41,333
2019	-
2020	20,667
2021	-
2022	20,667
2023	-
2024	20,667
2025	-
2026	20,667

It is important to note that this assumption is conservative if compared with the assumed deforested area by Congo Iron (i.e. 27,000 ha) in the national REL/FRL submitted to the UNFCCC.

Proposed Upward Adjustment to the Average Annual Historical Emissions over the Reference Period

The upward adjustment is reflected as the difference between the future emissions based on the historical average annual and the emissions adjusted for key factors that will impact Congo's future deforestation and degradation rates.

Table 55. Average adjustment per period in the ER-Program's lifetime

Period	Reducing Emissions from Deforestation		Reducing Emissions from Forest Degradation		Total (tCO_2e/year)
	Planned deforestation	Unplanned Deforesttion	Planned degradation	Unplanned Degradation	
	tCO_2e/year	tCO_2e/year	tCO_2e/year	tCO_2e/year	
2017-2027	5,460,259	259,854	2,714,636	257,654	8,692,402

Disaggregating and attributing the above adjustment to each management stratum, the resulting adjustments are provided in Table 56. It provides the projected emissions using the methods described above as required to capture the dynamics of each Management Strata and their drivers of deforestation and degradation as well as the changing national circumstances. It also provides the adjustment to be made to the historical average presented in Chapter 8.3. This constitutes the adjustment for the fact that historical averages cannot capture the dynamics in the ER-Program Area.

Table 56. Adjustment to be applied to average annual emissions in the Reference Period per Management Stratum

Difference (Adjustment)						
YEAR	Forest Conc NonProd	Protected Areas	Unattributed Areas	Forest Conc Production	Industrial Oil palm	Total
	[tCO_2e]	[tCO_2e]	[tCO_2e]	[tCO_2e]	[tCO_2e]	[tCO_2e]
2017	1,832,486	225,529	(2,040,883)	5,282,784	1,309,344	6,609,260
2018	2,616,709	254,827	(2,020,575)	5,265,733	1,304,798	7,421,492
2019	1,322,671	285,006	(1,999,678)	5,248,936	3,424,703	8,281,637
2020	2,112,399	316,090	(1,978,177)	5,232,391	3,323,334	9,006,036
2021	1,517,679	348,105	(1,956,054)	5,216,091	3,313,719	8,439,540
2022	2,313,226	381,076	(1,933,291)	5,200,035	3,304,141	9,265,187
2023	1,724,487	415,031	(1,909,871)	5,184,217	3,294,600	8,708,465
2024	2,526,183	449,997	(1,885,774)	5,168,635	3,285,095	9,544,136
2025	1,943,765	486,002	(1,860,981)	5,153,283	3,275,626	8,997,695
2026	2,751,961	523,075	(1,835,472)	5,138,159	4,072,846	10,650,569
TOTAL	**20,661,565**	**3,684,738**	**(19,420,755)**	**52,090,264**	**29,908,204**	**86,924,017**

The adjustment that is modeled exceeds the 0.10% of carbon stock limit set by Indicator 13.4 of the Methodological Framework over the period of 2017-2026, noted below inTable 57.

Table 57. Estimation of total carbon stocks

LULC Types	AGB+BGB	Total Program [ha]	Total Carbon Stock
	[tCO2e]	Area (ha)	[tCO2e]
NoData (NOD)		611	-
Primary Forest (PRI)	703	4,772,720	3,356,670,060
Secondary/Degraded Forest (DGS)	467	292,604	136,643,025
Wetland/Swamp Forest (FWL)	476	6,493,430	3,092,190,240
Semi-deciduous Forest (DEC)	383	171,218	65,561,254
Bare/grassland Nonforest (BAR)	102	416,007	42,340,631
Other wetland Nonforest (OWL)	167	65,054	10,848,390
Agriculture/Tree Plantation (AGR)	223	116,769	26,094,928
Water (WTR)	-	43,324	-
Total		12,371,737	6,730,348,529

Table 58. Comparison with actual adjustment.

Compare to Carbon Fund Adjustment	Maximum adjustment	Actual Adjustment	Difference between Maximum and Actual Adjustment
CF Max Adj (% Total Carbon Stocks)	0.10%		
Average adjustment 2017-2026 [tCO2e]	67,303,485	86,924,017	1,962,053

As the adjustment that was modeled exceeds the maximum permitted by the Carbon Fund, the adjustment was “capped” at the 0.1% level (6,730,349 tCO2e annually) by reducing the emissions from each management strata to match the maximum allowable adjustment.

8.5 Estimated Reference Level

Reference Levels provide the benchmark against which future emission reductions and removals can be measured to assess progress in reducing forest-related emissions. Reference Levels can be understood as business as usual scenarios developed by taking into account historic emissions, and in this case adjusted for national and regional circumstances to improve reliability. For this ER-Program historical average emissions will be calculated based on deforestation rates the years of 2003 and 2012 and adjusted appropriately for future expected trends for the Departments of Sangha and Likouala.

Future rates of emissions in Likouala and Sangha are based on historic rates, but have been adjusted upwards based on specific national and regional circumstances. This proposed adjustment from historical data rates and trends are justified by transparent, reliable, and conservative data and evidence as described below. Without this adjustment, historical deforestation and degradation is not representative of future trends, and therefore inaccurately underestimating emissions associated with deforestation and degradation.

Table 59. ER-Program Reference Level

ER-PA term year t	Average annual historical emissions from deforestation and degradation over the Reference Period (tCO2-e/yr)	Adjustment without CF Max Cap (tCO2-e/yr)	Adjustment with CF Max Cap [tCO2e/yr]	Adjusted Reference level-Capped (tCO2-e/yr)
2017	10,854,290	6,609,260	6,609,260	17,463,550
2018	10,854,290	7,421,492	6,730,349	17,584,639
2019	10,854,290	8,281,637	6,730,349	17,584,639
2020	10,854,290	9,006,036	6,730,349	17,584,639
2021	10,854,290	8,439,540	6,730,349	17,584,639
2022	10,854,290	9,265,187	6,730,349	17,584,639
2023	10,854,290	8,708,465	6,730,349	17,584,639
2024	10,854,290	9,544,136	6,730,349	17,584,639
2025	10,854,290	8,997,695	6,730,349	17,584,639
2026	10,854,290	10,650,569	6,730,349	17,584,639

Disaggregating the RL per Management Stratum without the adjustment capped, the results would be as per the table below.

Table 60. Reference Emission Level for the ER-Program (2017 -2027) – without CF Max Cap Applied

REL Projected (without Capped - Adjustment)						
YEAR	Forest Conc NonProd	Protected Areas	Unattributed Areas	Forest Conc Production	Industrial Oil palm	Total
	[tCO_2e]	[tCO_2e]	[tCO_2e]	[tCO_2e]	[tCO_2e]	[tCO_2e]
2017	4,354,546	1,130,708	730,649	9,141,888	2,105,759	17,463,550
2018	5,138,770	1,160,005	750,957	9,124,837	2,101,213	18,275,783
2019	3,844,731	1,190,184	771,854	9,108,041	4,221,118	19,135,927
2020	4,634,460	1,221,268	793,355	9,091,495	4,119,749	19,860,327
2021	4,039,739	1,253,283	815,478	9,075,196	4,110,134	19,293,830
2022	4,835,286	1,286,255	838,241	9,059,139	4,100,557	20,119,477
2023	4,246,547	1,320,210	861,661	9,043,322	4,091,016	19,562,755
2024	5,048,243	1,355,175	885,758	9,027,739	4,081,511	20,398,426
2025	4,465,826	1,391,180	910,551	9,012,388	4,072,041	19,851,986
2026	5,274,021	1,428,253	936,060	8,997,264	4,869,262	21,504,859
SUM	**45,882,168**	**12,736,522**	**8,294,563**	**90,681,308**	**37,872,360**	**195,466,921**

With the adjustment cap applied, the reference level is as noted below in Table 61. Note that the as the RL is capped at a maximum of 17,463,550 tCO_2e, the difference between the RL with and without the cap becomes more significant for each subsequent year, noted in Table 62.

Table 61: Reference Emission Level for the ER-Program (2017-2027) - with CF Max Cap Applied

REL Projected (with Capped Adjustment)						
YEAR	Forest Conc NonProd	Protected Areas	Unattributed Areas	Forest Conc Production	Industrial Palm	Total
	[tCO2e]	[tCO2e]	[tCO2e]	[tCO2e]	[tCO2e]	[tCO2e]
2017	4,354,546	1,130,708	730,649	9,141,888	2,105,759	17,463,550
2018	4,944,434	1,116,137	722,558	8,779,759	2,021,751	17,584,639
2019	3,533,051	1,093,700	709,282	8,369,681	3,878,926	17,584,639
2020	4,103,422	1,081,330	702,448	8,049,749	3,647,689	17,584,639
2021	3,681,869	1,142,258	743,237	8,271,247	3,746,028	17,584,639
2022	4,226,092	1,124,200	732,631	7,917,785	3,583,930	17,584,639
2023	3,817,151	1,186,715	774,533	8,128,893	3,677,347	17,584,639
2024	4,351,881	1,168,241	763,576	7,782,440	3,518,501	17,584,639
2025	3,955,772	1,232,290	806,555	7,983,059	3,606,963	17,584,639
2026	4,312,595	1,167,890	765,421	7,357,111	3,981,621	17,584,639
SUM	41,280,814	11,443,468	7,450,889	81,781,614	33,768,515	175,725,300

Table 62: Difference between Capped and Uncapped Adjusted RL by Year (2017-2026)

YEAR	Difference between Capped and Uncapped Adjusted RL
	[tCO2e]
2017	-
2018	(691,144)
2019	(1,551,288)
2020	(2,275,688)
2021	(1,709,191)
2022	(2,534,838)
2023	(1,978,116)
2024	(2,813,787)
2025	(2,267,347)
2026	(3,920,220)
Total	**(19,741,620)**

8.6 Relationship between the Reference Level and Any Intended Submission of a FREL/FRL to the UNFCCC

Completeness and Accuracy Under the UNFCCC and the CF MF

It is important to note that UNFCCC decisions and CF MF differ from the point of view of the requirements with regard to completeness and accuracy of Forest Reference Emission Level or Forest Reference Level (FRL). On the one hand, under the UNFCCC it is agreed that countries may follow a step-wise approach when developing their FRLs whereby they are allowed to improve the accuracy and completeness of their FRL with time. On the other hand, the CF MF requires to reach a high degree of completeness and accuracy at the very beginning, requiring to account for degradation if significant, account for carbon pools that are significant, and achieve IPCC Tier 2 in emission factors (even in degradation, in order to avoid high discount factors). These two different paces of achieving completeness and accuracy will cause that full consistency between the national FRL and the ER-Program's RL will not be possible at the beginning. This is important to take into consideration when comparing the two levels.

Table 63. Requirements under the UNFCCC and the CF MF regarding completeness and accuracy

UNFCCC	CF MF
Decision 12/CP.17, para 10 "*Agrees that a step-wise approach to national forest reference emission level and/or forest reference level development may be useful, enabling Parties to improve the forest reference emission level and/or forest reference level by incorporating better data, improved methodologies and, where appropriate, additional pools…*"	• Indicator 3.3: "*Emissions from forest degradation are accounted for where such emissions are more than 10% of total forest related emissions in the Accounting Area*" • Indicator 4.1: "*The ER-Program accounts for all Carbon Pools and greenhouse gases that are significant within the Accounting Area, both for Reference Level setting and Measurement, Monitoring and reporting (MMR)*". • Indicator 14.3: "*IPCC Tier 2 or higher methods are used to establish emission factors, and the uncertainty for each emission factor is documented*". • Criterion 22: "*For estimated emissions reductions associated with degradation, the same conservativeness factors may be applied if spatially explicit activity data (IPCC Approach 3) and high quality emission factors (IPCC Tier 2) are used. Otherwise, for proxy based approaches, apply a general conservativeness factor of 15% for forest degradation Emission Reductions*".

National FRL and how it has been Informed by the ER-Program's Reference Level

The Republic of the Congo is one of the first countries of Africa and the first country in francophone Africa to have submitted a Forest Reference Emission Level or Forest Reference Level (FRL) to the UNFCCC. As indicated above, following the step-wise approach recognized under the UNFCCC, the Republic of Congo submitted a first version of the FRL to the UNFCCC on January 2016[109], which relied on a combination of existing data and new data produced as part of the UN-REDD national program. It is important to note that at the time of the ER-PD the FRL had not completed the technical assessment process, which will require modifications and will provide comments on areas for improvement.

At the time of the inception of the national FRL in March 2015,[110] the main elements of the FRL were based on the FRL provided in the ER-PIN presented to the Carbon Fund in June 2014.[111] As such, two REDD+ activities were selected (i.e. Reducing Emissions from Deforestation; Reducing Emissions from Forest Degradation) and these were stratified in planned and unplanned. Therefore, the National FRL was informed at very early stages by the ER-Program's FRL.

This initial version was revised by using improved data on the forest concessions obtained by CN-REDD directly from concessionaires, and mainly through first estimates of carbon densities from the National Forest Inventory and the 2000-2012 Forest Cover change map produced as part of the UN-REDD national program.[112] The proposed adjustment for planned deforestation was also revised based on the improved data gathered in the development of the ER-Program's FRL, which is the main contribution of the FRL to the development of the national FRL.

Following the step-wise approach it is expected that several components of the national FRL will be improved in the coming months based on the lessons learned at the ER program level, which will serve to align both the ER program level and the national level[113] namely:

- Mapping of degradation: The ER-Program RL has shown that it would be possible to map forest degradation, and this has shown elsewhere. It is expected that the same approach used in the Accounting Area will be used for mapping degradation at a national level. This is financed with FCPF readiness funding and it is implemented by CNIAF and the support of FAO/GeoEcoMap. These new maps will serve to align the reference period of both levels and will serve to align the approach for estimating the adjustment in some cases. More information on this is provided in Section 8.1;

[109] http://redd.unfccc.int/files/2016_submission_frel_republicofcongo.pdf

[110] CN-REDD/ Congo, 2015. Draft excel spreadsheet with initial calculations of the FRL. Version June 2015

[111] https://www.forestcarbonpartnership.org/sites/fcp/files/2014/september/Republic%20of%20Congo%20ER-PIN%20final%20version%2011%20%28Clean%29_English_10%20July%202014.pdf

[112] CN-REDD/ Congo, 2015. Approche méthodologique établie pour déterminer le Niveau des Emissions de Référence pour les Forets (NERF) du processus REDD+ en République du Congo. Brazzaville, 36 p.

[113] CN-REDD. 2016. Budget for activities in fiscal year 2017

- Improvement of emission factors: It will be analyzed if emission factors could be improved using a similar approach as the ER-Program's level. With FCPF readiness funding a biomass map for the whole country will be produced by GeoEcoMap/CNIAF and the support of FAO. This will serve to derive more precise estimates of emission factors at the national level ;
- Other improvements NFI estimates: The ER program RL has produced its EF based on the NFI data. One of the improvements made has been the inclusion of heights in the estimation of biomass and the inclusion of biomass below 20 cm (more information in Chapter 8.3). With FCPF readiness funding a biomass map for the whole country will be produced by GeoEcoMap/CNIAF and the support of FAO. The NFI data will be reprocessed in order to include these two improvements.

ER-Program's FRL and how it has been Informed by the National RL

The ER-Program's FRL was prepared in order to comply with the requirements of the CF MF with regard to completeness and accuracy. The analysis of the existing products at the national level resulted in two major decisions taken at an ER-Program's level which resulted in a major change from the sources used to set the national FRL:

- Activity Data: The CNIAF 2000-2012 forest cover change map did not include a degradation class so it was not possible to achieve an IPCC Approach 3 for degradation which would translate in important uncertainty discounts. Moreover, the existing fuelwood harvesting information used for the national REL/FRL was incomplete, so using it would underestimate GHG emissions. Moreover, the national maps partially used global data for 2011 and 2012, which could be improved with the used of local maps as recommended by the GFOI MGD. As a result, it was decided to produce Land Cover maps which included a degradation class.
- Emission Factor: The NFI raw data for the sampling units located in the ER-Program area were available. However, the few number of sampling units and the lack of representation of various land use categories and strata, especially degraded forests, would have resulted in very high uncertainties on the one hand, and limitations to estimate degradation on the other. Hence, it was decided to complete these data with other data as described in Chapter 8.3.

Although the ER-Program's FRL informed the national FRL at its inception and it its preparation phase, due to the advanced stage of development of the National FRL, the information has been predominant in the opposite direction in the short term. In January 2016[114] and February 2016[115] various consultations between CN-REDD, FAO, FCPF and the consultants of the ER-Program took

[114] FCPF. 2016. Meeting minutes on the meeting for ensuring consistency between the national and sub-national FRLs

[115] CN-REDD. 2016. Meeting minutes of the ER-PD validation workshop held in the Brazzaville, 1-3 February 2016

place in order to ensure consistency between the national and the ER-Program's level. The outcome of these consultations was an improvement on the consistency of the ER-Program's FRL by making some modifications, namely:

- REDD+ Activities: Enhancement of carbon stocks was removed from the ER-Program's FRL;
- Land Cover data: The national 2000-2012 forest cover change map had a MMU of 0.5 ha for deforestation, meaning that deforestation is defined as a transition from forest to non-forest larger than 0.5 ha. Although the ER-Program's land cover maps are not aligned to these as it is used a post-classification method vs. a direct classification used at a national level, the ER-Program's maps were modified in order to ensure a 0.5 ha MMU in the forest cover maps.

Although some modifications were made to the ER-Program's level in order to ensure its alignment to the national FRL, this was done where it did not affect the accuracy and precision of the estimates. However, as indicated above the ER-Program level has provided various lessons learned which are expected to be used in the improvement of the national FRL.

Consistency Between the National FRL and the ER-Program's FRL

Although the CF MF does not require consistency between the national FRL and the ER-Program's FRL, it is important to identify the areas of consistency and the areas of deviation in order to improve these in the future. The following table gives an overview of the consistency in the main elements of the two FRLs.

Table 64. Differences between Regional FRL and National FRL.

	Regional and national levels are consistent
	The regional level is more complete or accurate or conservative than the national level
	The regional level is not consistent with the national level

FRL Elements	ER-Program FRL	National FRL	Comments
Scope			
REDD+ Activities	• Reducing emissions from deforestation ○ Planned Degradation ○ Unplanned Degradation • Reducing emissions from degradation ○ Planned Degradation ○ Unplanned Degradation	• Reducing emissions from deforestation ○ Planned Degradation ○ Unplanned Degradation • Reducing emissions from degradation ○ Planned Degradation ○ Unplanned Degradation	-

FRL Elements	ER-Program FRL	National FRL	Comments
Carbon pools	• Aboveground Biomass • Belowground Biomass	• Aboveground Biomass • Belowground Biomass • Dead wood (deforestation)	Dead wood pool was excluded in the ER-Program FRL as it was shown to be insignificant.
Gas	CO2	CO2	-
Reference Period	2003-2012	2000-2012	The end date of both reference periods is consistent, but the start date of the ER-Program's FRL is set to 2003 in order to be consistent with the CF MF which requires about 10 years prior to the end date. It is expected that this aspect will be aligned in the coming months.
Forest Definition	• the minimum area of 0.5 hectare; • The minimum height of 3 meters; • tree crown cover Minimum rate of 30%	• the minimum area of 0.5 hectare; • The minimum height of 3 meters; • tree crown cover Minimum rate of 30%	-
Forest Types	Primary, Secondary/Degraded, Semi-deciduous open forest, swamp forest	Primary, Secondary, and swamp forest	The ER-Program includes the degraded forest class and the natural open forest
Methodological approach			
Method definition of NR	• Historical emissions + adjustment	• Historical emissions + adjustment	-
REDD + activities that are adjusted	• Unplanned Deforestation • Planned Deforestation • Unplanned Degradation • Planned degradation	• Planned Deforestation • Planned degradation	Due to the existence of better data on co-variables that could explain the increase in unplanned deforestation and degradation, these two elements are also adjusted in the ER-Program's level.
Activity Data			

FRL Elements	ER-Program FRL	National FRL	Comments
Representation land - historic period	• Unplanned Deforestation: Approach 3 • Planned Deforestation: Approach 3 (2 in adjustment) • Unplanned degradation: Approach 3 • Planned Degradation: Approach 3	• Unplanned Deforestation: Approach 3 • Planned Deforestation: Approach 2 • Unplanned degradation: Approach 2 • Planned Degradation: Approach 3	
Emission Factor			
Net or gross factor? (NET = Density initial use carbon - carbon density final use)	• Unplanned Deforestation: Net • Planned Deforestation: Net • Unplanned degradation: Net • Planned Degradation: Net	• Unplanned Deforestation: Gross • Planned Deforestation: Gross • Unplanned Degradation: Net • Planned Degradation: Net	
IPCC Tier as defined under CF MF	• unplanned Deforestation: Tier 2 • Planned Deforestation: Tier 2 • Unplanned degradation: Tier 2 • Planned Degradation: Tier 2	• unplanned Deforestation: Tier 2 • Planned Deforestation: Tier 2 • unplanned degradation: Tier 2 • Planned Degradation: Tier 2	

Comparison of National FRL and ER-Program's FRL

The above differences with regard to the consistency will have opposite effects as the increased completeness of the ER-Program's FRL will lead to higher GHG emissions, while the increased conservativeness will lead to reduced GHG emissions.

Table 65. Comparison of estimates of national FRL and ER-Program FRL for Sangha and Likouala. The attribution to Sangha and Likouala of national GHG emissions has been done by the consultants as the national RL does not report per province.

Component	National FRL	ER-Program
GHG emissions in the Reference Period (2000/2003-2012) (tCO2e/year)	**10,109,147**	**10,854,290**
Unplanned Deforestation (tCO2e/year)	2,437,198	4,644,703
Planned Deforestation (tCO2e/year)	0	2,137,775
Unplanned Degradation (tCO2e/year)	19,991	2,350,483
Planned Degradation (tCO2e/year)	7,651,959	1,721,330
Adjustment (2015/2017-2024) (tCO2e/year)	**15,365,129**	**6,760,349**
Unplanned Deforestation (tCO2e/year)	0	259,853

Component	National FRL	ER-Program
Planned Deforestation (tCO2e/year)	12,547,892	5,460,259
Unplanned Degradation (tCO2e/year)	0	257,654
Planned Degradation (tCO2e/year)	2,817,236	2,714,636
Total (tCO2e/year)	**25,474,276**	**17,614,639**

Although the final estimate of the RL at the national and regional level are very similar for the period 2015-2024, the average historical emissions in the reference period and the adjustment are different. The main causes for this:

- Average historical emissions in the Reference Period:
    - Deforestation: a) The national level considers a Reference Period from 2000-2012, including three additional years (with respect to the Reference Period used in the ER-Program) with lower deforestation rate which will reduce the average: b) the national level has sourced the Activity Data from a national forest change map in which losses with an area lower than 0.5 ha were not considered, while the post-classification change maps produced at a regional level detects changes at a spatial scale of less than 0.5 ha still respecting the forest definition as the individual maps have a MMU of about 0.5 ha. This is relevant since a significant proportion of deforestation occur due to small-scale conversions in slash-and-burn systems in the Congo basin[116] and in this case this suggest that there are more than 25% of losses than the national map which happens at spatial scales < 0.5 ha.; c) the emission factors at the regional level are regional specific so they are higher than those at the national level which average relatively intact forests in the north of Congo with heavily degraded forests in South Congo[117].
    - Degradation: The national estimates are based on a proxy approach using statistics of firewood consumption and timber production. However, not all degradation occurs because of this reason and initial stages of slash-and-burn agriculture does cause degradation, so the method used at the national level would underestimate degradation.

- Adjustment: The adjustment at the national level is higher, despite the fact that the regional level includes the adjustment for unplanned deforestation and degradation. The reason is that the regional level applies more accurate data (i.e. interviews with concessionaires, etc.).

[116] Tyukavina et al. 2013. National-scale estimation of gross forest aboveground carbon loss: a case study of the Democratic Republic of the Congo

[117] Karsenty et al. (2016). Do Forest Management Plans in Congo Lead to Greater Deforestation?. http://dpfac.cirad.fr/sites/default/files/documents/Response%20to%20Brandt%20FINAL%20March%2017.pdf

9 APPROACH FOR MEASUREMENT, MONITORING AND REPORTING

9.1 Measurement, Monitoring and Reporting Approach for Estimating Emissions Occurring Under the ER-Program within the Accounting Area

Overview of Forest Monitoring system (FMS)

Overall structure of FMS

The Forest Monitoring System (FMS) of the ER-Program will be fully integrated in the existing National Forest Monitoring System (NFMS), so it will rely on existing systems and organizational structures, yet the specific methods for monitoring certain parameters may change. This NFMS was established in accordance to the decision 4/C.15 of Copenhagen and it has two main functions: a monitoring function and a Measurement, Verification and Verification (MRV) function.

The **monitoring function** enables the legal management of forests through: a) the rights of use of the LCIPs; b) the legal exploitation on the base of legal authorizations (annual harvesting permits and authorizations). The monitoring is done in the base of:

- Legal texts (laws, decrees, "arrêtés" or directives) on the sustainable management of forests ;
- Forest management instruments (forest management series instruments, instruments of management of protected areas, and other instruments);
- REDD+ Principles, Criteria and Indicators, adapted to national circumstances ;
- Satellite imagery;
- IT databases (WEB portal) ;

This monitoring function will also be used for the monitoring of legal compliance, safeguards and other aspects of the ER-Program, but these functions will not be covered in the present chapter as the quantification of GHG emissions belongs to the MRV function, which is explained below.

The **MRV function** of the NFMS allows:

- Estimation of (i) GHG emissions of anthropogenic origin and (ii) carbon sequestration;
- Measurement of (i) the changes in forest areas and (ii) the changes in carbon stocks associated with the REDD+ activities;
- Reporting GHG mitigation performance to the UNFCCC ;
- Storing the data and make them available to eventual verifications.

As indicated above, the FMS will rely on these MRV functions of the NFMS for estimating GHG emissions. However, it will only have the specific reporting on the ER-Program.

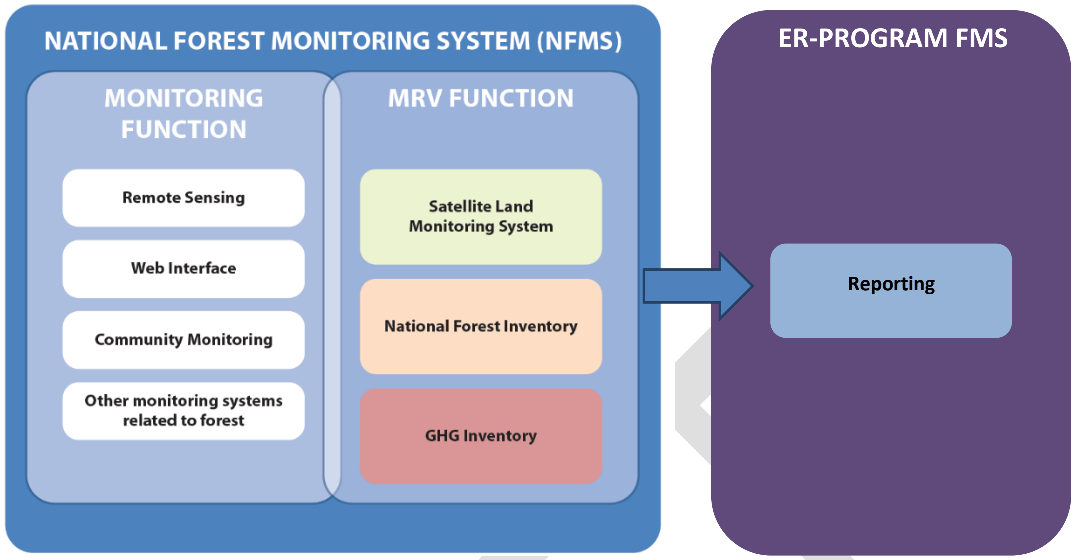


Figure 21. Overall structure of the NFMS

Principles of the FMS design

The emissions by sources and removals by sinks measured, monitored and reported by the FMS will be consistent with those reported by the RL as required by Criterion 14 of the methodological framework. This will be done through four main principles:

- **Consistent scope**: The same scope in terms of geographical area, REDD+ activities, carbon pools and GHG gases will be kept with regard to the RL (Indicator 14.1 of the CF MF);
- **Activity Data (AD)**: The data on the magnitude of human activity resulting in emissions or removals taking place during a given period of time, will be measured and monitored following the same methods used for the defining this in the RL (Indicator 14.2 of the CF MF);
- **Emission Factors (EF) and default values:** The same EFs and default values used for the RL will be used in the estimation of GHG emissions by sources and removals by sinks (Indicator 14.3 of the CF MF);
- **GHG accounting:** The same equations, calculation procedures and QA/QC as used for the RL will be used (Indicator 14.1 of the CF MF).

This would mean that the only parameters being modified with regard to the RL would be the AD. Considering the methods described in Chapter 8, this would mean that only one parameter would be measured:

Table 66. Parameters Measured for MRV

Activity Data		REDD+ activity	Geographical boundaries
ΔA_j	Area of Land Use subcategory / stratum converted to another Land Use subcategory / stratum (transition denoted by j) in a certain year which would be estimated through remote sensing techniques.	• Reducing emissions from deforestation • Reducing emissions from degradation	All the Accounting Area

Measurement, Monitoring and Reporting Process

The general measurement, monitoring and reporting process consists in all operations of data collection of EO data, QA operations, and final reporting. A general overview of the FMS process is provided in the following simplified process diagram:

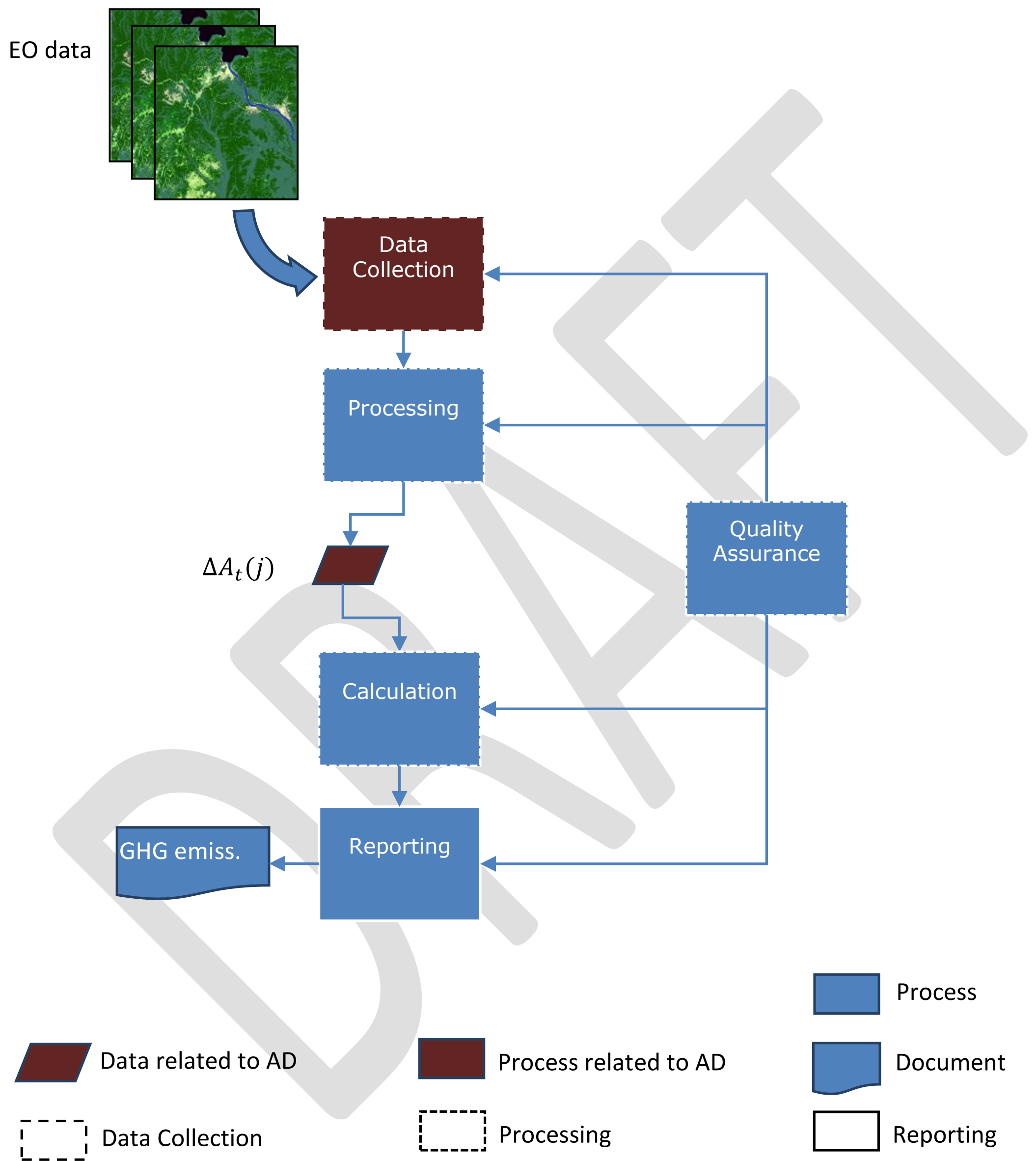


Figure 22. Process diagram of the FMS

Each of the operations is described in the following sections.

Data Collection and Processing

Data collection and processing will be done in order to produce Activity Data which will be in the form of: area of conversion of land use subcategories / strata (ΔA_j). The main specifications for data collection and processing are provided in the following table.

Table 67. Main specifications for data collection and processing, MRV

<table>
<tr><td>Parameter:</td><td>ΔA_j</td></tr>
<tr><td>Description:</td><td>Area of Land Use subcategory / stratum converted to another Land Use subcategory / stratum (transition denoted by j) in a certain year</td></tr>
<tr><td>Data unit:</td><td>ha year^{-1}</td></tr>
<tr><td>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 ER-PA</td><td>The source of these data is the LULC change map produced through the combination of LULC maps for the beginning and end of the different periods if a post-classification method is applied. For the first monitoring event, the 2015 LULC map will be used as the benchmark map.

The AD must have the following specifications as indicated in Chapter 8.3:
<table>
<tr><th>Specification</th><th>Requirement</th></tr>
<tr><td>Approach</td><td>Approach 3 - tracking land-use changes using spatial explicit data</td></tr>
<tr><td>Wall-to-wall vs. sampling</td><td>Wall-to-Wall</td></tr>
<tr><td>Type of sensor</td><td>Landsat 8 or similar sensor</td></tr>
<tr><td>Minimum Mapping Unit (MMU) ≈ spatial resolution</td><td>0.08 ha (1 LANDSAT pixel)</td></tr>
<tr><td>Classification system</td><td>The following classification system of the maps:
• Primary Forest (PRI)
• Degraded and Secondary Forests (DGS)
• Wetland/Swamp Forests (FWL)
• Natural open Forests (DEC)
• Bare and Grassland Non-forests (BAR)
• Other Wetland Nonforests (OWL)
• Agriculture and Tree Plantations (AGR)</td></tr>
<tr><td>Positional accuracy</td><td>1 pixel</td></tr>
<tr><td>Epochs of mapping/interpretation and Benchmark year</td><td>Benchmark map in 2015 or 2017 and the year of monitoring.</td></tr>
<tr><td>Thematic accuracy</td><td>Accuracy of LU change maps and change detection. Estimation of uncertainties of the AD at the 90% confidence level using estimates derived from change detection</td></tr>
</table></td></tr>
</table>

	accuracy assessment. Follow Olofsson et al. (2014)[118] **Methods**: The LULC maps will be produced following the same methods as described in Chapter 8above and following the Standard Operating Procedures (SOPs) that will be defined (see below).
Frequency of monitoring/recording:	At least every two years at each monitoring event. This is necessary to report in the biennial reports to the UNFCCC and is in line with the requirements of the FCPF CF MF which indicates that reporting should be at least twice in the ER-PA term.
Monitoring equipment:	Monitoring equipment will be remote sensors.
Quality Assurance/Quality Control procedures to be applied:	• QA/QC procedures must be in place following the guidance provided in 2006 IPCC GL – Volume 1 – Chapter 6. As part of the QA/QC procedures, at least the following must be in place: • SOPs: A description of the pre-processing, processing and post-processing of satellite imagery in order to produce Land Cover maps is provided in Chapter 8.3. However, these are not detailed SOPs that will ensure internal and external consistency, hence, SOPs will be prepared by the consultant who produced the maps, activities that are budged by CN-REDD and will be conducted in 2016. • Training: Training procedures in order to ensure that the staff that will collect the data or apply the procedures is dully trained. In order to ensure a correct transfer of know-how, it is planned that the consultant who produced the maps will provide training to trainers of the CNIAF team (2 workshops and one technician invited to work 6 months with the team) in order to ensure a correct implementation of SOPs. These activities are budgeted by CN-REDD and will be conducted in 2016; • QA: Staff not involved directly the remote sensing data processing or data collection must check that the SOPs have been correctly implemented, by confirming that the procedures have been followed and by checking a representative number of units in order to confirm that they have been produced following the methods defined in the SOP. SOPs will include QA procedures in order to ensure this check in every operation of the processing chain. These will be prepared as part of the activities above in 2016; • Verification: Verification will consists in this case in an Accuracy Assessment which will be conducted using the same methods used for conducting the accuracy Assessment of period 2003-2012.

[118] Pontus Olofsson, Giles M. Foody, Martin Herold, Stephen V. Stehman, Curtis E. Woodcock, Michael A. Wulder, Good practices for estimating area and assessing accuracy of land change, Remote Sensing of Environment, Volume 148, 25 May 2014, Pages 42-57, ISSN 0034-4257, http://dx.doi.org/10.1016/j.rse.2014.02.015.

Identification of sources of uncertainty for this parameter	A description of sources of uncertainty in area estimates through remote sensing techniques may be found GOFC-GOLD REDD Sourcebook[119] or in GFOI (2014).[120]
Process for managing and reducing uncertainty associated with this parameter	Systematic errors will be reduced through the implementation of QA/QC procedures as described in the previous point. Random errors are reduced as far as practical using the best sampling intensity of training data and the most spatially accurate image resolution. Both types of errors will be assessed through a formal accuracy assessment which will comply with the guidance provided in Olofsson et al. (2014).
Any comment:	At the time of this report, it is not envisaged that communities will be involved in the monitoring of this parameter as data collection will be done through Earth Observation systems.

Calculation

In order to execute this operation of the process, the same IPCC methods and equations described in Chapter 8 will be used to estimate GHG emissions in the monitoring period.

Once changes in carbon stocks under the ER-Program are estimated for each activity i ($\Delta \boldsymbol{C}_{LU,i}$), it would be necessary to determine the GHG emission reductions that would be generated by the program. The following equations would be applied:

$$\boldsymbol{ER}_{LU} = \sum_{i}\sum_{t}^{T}(\boldsymbol{RL}_{i,t} - \Delta \boldsymbol{C}_{LU,i} \times \boldsymbol{T}) \qquad \textbf{EQ 7}$$

Where:

$\boldsymbol{ER}_{LU}$	=	GHG emission reductions; tCO_2 year^{-1}.
$\boldsymbol{RL}_{i,t}$	=	GHG emissions of the RL in REDD+ activity i in year t; tCO_2 year^{-1}.
$\boldsymbol{T}$	=	Years in monitoring period, year

The uncertainty of the GHG emissions reductions would have to be estimated through Montecarlo methods as described in the 2006 IPCC GL – Volume 1 – Chapter 3. The final uncertainty reported under the FCPF CF MF for deforestation and degradation,[121][122] will serve to define the conservativeness factor to be applied in order to define the amount set aside in the buffer reserve.

[119] The November 2014 version of GOFC-GOLD sourcebook (used here) can be downloaded from http://www.gofcgold.wur.nl/redd/sourcebook/GOFC-GOLD_Sourcebook.pdf

[120] GFOI (2013) Integrating remote-sensing and ground-based observations for estimation of emissions and removals of greenhouse gases in forests: Methods and Guidance from the Global Forest Observations Initiative: Pub: Group on Earth Observations, Geneva, Switzerland, 2014.

[121]

[122] Only if spatially explicit activity data (IPCC Approach 3) and high-quality emission factors (IPCC Tier 2) are used, i.e. Approach 3. Criterion 22 of the FCPF CF MF.

Table 68. Conservativeness factors to be applied to Emission Reductions as defined by the FCPF CF MF

Aggregate Uncertainty of Emissions Reductions	Conservativeness Factor
= 15%	0%
> 15% and = 30%	4%
> 30 and = 60%	8%
> 60 and =100%	12%
> 100%	15%

$$\boldsymbol{ER_{LU}} = \sum_{i}\sum_{t}^{T}(\boldsymbol{RL_{i,t}} - \Delta\boldsymbol{C_{LU,i}} \times \boldsymbol{T}) \times (\mathbf{100} - \boldsymbol{CF_i})/\mathbf{100} \qquad \textbf{EQ 8}$$

Where:

$\boldsymbol{CF_i}$ = Conservativeness factor for REDD+ activity i ; percentage.

Reporting

Once the emission reductions are calculated, these will be reported providing all information in a transparent way demonstrating that the principles set in Chapter 9.1 have been followed. The following information will be reported:

- Reporting of parameters measured and monitored;
- Total emission reductions;
- Emission reductions disaggregated:
    - REDD+ activity and sub-activity
    - Per Management Stratum
    - Per concessionaire and participant in the benefit sharing mechanism.

In line with the national Forest Reference Emission Level submitted to the UNFCCC, ER-Program reports on emissions from both planned and unplanned degradation. Planned deforestation is identified as caused by industrial logging in Forestry Concession Production Areas, and unplanned degradation is identified as not sanctioned or zoned to be degraded and can happen across all other Management Strata. Though the areas susceptible to unplanned and planned degradation and are defined differently between national-level accounting and the ER-Program, it is important to report separately as have uniquely different drivers of degradation.

9.2 **Organizational Structure for Measurement, Monitoring and Reporting**

Overall Organization Structure

The program's FMS will be fully integrated in the existing NFMS, so it will rely on existing organizational structures, responsibilities and competencies.

To ensure long-term sustainability in the context of the ER-Program, CNIAF, under the direction of the MEFDDE, will be responsible for the general coordination and reporting to the Carbon Fund and to the UNFCCC, and will be responsible for the production of the activity data (ΔA_j) and the management of the monitoring functions of the NFMS.

There is a desire to have similar monitoring processes between national efforts and within the ER-Program Area. Currently there is an ongoing project financed with the FCPF readiness grant which intends to transfer the necessary know-how to CNIAF in order to be able to produce similar maps as those produced at the ER program level. This effort will include the establishment of SOPs for conducting this tasks and the necessary capacity building actions. The subsequent technical procedures will be followed to methodologically account and monitor forest degradation at the national level and reconcile differences between the reference level set in the Accounting Area and that of the National FREL:

1. CINAF will clearly define the concept of what constitutes degradation at national level. It is likely that the definition and criteria used in the ER-PD will be used to define degradation.
2. Reference areas will be exampled and spectral thresholds will be set for detecting degradation (and deforestation).
3. Codes for the creation of decision trees, mobile filtering windows will be created in MATLAB to R.
4. Sassan Saatchi with FAO and CINAF will standardize the method to detect forest degradation in a Free and Open Source Software (FOSS) environment
5. CNIAF will appoint experts from within the MRV cell to train in LiDAR techniques with Sassan Saatchi to identify degradation.

Local communities will not have a participation in the MRV function. However, it is important to note that in the monitoring function indicated in Chapter 9.1 they can play a prominent role through the Independent REDD+ Observer.

Workflows

The FMS consists of three different levels as shown in the following figure.

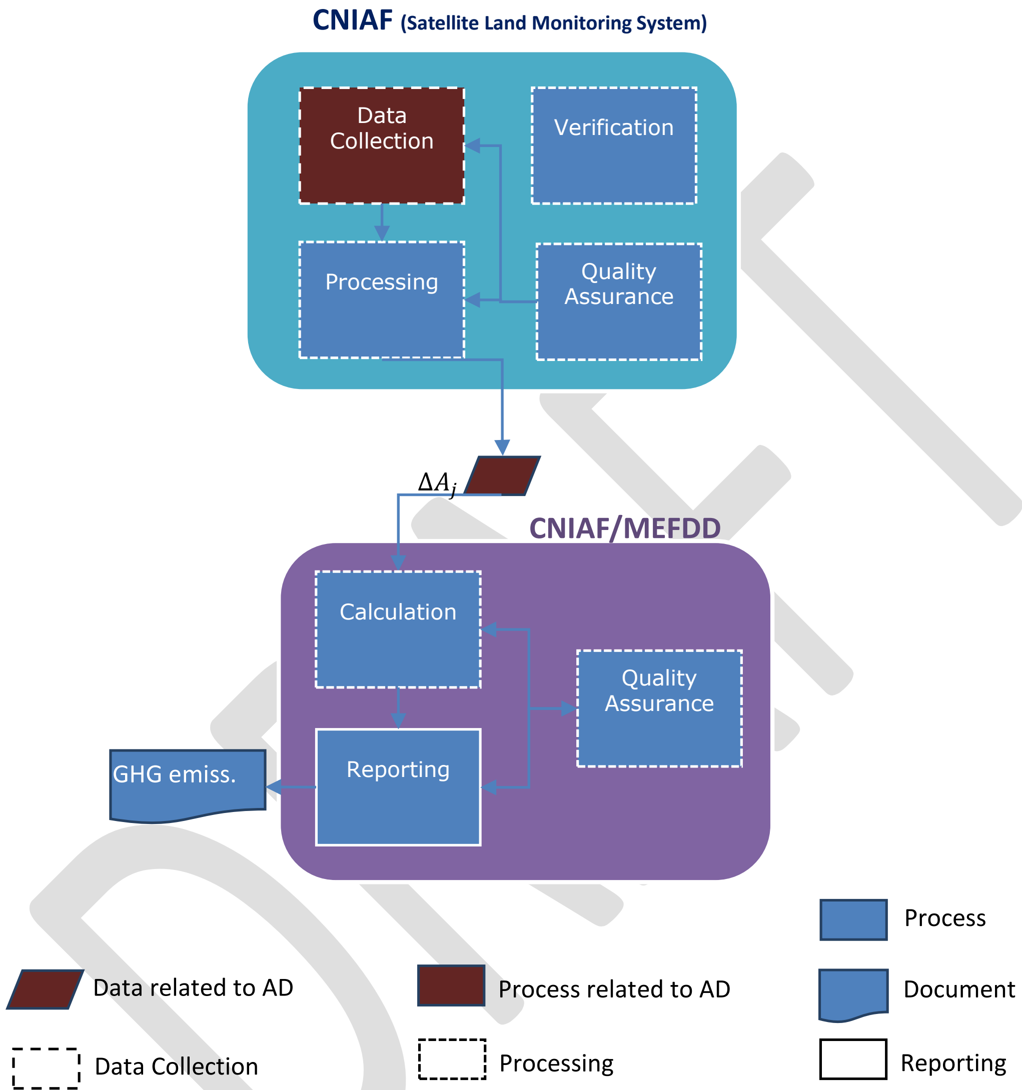


Figure 23. Data flows of the FMS system and responsibilities

9.3 Relation and consistency with the National Forest Monitoring System

It is important to note that full consistency with the NFMS cannot be achieved as the scope, accuracy and methodologies between the national and the ER-Program differ. The reason is that both the FMS and the NFMS have to be consistent with their respective RLs, and since these differ as indicated in Chapter 8.6, their NFMS will differ too, at least in the interim.

However, it is planned that with future revisions of the national FRL, and revisions of the NFMS, this consistency will be improved. One very important piece of consistency will be the use of identical methods and specific for mapping at both levels; as indicated in Chapter 8.6 and in Chapter 9.1.2 above, it is expected that by mid-2017 the same mapping methods used for the ER-Program will be upscaled to the national level, which will allow to the alignment of the AD. Therefore, although the RL might differ currently, it is expected that the national RL will progressively align to ER-Program RL, but it is not expected that they will be fully consistent. However, it is expected that monitoring will rely on exactly the same methods.

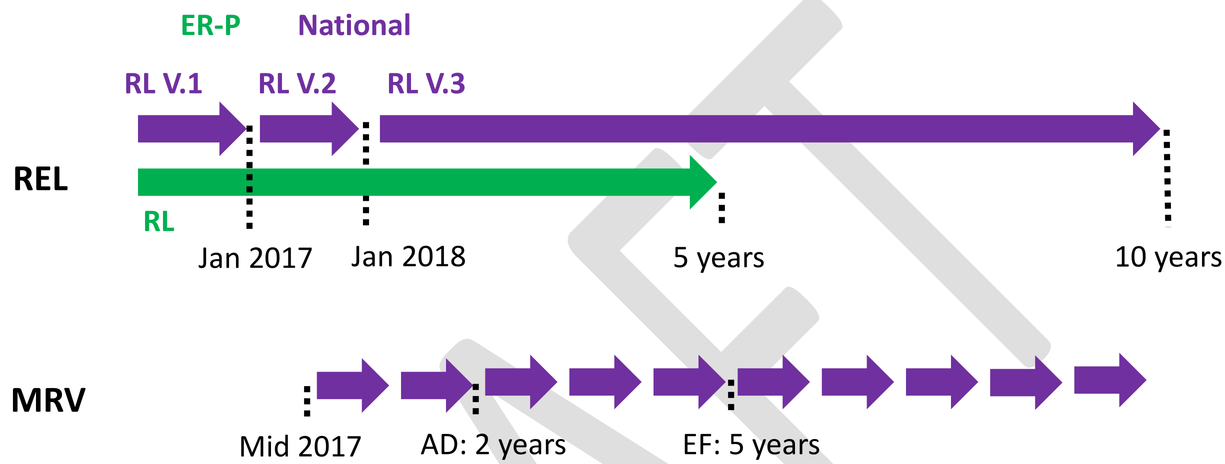


Figure 24. Figure showing the temporal dimension of the MRV/RL for both levels

The FMS system will enter into operation in mid-2017, when the national MRV system will be in operation. From that point forward the AD will be updated every 2 years (consistent with the biennial reporting set under the UNFCCC) and the EFs will be updated every 5 years. However, the EF of the ER-Program is not expected to be updated as the ER-PA term is expected to end within five years. The FMS will rely on most of the MRV functions of the NFMS.

10 DISPLACEMENT

10.1 Identification of Risk of Displacement

Background

Displacement, often called leakage, is caused when land-use activities from inside the ER-Program Accounting Area shift emissions to outside the ER-Program Accounting Area. Traditionally, leakage or displacement has been divided into primary displacement and secondary displacement. Primary displacement includes 1) geographically constrained activity-shifting and 2) non-geographically constrained activity shifting displacement (sometimes called outsourcing). Secondary displacement, includes market displacement and super-acceptance of alternative livelihoods.

Table 69. Table adapted from CF MF Issues Paper

Displacement Category	Type	Description
Primary – Activity Shifting	Geographically constrained (PL-GC)	Activity-shifting displacement is displacement that directly results from REDD+ activities. In this case because of the REDD activities are implemented, the agents move somewhere else but within a constrained area from the REDD activities are taking place. *Example: If small local agents reduce biomass via fuelwood collection or small-scale agriculture, activities may be shifted to adjacent areas, which may be easily detected.*
	Non-geographically constrained (PL-NGC)	Activity-shifting displacement is displacement that directly results from REDD+ activities. In this case because of the REDD activities are implemented, the agents move somewhere else but they are not constrained geographically. *Example: If timber for local use becomes unavailable for use by actors in the REDD Area due to REDD activities, and it must be imported from elsewhere that cannot be a priori be identified.*
Secondary	Market (SL-M)	Secondary displacement is the indirect result of implementing REDD+ activities. Specifically, market displacement is a form of secondary displacement where REDD+ activities result in increased emissions elsewhere due to changes in supply of forest-related products. In REDD+, market displacement is caused by constraints in forest resources that force a shift in market equilibrium, resulting in extraction or land use change outside project boundaries. Unlike activity-shifting, market displacement is indirect and involves 3rd parties unrelated to the original project. *Example: If timber from the Accounting Area is reduced or stopped, and it causes operators in another country to supply more timber to fill the gap.*
	Super-acceptance of	Livelihoods options resulting from REDD+ activities being adopted beyond the original deforestation agents are referred to as super-acceptance of alternative livelihoods. And can be positive or negative.

Displacement Category	Type	Description
	alternative livelihoods NOT INCLUDED	As it is not accounted for in the context of the United Nations Framework Convention on Climate Change (UNFCCC) and often considered negligible, few methodologies attempt to quantify or adjust for super-acceptance of alternative livelihoods.

For the Congo ER-Program, any activity shifting displacement that would move to bordering countries (Cameroon, DRC, Gabon, CAR) will not be accounted for. This is because displacement that occurs in other countries is the most challenging to account for and quantify, as little or no monitoring may occur in foreign countries. Additionally, determining causation and attributing responsibility or liability for the displacement can be very difficult. It must be noted that, following the precedent established by the UNFCCC and the Methodological Framework, international displacement is usually not monitored, estimated or accounted for.

Assessment of Risk of Displacement

However, leakage or displacement within Congo but outside of the ER-Program of Sangha and Likouala Departments should be assessed. For PL-GC, this could be the displacement of agents from the ER-Program Area into Cuvette and Cuvette West. For PL-NGC, this will be limited to commercial agents (forestry or agricultural) and migrants. Table 70 identifies for each of the ER-Program Measures the associated risk for Displacement (Indicator 17.1), with risk mitigation strategies included in Table 71**Error! Reference source not found.** (Indicator 17.2)..

Table 70. ER Program Measures and Displacement Risk

REDD Measures	Driver of deforestation or degradation	Risk of Displacement (L,M,H)			Explanation / justification of risk assessment
		PL-GC	PL-NGC	SL-M	
RIL and LtPF	Agents of deforestation are the forest concession companies. Those who adopt the REDD activities by implementing logged to protected, may have reduced volume of timber to sale. Volumes associated with RIL are not expected to decrease.	n/a	L	L	Concession holders, who hold multiple concessions both inside and outside of t the ER-Program area could increase their DF/DG due to reducing it in another concession this could be accounted for in the MRV of national reporting by MFEDD (PL-GC) The risk of SL-M is low because for RIL activities do not significantly affect timber production volumes and would thus not increase production elsewhere by either these concession holders (PL-NGC) or others globally (SL-M).
HCVPalm	The agents of DF are the oil palm concession holders. Those who adopt the REDD activities will reduce the forest areas cleared	n/a	L	L	Current concession oil palm holders in the ER-Program Area have only just begun clearing, planting and producing and are nowhere near their capacity. Thus any reduction in productive capacity due to ER-Program measures would be very

REDD Measures	Driver of deforestation or degradation	Risk of Displacement (L,M,H)			Explanation / justification of risk assessment
		PL-GC	PL-NGC	SL-M	
	and planted in oil palm beyond that which is legal and biophysically suitable. This may impact the amount of palm oil that they can produce.				unlikely to cause them to increase production outside the ER-Program Areas (PL-NGC). As Congo is a net importer of palm oil and the amount of production in the ER-Program area is currently very small (< 800 tons in Sangha and less in Likouala), thus any reduction in the ER-Program Area will not likely cause increase in production outside the country (SL-M). Though there is discussions to move palm oil production to savannas, there clearly remains evidence that palm oil production will continue in the North where yields are often twice as high. Efforts to move palm oil production to savanna areas need political support and education/outreach to support nutrient cycling in non-forest soils.
GrMining	The agents of DF are those companies holding mining concessions. For those that adopt the REDD activities they reduce the area DF for mining and infrastructure activities beyond that which is the industry's common practice (adjusted for local conditions).	n/a	L	L	The ER-Program measures associated with green mining do not restrict the amount of minerals which can be extracted from the ER-Program Area, thus they will not cause displacement (PL-NGC, SL-M).
SHAgCocoa SHAgPalm ConAg PA	Agents include the community members officially associated with the forest concession and other actors living in the ER-Program Area who cause deforestation from small scale agriculture, illegal logging, and fuel wood.	L	n/a	n/a	Any displacement from actors moving within the ER-Program Area will be accounted for with MRV. It is unexpected that agents will move south from the borders of Sangha and Likouala into Cuvette and Cuvette West due to the following 1) most of the border of Likouala is forested wetlands which are not populated, 2) there is a significant part of the Sangha border which is the ATAMA plantation where people are not living, 3) the remaining Sangha border has the d'Odzala Kokoula protected area which spans the department borders and is managed by African Parks where any ER-Program measures would be implemented holistically across the protected area which would mean agents would not move from the ER-Program Area, and 4) the rest of the Sangha border is with Gabon and does not require a displacement assessment.

10.2 ER-Program Design Features to Prevent and Minimize Potential Displacement

Though the ER-Program is designed to address drivers and agents of deforestation and degradation in the ER-Program Accounting Area, each activity has a risk of displacement, or shifting activities out of the ER-Program Accounting Area. Possible risk mitigation strategies associated with each of the risks identified in Chapter 10.1 above are listed below (Indicator 17.2).

Table 71. Mitigation Activities to Reduce Displacement Risk

REDD Typology	Driver of deforestation or degradation	Risk Mitigation Activities and Accounting Treatment
Reduced impact logging (RIL) in forest concession production areas and logged to protected (LtP). *Reducing emissions from planned DF and DG*	Agents of deforestation are the forest concession companies. Those who adopt the REDD activities by implementation of sustainable harvesting practices, they may have reduced volume of timber to sale.	If timber companies are to reduce harvest rates, market displacement will exist within the ER-Program Area and will be the one of the most challenging activities to mitigate. In order to reduce displacement timber companies may not only focus on reducing destructive practices with RIL, but on ways to improve/ increase regrowth of desired species such as Sapelli. Overtime market displacement could be slightly reduced, reducing the risk rating. In addition, the ER-Program can promote mill efficiency through improved mill technology where more milled lumber can be extracted from a single log.
Reduced conversion of forests in industrial oil palm plantations by concession holders. *Reducing emissions from planned DF*	The agents of DF are the oil palm concession holders. Those who adopt the REDD activities will reduce the forest areas cleared and planted in oil palm beyond that which is legal and biophysically suitable. This may impact the amount of palm oil that can be produced.	Market displacement for palm oil cannot be mitigated, as there is no expected reduction in demands for palm oil. Little is known about improved oil palm species that would succeed in Congo (most research and seedlings come from Cameroon). If there are limits to oil palm production areas, the ER-Program activities should consider improved oil palm varieties with higher yields. In addition, CIRAD suggests a staggered planting pattern with leguminous plants planted to increase yield, maximize growing space and potentially allow for foodcrops in-between. In general, more research will be conducted improve agriculture to reduce risk and reduce the risk rating.
Reduce impact mining *Reducing emissions from Planned DF*	The agents of DF are those companies holding mining concessions. For those that adopt the REDD activities they reduce the area DF for mining and infrastructure activities beyond that which is the industry's common practice (adjusted for local conditions)	ER-Program measures are not expected to affect market displacement, as improved management of pilings and tailings do not affect extraction rates. As mining activities are very restrictive to where specific mineral deposits occur, activity shifting displacement is very limited and should not affect the risk rating.
Reducing DF and DG in all the other forest areas not covered above.	Within the forest concessions, the areas which are accessible (which includes community, conservation, and protection) the agents include the	Project activities to address deforestation in forestry concession, non-production areas include activities that meet the needs of those living and/or dependent on the forests within the concession boundaries. Project activities such as smallholder oil palm and

REDD Typology	Driver of deforestation or degradation	Risk Mitigation Activities and Accounting Treatment
Reducing emissions from unplanned DF and DG	community members officially associated with the forest concession and other actors living in the ER-Program area (with access timber harvesting equipment).	cocoa production will help slow clearing for agriculture, but could risk displacing food production for commodity crops. The promotion of foodcrops alongside commodity crops is an important part of the ER-Program, and the only way to reduce risk and the risk rating. Research and extension will be carried out by the forestry concession holders.
	Within the protected areas, the areas which are accessible to the agents include the community members officially associated with the forest concession and other actors living in the ER-Program area (with access timber harvesting equipment).	Communities who clear forest within Protected Ares are almost exclusively bound to roads. Project activities such as improved governance of protected areas may displace forest clearing in Protected Areas into other Management Strata. Since most forest clearing is for agriculture along the road, project activities listed above help mitigate this displacement, and reduce the risk rating.
	All other forest areas not accounted for above that are accessible, the agents include the community members officially associated with the forest concession and other actors living in the ER-Program area (with access timber harvesting equipment).	Risk is mitigated by the integration of project activities such as smallholder oil palm and cocoa production grown alongside foodcrops as listed above. The paring of these activities is the only way to truly reduce risk and the risk rating.

11 REVERSALS

11.1 Identification of Risk of Reversals

The potential risk of reversal of temporary and permanent carbon stocks within the ER-Program Accounting Area are assessed across four general categories. The identification and description of risk described in this section is to fulfill Indicator 18.1 of the MF, and is used to quantify ERs to allocate to the ER-Program CF Buffer. Two buffer reserve accounts will be established which together will comprise the ER-Program non-permanence CF Buffer:

- An ER-Program-specific 'Reversal Buffer' account to hold ERs set aside for the purpose of managing Reversal Risks, and
- A 'Pooled Reversal Buffer' account to hold ERs set aside for the purpose of managing Reversal Risks that, if materialized, may exceed the amount of ERs set aside in the Reversal Buffer account (covering, on a pro-rata basis and subject to certain requirements, Reversal Risks that may materialize under any ER-Program for which an ER-PA has been signed).

The approach below leverages the new FCPF ER-Program Buffer Guidelines, and the ER-Program's risk of reversal was evaluated on the following key risk factors:

A. Lack of broad and sustained stakeholder support
B. Lack of institutional capacities and/or ineffective vertical/cross sectoral coordination
C. Lack of long term effectiveness in addressing underlying drivers
D. Exposure and vulnerability to natural disturbances

Under each category the risk is assessed and a 'risk deduction' in percentage is assigned. The risk factors take into account mitigation activities that the ER-Program is implementing to reduce risk of reversal. This value shall be used to calculate the different ER-Program Buffers quantity as delineated in Chapter 11.3.

The table below will be reassessed during each monitoring period and the Buffer Manger (as defined by the Buffer Guidelines), will take into account the results of any related assessment done by another entity or body authorized by and acting on behalf of the CF.

Risk Factors	Chosen Risk Indicators	Discount (increment)	Resulting Reversal Risk Set-Aside %
Default risk	Not applicable, fixed minimum amount	**10% (Default Reversal Risk Set-aside)**	**10%**
A. Lack of broad and sustained stakeholder support	**Indicator A.1:** Has the jurisdictional program been developed in consultation with representative agents of deforestation (and degradation)? ***Justification for percent set-aside:*** *The ER-Program has a comprehensive stakeholder engagement process, see Chapter* 5	Reversal Risk is considered medium: 5% discount	**5%**

B. **Lack of institutional capacities and/or ineffective vertical/cross sectoral coordination**	**Indicator B.1**: As the jurisdiction is subnational, does the national government have documented policies or publicly stated support for the operation and direct GHG crediting of (or payments to) the subnational jurisdictional program? ***Justification for percent set-aside:*** *The ER-Program legally supported at the national level and has been identified by the national government as the initial area for implementation and to receive results-based payments from the Carbon Fund.* **Indicator B.2:** Has the national government received or is receiving REDD+ readiness funding from bilateral or multilateral donors supporting the development of REDD+ programs and strategies that mitigate reversal risk? ***Justification for percent set-aside:*** *The Congo has been successful in securing multiple sources of funding for REDD+ from donor as well as signing a Letter of Intent with the Carbon Fund for results-based payments. Some highlights of this funding include:* • *The grant agreement ($ 200,000 USD) signed with the FCPF for the formulation of the preparation of a preparation request signed July 21, 2009;* • *Approval of R -PP in June 2010 by the FCPF Participants Committee;* • *The grant agreement ($ 3.4 million USD) signed with the FCPF for the implementation of the preparation of an application for preparation January 11, 2012;* • *The grant agreement ($ 4.0 million USD) signed with the UN-REDD Programme in Oct. 2012;* • *The signing of a cooperation agreement in May 2012 between the Government and the IPC-OLAM Development in Northern Congo REDD + pilot project LEU Pikounda North;* • *The wording of the CN-REDD by terms of reference to solicit financial support from the Forest Economic Diversification Project (FELP) for the recruitment of a consultant to help the Republic of Congo in the development of ER-PIN;* • *The submission of the application to the FIP March 6, 2015 for funding to i) develop projects that contribute to the protection of conservations of forest resources ii) secure funds upstream in the reduction program North-emission Congo (ER-Program)* • *MTR Submission of 20 Mar 2015 to draw up an advanced scene of the REDD+ process in Congo*	Reversal Risk is considered medium: 5% discount	**5%**

B. Lack of institutional capacities and/or ineffective vertical/cross sectoral coordination (CONTINUED)	**Indicator B.3:** Is the jurisdictional proponent undertaking REDD+ readiness activities targeting governance issues, and demonstrating the adoption of improved governance structures and processes that will enhance the long-term effectiveness of the jurisdictional program (e.g., changes related to transparency and accountability, grievance oversight and redress mechanisms, and/or rule of law)? Where the jurisdiction is subnational, is the jurisdictional proponent undertaking such readiness activities, or can clearly demonstrate governance related to the jurisdictional program is better than indicated by the national governance rating? ***Justification for percent set-aside:*** *The national government who is responsible for the ER-Program, is implementing a whole suite of REDD+ readiness activities and related activities to improve governance and support transparency and accountability under for the ER-Program. These include:* • *FLEGT VPA process which includes the ER-Program Areas* • *Engagement of Private Sector and the use of REDD+ Participation for support their commitment to ER-Program Measures and reporting of results* • *Dedicated ER-Program Management Entity, operating under a multiple stakeholder governance process, with requires operational and financial reporting both to the governance boards and publically* • **Indicator B.4:** Has the jurisdictional program been established and structured to ensure its continuity and long-term effective functioning regardless of changes in government (e.g., the jurisdictional program is managed and operates independent of the elected government and/or is protected by law)? ***Justification for percent set-aside:*** *Some of the risk associated to changes in government will be mitigated by the manner in which the ER-Program is established and managed. Under the institutional arrangements, a non-government legal entity will be established and operationalize. There will be a legal decree that authorizes and recognizes the rights this entity has to manage the ER-Program in accordance with its bi-laws and governance document. These would withstand a change in government. At this time the ER-Program does not meet this mitigation factor, however the design and authorization of the ER-Program Entity and the terms of the ER-PA with the Carbon Fund, could support this in the future.* **Indicator B.5:** Have laws, policies or regulations establishing clear, uncontestable carbon rights been enacted? ***Justification for percent set-aside:*** *Like with most countries Congo does not have a law to clearly define carbon tenure. In the absence of that, the ER-Program has developed a set of institutional arrangements and participation agreements to support the securing of tenure and the implementation of a results-based benefits sharing plan.*		

Risk Factors	Chosen Risk Indicators	Discount (increment)	Resulting Reversal Risk Set-Aside %
C. Lack of long term effectiveness in addressing underlying drivers	**Indicator C.1:** Does the jurisdictional program incorporate and is implementing strategies, policies or measures that maintain production of the significant commodities driving deforestation (and degradation, where relevant) within the jurisdiction; and/or does the jurisdictional program affectively commodity drivers of deforestation (and degradation)? ***Justification for percent set-aside:*** *The ER-Program Area currently only has one major commodity produced: timber in Sangha. However the ER-Program Measures will not have a significant impact on the production, but promotes reducing the impact of logging operations. Potential future oil palm production within the ER-Program Area may decrease with implemented ER-Program Activities. In the proposed ER-Program Activities, smallholders may also benefit from oil palm production, and not only the agro-industry.* **Indicator C.2:** Are strategies, policies or measures being implemented to address subsistence drivers of deforestation (and degradation, where relevant) and are supporting a majority of the agents associated with such subsistence activities; and/or is the jurisdictional program affect subsistence drivers of deforestation? ***Justification for percent set-aside:*** *The ER-Program promotes activities such as conservation agriculture, which supports food production of agents associated with subsistence activities. In addition the incorporation of smallholder cocoa production and smallholder oil palm production further improves livelihoods and has the potential to move communities out of a subsistence lifestyle.* **Indicator C.2:** Are strategies and measures in place to address international activity shifting leakage to out of the ER-Program Area? ***Justification for percent set-aside:*** *The ER-Program identifies actors that may shift activities to other locations including internationally. Leakage risk is reduced for Forestry Concession Holders by: 1) supporting improved milling technologies to get higher volumes of milled lumber out of harvested logs, and 2) Reduced Impact Logging will improve timber production and reduce damage to harvested wood, which will lead to more merchantable timber. Leakage risk associated with the creation of HCV areas in Industrial Oil palm Concessions is minimal. Since palm oil is an international commodity, activity shifting to fill market demand, clearing forests for industrial oil palm is expected to shit to areas with lower biomass such as Indonesia (for example ATAMA is an Malaysian company, and any possible land-clearing activities that are reduced in Congo, will likely shift to Southeast Asia).*	Reversal Risk is considered medium: 2% discount	**3%**

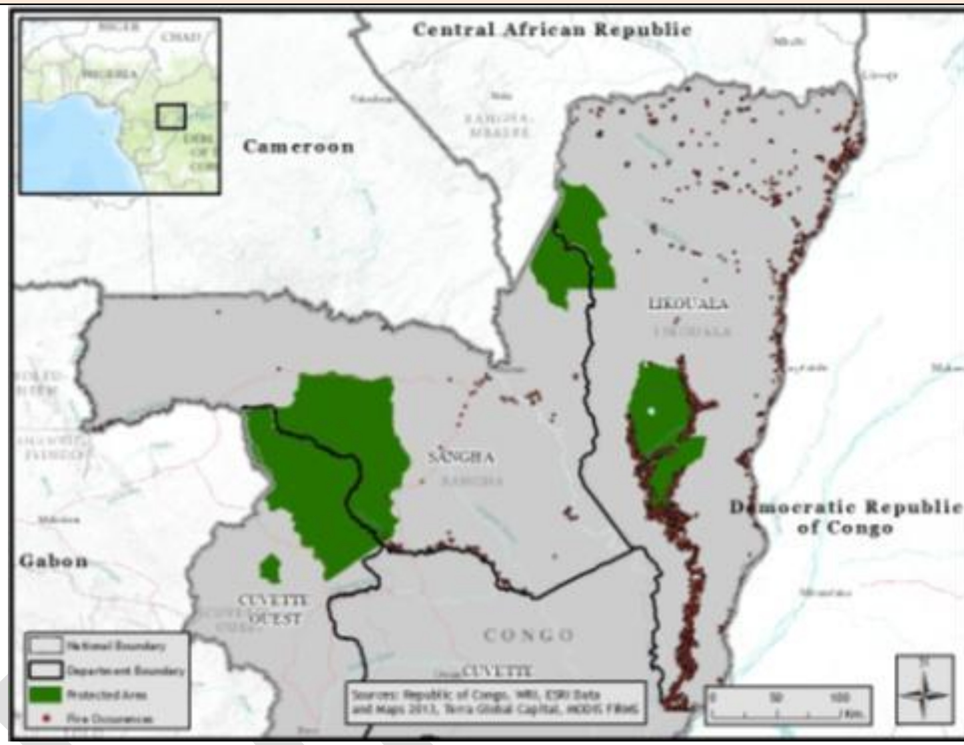
Risk Factors	Chosen Risk Indicators	Discount (increment)	Resulting Reversal Risk Set-Aside %
D. **Exposure and vulnerability to natural disturbances**	**Indicator D.1:** Is natural wildfire is present in the Accounting Area significantly threatening the ER-Program through the loss of the accumulated VCUs? ***Justification for percent set-aside:*** *Evidence for Natural Risks is very low:* *Paleoecological studies suggest a strong influence of previous human involvement on the historical fire regime in the region dating back to 2000 BCE*[123]*, playing a significant role in shaping the mosaic between tropical rainforest and savannah areas. While research regarding the current fire regime and annual hectares burned is sparse for the Congo Basin region, analysis of MODIS satellite imagery demonstrates that wildfire generally occurs during seasonal dry periods in December/January and June/August*[124]*. Over the previous decade, a persistent drought throughout the Congo Basin has increased vulnerability to large wildfire events.*[125] *Historical data suggests a severe drought return internal of roughly 30 years.*[126] *Fires within the Republic of Congo account for less than 10% of those within the general Congo Basin region, and occur primarily along road networks or along the border with the Democratic Republic of Congo (Figure 25) or in existing grassland ecosystems. Increasingly, the Program Area is a focus of international capacity development in terms of wildfire management, including a mission from the USDA Forest Service in 2009 to establish sustainable fire management practices. While the majority of the brushfires appear to be set along road networks and within existing savannah, the relatively high frequency of human-caused burning in addition to the severe ongoing drought and 30-year drought return interval, the loss of carbon stocks due to fire is assumed to be major, with a return interval of 30-years. In 2015 fires were seen over the ER-Program area, though this is not a normal occurrence. Fires were believed to be started by human activities and are not associated with Natural Risk*	Reversal Risk is considered low: 5% discount	**0%**

[123] Archibald, Sally; Staver, A; Levin, S. 2011. Evolution of human-driven fire regimes in Africa. *Publication of the National Academy of Science (PNAS)* 109: 3, 847-852

[124] Mane, Landing; Amani, Patrick; Wong, Minnie. 2011. Fire monitoring in the Congo Basin using MODIS: Current drawbacks and future requirements. GOFC-GOLD Fire and USIDNR Wildland Regional Network Meeting. Wildland Fire Conference, South Africa, 9 May 2011.

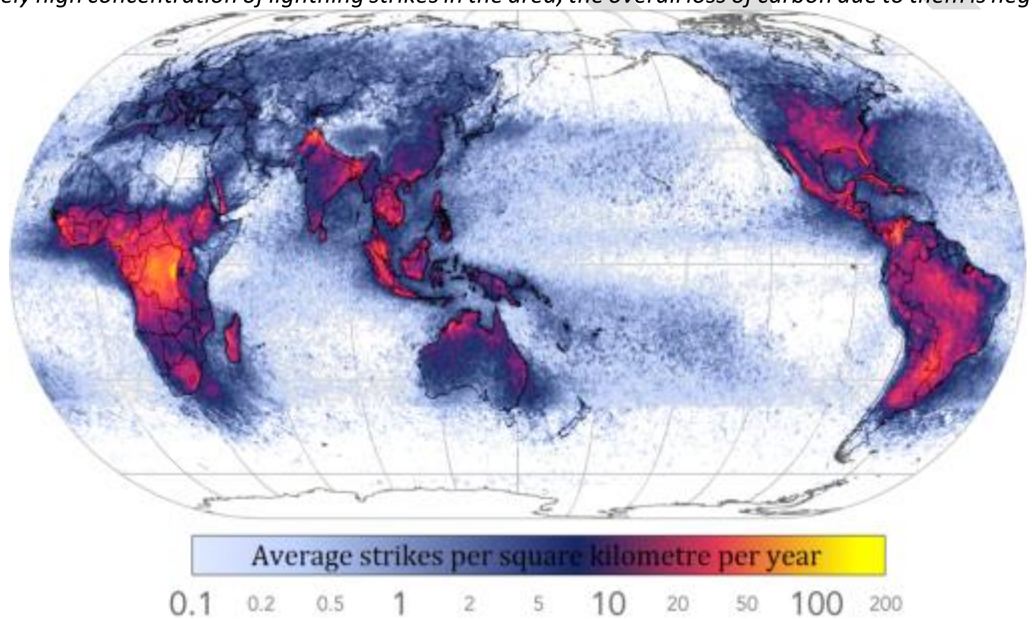
[125] Zhou, Liming; Tian, Yuhong; Myeni, Ranga; Ciais, Phillipe; Saatchi, Sassan; Liu, Yi; Piao, Shilong; Chen, Haishen; Vermote, Eric; Song, Conghe; Hwang, Taehae. 2014. Widespread decline of Congo rainforest greenness in the past decade. *Nature* 509: 86-90.

[126] Masih, I; Maskey, S; Mussa, F.E.F; Trambaur, P. 2014. A review of droughts on the African Continent: a geospatial and long-term perspective. *Hydrological Earth Science* 18, 3635-3649.

Risk Factors	Chosen Risk Indicators	Discount (increment)	Resulting Reversal Risk Set-Aside %
D. Exposure and vulnerability to natural disturbances (CONTINUED)	 **Figure 25. Fire Occurrences Between 2005-2015 (Source: Terra Global Capital, MODIS FIRMS Archive Data)**		

Risk Factors	Chosen Risk Indicators	Discount (increment)	Resulting Reversal Risk Set-Aside %
D. Exposure and vulnerability to natural disturbances (CONTINUED)	**Indicator D.2:** Do forest insects and disease present in the Accounting Area significantly threaten the ER-Program through the loss of the accumulated VCUs? ***Justification for percent set-aside:*** The Program Area is composed of a mosaic of intact primary and degraded forest, forested wetlands, and grasslands. While non-native agricultural pests have been noted throughout the region, there are not recognized major pathogenic threats to forests in the Republic of Congo.[127]		

[127] U.N. Food and Agriculture Organization (FAO). 2009. Global review of forest pests and diseases: a thematic study prepared for the framework of the Global Forest Resources Assessment 2005.

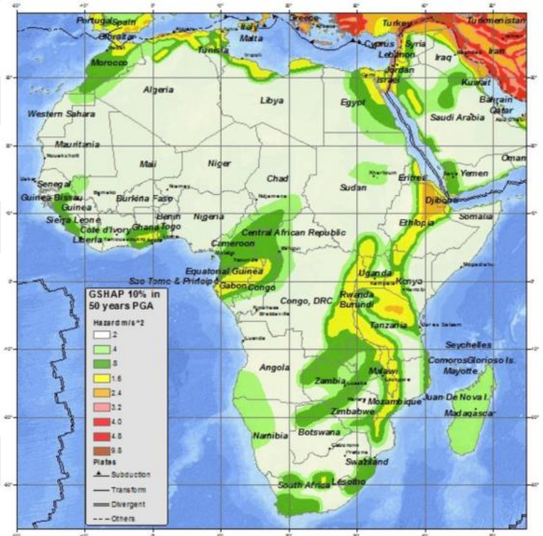
Risk Factors	Chosen Risk Indicators	Discount (increment)	Resulting Reversal Risk Set-Aside %
D. Exposure and vulnerability to natural disturbances (CONTINUED)	**Indicator D.3:** Does extreme weather patterns present in the Accounting Area affect the accumulated VCUs? ***Justification for percent set-aside:*** *The Program Area, encompassing the Departments of Likouala and Sangha, experiences extreme weather events in two forms: frequent lighting strikes and seasonal flooding. Globally, the largest frequency of lightning strikes occurs within Central Africa, particularly the Republic of Congo and the Democratic Republic of Congo (*Figure 26*). Lightning strikes occur most often in the area within the forest concession of Kabo, in Likouala, due to the high concentration of iron in the soils. Despite the relatively high concentration of lightning strikes in the area, the overall loss of carbon due to them is negligible.*  **Figure 26. Global Lightning Strikes (Source: Lightning Imaging Sensor)**		

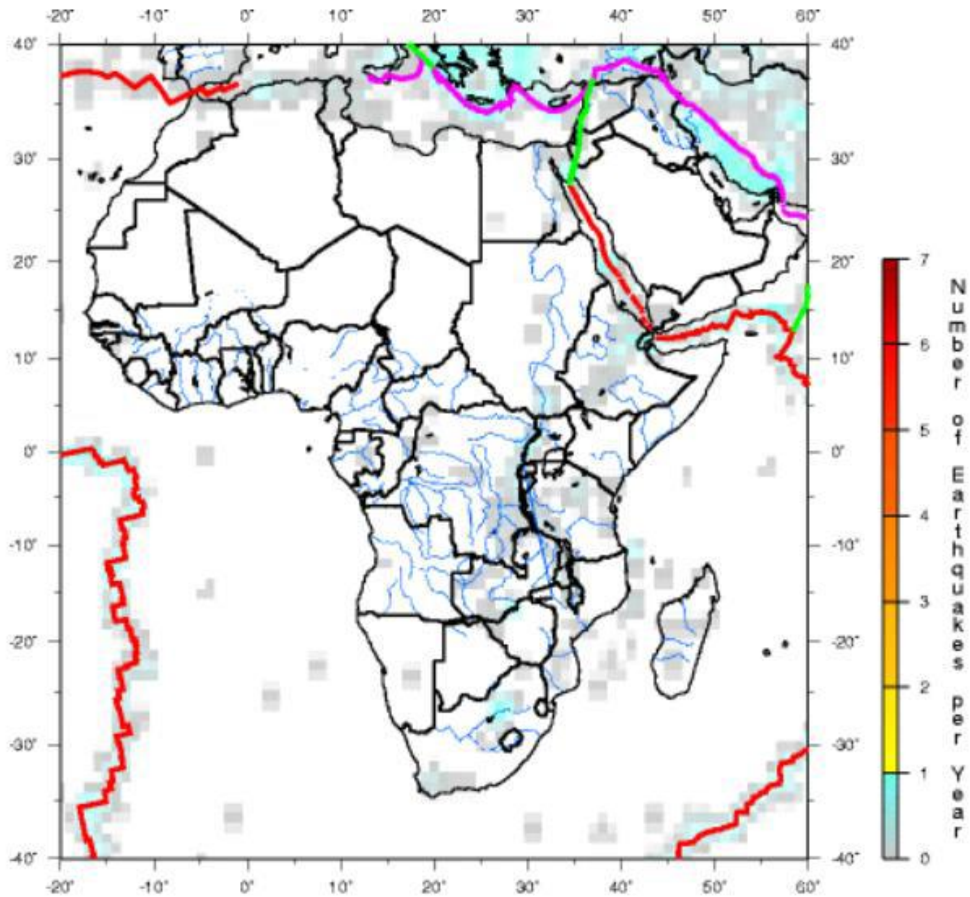
<table>
<tr><th>Risk Factors</th><th>Chosen Risk Indicators</th><th>Discount (increment)</th><th>Resulting Reversal Risk Set-Aside %</th></tr>
<tr><td>D.
Exposure and vulnerability to natural disturbances (CONTINUED)</td><td>

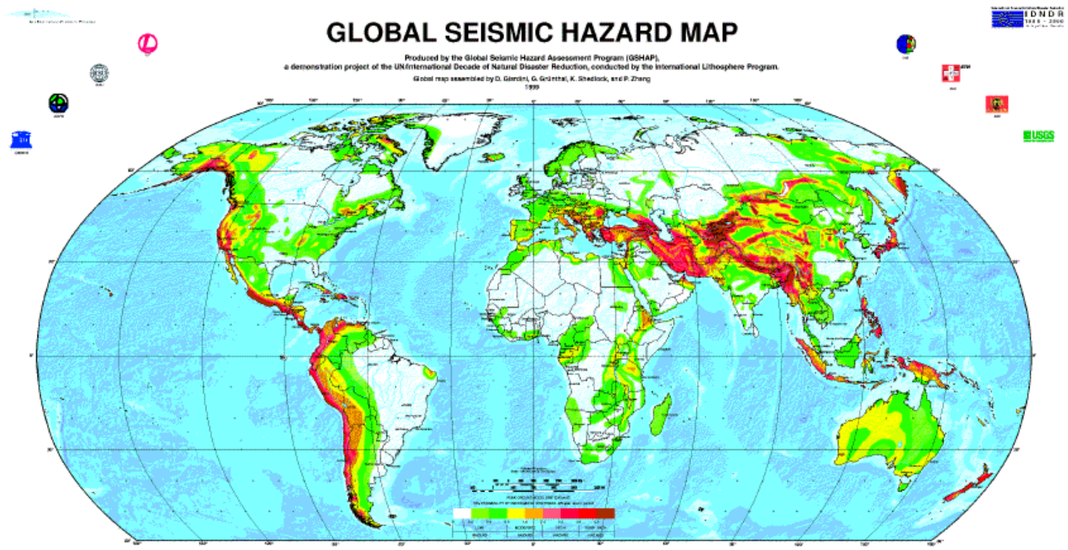
*Seasonal flooding is a natural part of the hydrological regime of the region. The flooding primarily occurs along lowland estuarine habitat abutting the major rivers in the area (*Figure 27*). While the flooding can occasionally cause natural-disaster impacts on the local communities, the effect on the forest carbon stocks is generally nonexistent; the regions where the flooding occurs are composed of forested wetlands, which are ecologically adapted to the seasonal flooding cycle. Due to the essentially nonexistent impact of flooding and lightning strikes on the carbon biomass in the Program Area, the risk of reversals from extreme weather events is assumed to be insignificant.*

Figure 27.Flooding-Prone Wetlands and Rivers in Likouala and Sangha

</td><td></td><td></td></tr>
</table>

Risk Factors	Chosen Risk Indicators	Discount (increment)	Resulting Reversal Risk Set-Aside %
D. Exposure and vulnerability to natural disturbances (CONTINUED)	**Indicator D.4:** Does geological risk significantly threaten the accumulated VCUs? ***Justification for percent set-aside:*** The Program Area is situated in a region subject to minimal risk of loss due to earthquakes. The risk of loss of trees from earthquakes is low given the low anticipated strength of potential earthquakes (i.e. less than or equal to Class VI according in modified Mercalli scale classes). The Program Area has not observed any seismic activity recently (Figure 28 and Figure 29). The Global Seismic Hazard Assessment Program (GSHAP) of the International Lithosphere Program (ILP) and the International Council of Scientific Unions (ICSU) has put the Republic of Congo into the low-risk category (**Error! Reference ource not found.**). The last major seismic event in the Congo Basin region was the 2005 Lake Tanganyika earthquake at magnitude 6.8, which occurred in the eastern region of the Democratic Republic of Congo and did not result in any noted forest losses in the Republic of Congo. The volcanic activity in the vicinity of the Program Area is nonexistent, and there are no active volcanoes in the region. The Program Area is far from active volcanoes, i.e. Nyiragongo and Nyamuragira volcanoes in the DRC, the only active volcanoes in the region. Additionally, the World Bank's disaster review did not identify earthquakes as major risk factor (World Bank 2011). Therefore, risk of loss from geologic factors was assumed to be negligible.  **Figure 28. Seismic hazard map for Africa (Source: USGS 2012)**		

Risk Factors	Chosen Risk Indicators	Discount (increment)	Resulting Reversal Risk Set-Aside %
D. Exposure and vulnerability to natural disturbances (CONTINUED)	 **Figure 29. Average Number of Earthquakes Per Year - Magnitude 5 or Freater, All Depths. Majour Tectronic Boundaries: Subduction Zones-purple, Ridges-Red, and Transform Faults-Green (Source: USGS 2012b)**		

Risk Factors	Chosen Risk Indicators	Discount (increment)	Resulting Reversal Risk Set-Aside %
D. Exposure and vulnerability to natural disturbances (CONTINUED)	 **Indicator D.5:** Are there other natural risks present in the Program Area that may impact the accumulated VCUs? ***Justification for percent set-aside:*** There are no other risks present in the Program Area that may impact the accumulated VCUs.		

Summary of ER-Program Reversals Risk

The following table summarizes the anthropogenic and natural risks of reversals that could affect the ERs during the term of the ER-PA.

Table 72. Summary of the anthropogenic and natural risks of reversals that could affect the ERs during the term of the ER-PA

Summary of Risks Reversals		%
	Default risk	10
A	Lack of broad and sustained stakeholder support	5
B	Lack of institutional capacities and/or ineffective vertical/cross sectoral coordination	5
C	Lack of long term effectiveness in addressing underlying drivers	3
D	Exposure and vulnerability to natural disturbances	0
Actual Reversal Risk Set-Aside (%)		**23**

Determining the Actual Reversal Risk Set-Aside Percentage

From the Actual Reversal Risk Set-Aside Percentage above half of the Default Risk percentage of 10% (i.e. 5%) will be deposited as Buffer ERs into the Pooled Reversal Buffer account while the remainder of 15% will be deposited as Buffer ERs into the Reversal Buffer account.

11.2 ER-Program Design Features to Prevent and Mitigate Reversals

The mitigation activities are defined in Chapter 11.1

11.3 Reversal Management Mechanism

Table 73. Reversal Management Mechanism

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

For option 1, explanation of Reversal management mechanism.

Not applicable.

For option 2, explanation of Reversal management mechanism.

The ER-Program applies the ER-Program CF Buffer approach. The number of credits to allocate to the non-permanence buffer are provided in Chapter 0.

11.4 Monitoring and Reporting of Major Emissions that could lead to Reversals of ERs

A detailed description of the Monitoring Plan can be found in Chapter 9. As the ER-Program is very much linked to Land-use, land cover and land-use and land change monitoring through remote sensing reversals are easy to identify (Indicator 21.1). The ER-Program will monitor reversals as follows:

- The ER-Program will prepare a non-permanence risk report, using the FCPF ER-Program Buffer Guidelines provided in Chapter 11.1 at each monitoring and verification period as specified in ER-PD Chapter 9.
- ERs for the non-permanence buffer shall be deposited in its respective account based upon the non-permanence risk report for any ER delivered to the Carbon Fund
- The ER-Program will monitor potential reversals between verification events, using readily available products such as Fire Information for Resource Management (NASA Modis Product), Global Forest Watch, Google Earth, field reports and other sources.
- Where an event occurs that represents more than five percent of total forested area in the ER-Program Area that is not planned for, a reversal report will be prepared and provided to the Carbon Fund as follows:
    - The report shall include a conservative estimate of the carbon stocks lost from ER-Program Area (i.e. losses to stocks on which ER have previously been delivered to the Carbon Fund, based on monitoring of the full area affected by the loss event).
    - ERs from the CF buffer pool will be put on hold until the next monitoring and verification period is completed.
    - When the monitoring and verification is completed the actual ERs lost will be cancelled from the CF buffer pool. Any over withheld credits will be released back into the CF buffer and under withheld be made up from other credits in the CF buffer pool.

In addition, if the ER-Program is found to have emissions in the Accounting Area or changes in ER-Program circumstances that could lead to Reversals, the ER-Program will report to the Carbon Fund within 90 days (Indicator 21.2).

12 UNCERTAINTIES OF THE CALCULATION OF EMISSION REDUCTIONS

Note: *The uncertainty analysis will be revised in the final ER-PD in order to include the uncertainty given by the results of the Accuracy Assessment conducted by CNIAF for the period 2003-2012. The uncertainty of the map area estimates will be considered in two ways, by considering the bias or difference between the "adjusted" areas and the mapped areas, and its statistical precision, therefore increasing the uncertainty of emission reductions and the potential uncertainty discount, but not by adjusting the estimates. The estimated areas have not been replaced by the "adjusted" as these have a very high statistical error (55% for deforestation and 19% for degradation at 90% of confidence) which constrains future monitoring of emission reductions (i.e. the difference could be within the error bars). The use of wall-to-wall maps does not have this issue if consistent mapping methods are used for both the reference level and the monitoring of the program, which is what is planned.*

Box 3. Note on uncertainty calculation

The approach followed in quantifying the emission reductions in the ER-Program area includes uncertainty assessment throughout the work. To identify the key sources of uncertainty and the calculation of the uncertainty, recommendations from Chapter 3 of the 2006 IPCC Guidelines for National Greenhouse Gas Inventories and the Carbon Fund Methodological Framework are applied.

According to the MF, the ER-Program must address the uncertainty related to the RL and MRV by focusing on the following steps:

1. Identify and assess sources of uncertainty
2. Minimize uncertainty where feasible and cost effective
3. Quantify remaining uncertainty

12.1 Identification and Assessment of Sources of Uncertainty

This section summarises the ER program approach to identify sources of errors in calculating the emissions from the activities in the program area, to minimize the uncertainty by improving the methodology or providing mitigation techniques, and finally quantify the remaining uncertainty according to the FCPF Methodological Framework (MF) and the 2006 IPCC guidelines for National Greenhourse Gas Inventories on Uncertainties (Chapter 3). The overall methodology will focus on:

1. Determining the uncertainty in individual variables associated with the emission factors and activity data
2. Aggregating the component uncertainty to emission factors and activity data and finally to the total emissions and removals.
3. Identify significant sources of uncertainty in the variables to help with prioritising the data collection to improve emissions and future monitoring and verification process.

As indicated in Chapter 8.3, for the estimation of the average annual historical GHG emissions from **deforestation and forest degradation**, the stock-change method (Activity Data x Emission Factor) are applied. The Activity Data would be derived from comparison of land cover maps for different epochs (Approach 3) and the emission factors have been estimated with local measurements and remote sensing data (Tier 2-3). The uncertainty in the Stock-change method will include the uncertainty of all variables associated with emission factors and activity data.

Sources of Uncertainty in Activity Data

Activity Data used to estimate deforestation and unplanned forest degradation in the reference period is derived from remote sensing analysis and includes Landsat data collected over at least at three points in time for capturing the LULC change in the ER-Program area. In the case of deforestation, the allocation of Land Use transitions to planned deforestation and unplanned deforestation was done by their location in areas sanctioned for development inside or outside of concession areas. The transitions from the planned deforestation included transitions from the infrastructure, permanent roads including primary and secondary roads developed during the reference period inside concession areas. The overall sources of uncertainty associated with the use of satellite imagery can be summarized in: 1) the quality and suitability of the satellite data in terms of spatial and temporal resolutions, 2) the interoperability of different sensors and sensor generations that may cause differences in classification in time series data, 3) the consistency and quality of radiometric and geometric preprocessing of data, 4) the thematic and cartographic standards such as the land cover type and the minimum mapping unit, and 5) the interpretation procedure from either automatic classification of the imagery or the visual interpretation. We address these sources of uncertainty by following the GOFC-GOLD REDD sourcebook (GOFC-GOLD, 2009).128 In what follows we provide a list of sources of uncertainty in activity data and the steps to minimize or mitigate the uncertainty:

- **Quality of Satellite Imagery:** In general, the Landsat data covering the entire project area is partially contaminated by cloud and haze, and problems associated with the scan line correlator (SLC) failure (May 2003) that can cause artifacts in the forms of strips across the landscape. To develop the historical LULC change for the reference emission levels, we concentrated on the years 2003, 2012, and 2015 and for each year, collected Landsat 7, Landsat 5 and Landsat 8 OLI imagery. The methodology to quantify RL activity data in terms of land cover and land use change included development of wall-to-wall mosaic for each year. Although, the reference period is 2003-2012, the images associated for 2000 was also included to allow inclusion of cloud-free imagery of the year 2000 that matched the LULC maps available at the national level. Uncertainty associated with the lack of data

[128] GOFC-GOLD, 2009, Reducing greenhouse gas emissions from deforestation and 46 degradation in developing countries: a sourcebook of methods and procedures 47 for monitoring, measuring and reporting, GOFC-GOLD Report version COP14-2, 48 (GOFC-GOLD Project Office, Natural Resources Canada, Alberta, Canada.

for each time period due to clouds and scan lines were minimized by including multi-temporal Landsat imagery for each period using the Google Earth Engine processor. Earth Engine contains a variety of Landsat specific processing methods. Specifically, there are methods to compute at-sensor radiance, top-of-atmosphere (TOA) reflectance, surface reflectance (SR), cloud score and cloud-free composites. These relatively cloud free imagery allowed us to reduce the effect cloud pixels on unclassified pixels in 2003, 2012, and 2015 imagery. The use of Google Earth Engine Algorithm reduced the cloud cover in imagery and replaced the cloud, shadow and the scan line pixels with reflectances from the time series data within each epoch. This process reduced the number of noisy or cloud and shadow-affected pixels to a minimum of less than 5% in for each epoch. An algorithm for processing the Landsat imagery for each epoch at the reflectance level by using cloud masks, and improving any geometric effects by using the MODIS (Moderate Resolution Imaging Spectroradiometer) BRDF (Didirectional Reflectance Distribution Function) data was developed for the ER Program area and was delivered to FAO and CNIAF analysts to be applied at the national level (See ANNEX 13. Uncertainty Evaluation of Mapping Products).

- **Differences in Sensors:** We used three different Landsat sensors to compile the wall-to-wall mosaics for each epoch. These differences may have an impact on the classification of the time series data and introduce uncertainty in the detection of forest cover or land cover and land use change. Although the sensors are different, the reflectance derived from each sensor after the atmospheric corrections are all cross-calibrated by using the MODIS BRDF corrections. The cross-calibration of the reflectance data from all three sensors minimizes the uncertainty associated with the interoperability of the different sensors.
- **Cartographic and Thematic Standards:** Implementing the minimum mapping unit (mmu) in the process of classification of a pixel into degraded forests. This process could artificially remove a large number of pixels segmengeted as degraded. The segmentation process was modified to allow for a minimum five pixels in the clustering algorithm. This process removed a large number of isolated pixels by enforcing an MMU of about 0.54 ha. The process improved the bias in the classification significantly by removing approximately 15% of total number of pixels classified as degraded or deforested. Classification errors associated with the thematic standards impacted the separation of LULC classes and included both random and bias errors. These errors may be due to automatic classification methodology based on spectral information, lack of ancillary data for accurately quantifying the spectral information associated with LULC classes, and the lack of sensitivity of the spectral data to accurately distinguish different land cover classes, particularly degraded forest and agroforestry systems. The errors in image classification for detecting deforestation and degradation were reduced by comparing the Landsat imagery with high resolution Google imagery to develop training pixels. A set of traning data was developed for automatic classification from time series analysis of imagery from the Google Earth Engine and the expert analysts. All residual errors were quantified using independent validation data from visual interpretation of the high-resolution of Google imagery, field observations, and comparison with other existing maps developed from

high resolution imagery for some of the forestry and mining concessions. Some of the identified errors:

a. Isolated pixels of natural forest gaps were confused with the degraded forests. We found large areas being classified into degraded forests, particularly in the vicinity of roads and logging concessions. We reduced the uncertainty between the natural gaps and degraded areas by imposing a canopy cover threshold of 75% for separating intact and degraded forests and applying the minimum mapping unit of about 0.5 ha to filter out the isolated pixels.
b. Forest degradation occurred in areas of naturally open forests or along the edges of savanna or transitions between terra firme and swamp forests. However, there were significant confusion between degraded forests and naturally open or successional forests. Time series analysis of Landsat imagery and contextual analysis of the spectral information were used to reduce the errors associated with these naturally open or successional forests from the process of land use activities. The analysis also focused on the transition of LULC during the reference period and if an area remained degraded through time, it did not contribute to emissions and removals.
c. Areas of degraded forests that are not successfully separated from the primary forest are reclassified into primary forest to allow conservative estimates of degraded areas or land use change. This process is performed internally during the segmentation and classification process by visually assessing the classification accuracy with respect to the training data or from the expectations of expert analysts. Similarly, areas with significant confusion between tree plantation and degraded areas are reclassified into degraded forests for conservative estimate of emissions from tree plantations. These reductions were mainly due to differences in the emission factors of primary, degraded, and plantation forests and helped with the overall reduction of the uncertainty estimates of RL of unplanned degraded forests
d. In areas with high density of deforestation, we extracted samples of Landsat imagery and directly analysed the data by visual inspection and included a larger number of samples for image segmentation and classification
e. Impacts of noisy pixels from the residual of cleaning the image data for cloud and cloud shadows. These pixels may have misclassified into degraded forests but transitioned in to other LULC classes in the historical data analysis. Areas of cloud cover in one or more Landsat imagery that coincided with higher deforestation and degradation were examined and reclassified by visual interpretation, reducing errors associated with false classification and transitions in LULC. Furthermore, by using a decision-rule approach to combine the time series classification, the methodology reduced the effect of noisy pixels on the land cover transitions significantly (ANNEX 12. Uncertainty) The remaining errors are quantified by the independent validation of the classification maps.

Regarding the Activity Data used for the adjustment of planned deforestation (Designated Oil Palm Areas Plantations (PalmA) and Mining Concession Areas (MinA), the following sources of uncertainty were identified:

1. Lack of Data: Data on planned deforestation included in the reports are acquired from the government covering concessions on the development of roads and settlements and other infrastructure in the region.
2. Lack of representativeness of data: The available data covered majority of planned deforestation activities in the region. In the case of the missing data, sampled data from other regions was used, assuming that the conditions are comparable to areas with available data.

Steps to minimize uncertainty

All possible steps in minimizing the uncertainty associated with the data, processing, and interpretation of satellite imagery have been discussed above. Minimizing uncertainty follows a series of QA/QC procedures recommended by the 2006 IPCC GL chapter 3. We showed how some sources of uncertainties (e.g., misreporting/misclassification) may be reduced or eliminated by implementing QA/QC procedures and improvements in data collection and/or methodologies when identified.

Assessment of contribution of sources of uncertainty

The main sources of uncertainty after mitigating all possible errors due to processing and cloud cover would be the uncertainty associated with the interpretation and classification of the imagery. The classification of the imagery through time can generate both random and systematic errors as mentioned above. The systematic error is due to the sensitivity of the data to changes of forest cover, particularly in separating degraded forests and agroforestry system. This source of error is controlled by the SOP as suggested by the Indicator 8.1 of the Methodological Framework suggesting that *Systematic errors are minimized through the implementation of a consistent and comprehensive set of standard operating procedures, including a set of quality assessment and quality control processes that work within the local circumstances of the ER Program.*

The random error on the other uncertainties are reduced to the extent practical based on their relative contribution to the overall uncertainty of the emissions and removals over the project area as suggested by the Indicator 8.2 of the Methodological Framework. The overall uncertainty due to land cover and land use change that includes both random and systematic errors can be estimated using formal validation process as outlined by Olofsson et al. 2014.

The Olofsson method provides a set of "good practice" recommendations for designing and implementing an accuracy assessment of a change map and estimating area based transitions of LULC classes on the reference sample data. The good practice recommendations address the three major components: sampling design, response design and analysis. The primary good practice recommendations for assessing accuracy and estimating area are: (i) implement a probability sampling design that is chosen to achieve the priority objectives of accuracy and area estimation while also satisfying practical constraints such as cost and available sources of reference data; (ii) implement a response design protocol that is based on reference data sources that provide sufficient spatial and temporal representation to accurately label each unit in the sample (i.e., the “reference classification” will be considerably more accurate than the map classification being evaluated); (iii) implement an analysis that is consistent with the sampling design and response design protocols; (iv) summarize the accuracy assessment by reporting the estimated error matrix in terms of proportion of area and estimates of overall accuracy, user's accuracy (or commission error), and producer's accuracy (or omission error); (v) estimate area of classes based on the reference classification of the sample units; (vi) quantify uncertainty by reporting confidence intervals for accuracy and area parameters; and (vii) provide an estimate of adjusted area (bias-corrected) based on the omission and commission errors. The estimation of uncertainty of LULC change for the ER program area are provided below under the uncertainty of activity data.

Emission Factors

The emission factors are calculated by estimating forest carbon stocks in each LULC class in the ER-Program area. The ER-Program adopted a hybrid technique to estimate the carbon stocks by integrating the forest inventory data with remote sensing measurements of forest structure. The hybrid approach has several sources of uncertainty that are minimized and quantified throughout the estimation process. These include:

1. **Sampling Error:** The network of national forest inventory (NFI) plots are distributed systematically over the country but the locations are sparse and do not provide adequate information for estimating carbon stocks in degraded, croplands, and deforested areas. Additional plot data are required to accurately quantify the forest biomass in all LULC classes. Data acquired in various concessions was found to display lack of sampling in all LULC classes. As a result, existing plots were not enough or representative of all LULC classes. To minimize the large error associated with the sampling density of the forest structure and biomass, we included spaceborne LiDAR measurements from the ICESAT GLAS data (ANNEX 12. Uncertainty).
2. **Measurement Error:** There were also measurement errors in NFI plots. The individual plots are each 0.5 ha and are nested in order to collect all trees > 20 cm in the larger 20 m x 250 m plot and trees > 10 cm in three smaller 10 m x 20 m plots. We identified three measurement errors in the NFI data that are often common in all NFI data and together they can impact the uncertainty of estimates of the forest above ground biomass (AGB): 1. Errors in measuring the diameter (D), errors in measuring tree height (h), and error in identifying or measuring species wood density (ρ). These errors have been minimized by in several steps. A clean version of the NFI data after the FAO analysis and workshop changed and corrected the DBH measurements and apparently removed or corrected the erroneous measurements. However, no notes on these corrections and sources of errors were available at the time of this report. By comparing the data before and after the data correction, we concluded that some of the anomalously high DBH values have reduced in size. After minimizing the DBH error, we still considered a nominal error associated with

the DBH measurements. Similarly, height data were examined at different NFI plots and it was concluded that no relations between height and DBH could be established. As height values did not seem to be accurate, the height data were eliminated in order to minimize the error and AGB was estimated using allometric models without height. Similarly, we found errors associated with identifying the tree species and the allocation of wood density based on FAO and global data sets. The uncertainty of average wood density of the plot was estimated by comparing wood density values from different sources and quantifying the error associated with the missing species identification that required average tree wood density.

3. **Allometric Model Error:** Tree biomass is estimated from size measurements and species wood density from allometric models. These models can be variable depending on the forest type, environment and edaphic conditions controlling growth and mortality of trees and other factors that impacts species composition and structural variations. There are several models in the literature that can be used to estimate the tree biomass and hence the biomass of a plot when inventory is available. The uncertainty of the allometric model is due to the choice of tree biomass allometry model, the errors associated with the coefficient of the model, or associated with the residual model error. The largest uncertainty is related to the choice of allometry (Saatchi et al. 2015; Picard et al. 2015). This error can be minimized by using the latest Chave et al. 2014 allometry. The model includes measurements of DBH and wood density and but replaces the height with an estimate based on the variations of tree height along climate and water stress gradients (Chave et al. 2014).
4. **Representatively of the NFI plots:** The inventory data collected by the CNIAF and delivered to the ER Program did not include data for all plots located in the swamp forests. Due to the difficulty of establishing and measuring tree size and structure in permanently or seasonally inundated forests, the CNIAF team concentrated on the terra firme forests. Therefore, the NFI data do not provide a complete systematic sampling of forests at the national and sub-national scale. To minimize the problem of bias sampling in the NFI data, we included LiDAR measurements collected systematically over the entire country in all forest types.
5. **Other Sources of Errors:** The *a priori* location of the plots provided by the CNIAF to the ER-Program as part of the systematic sampling approach were not the true location of plots. Notes from the field operators provided the new UTM coordinates of the beginning and ending of the cluster plots. These additional notes did not include any errors but could be used to estimate the location of the plots, particularly in identifying the LULC class for each field plot.

The augmentation of the NFI data with LIDAR measurements improved the estimation of biomass for all LULC classes. There were a total of 61,000 LIDAR shots of about 0.25 ha over the departments of Sangha and Likouala together. These measurements cover a variety of vegetation types including the degraded forests and other land use classes of agriculture and agroforestry. LIDAR sampling of the vegetation is approximately systematic with some level of clustering. The LIDAR measurement errors have been quantified in previous studies (Lefsky, 2010; Saatchi et al., 2011) and these errors have been propagated through the biomass estimation. In general, the following sources of uncertainty in LIDAR-derived biomass was identified and included in the overall assessment of the uncertainty.

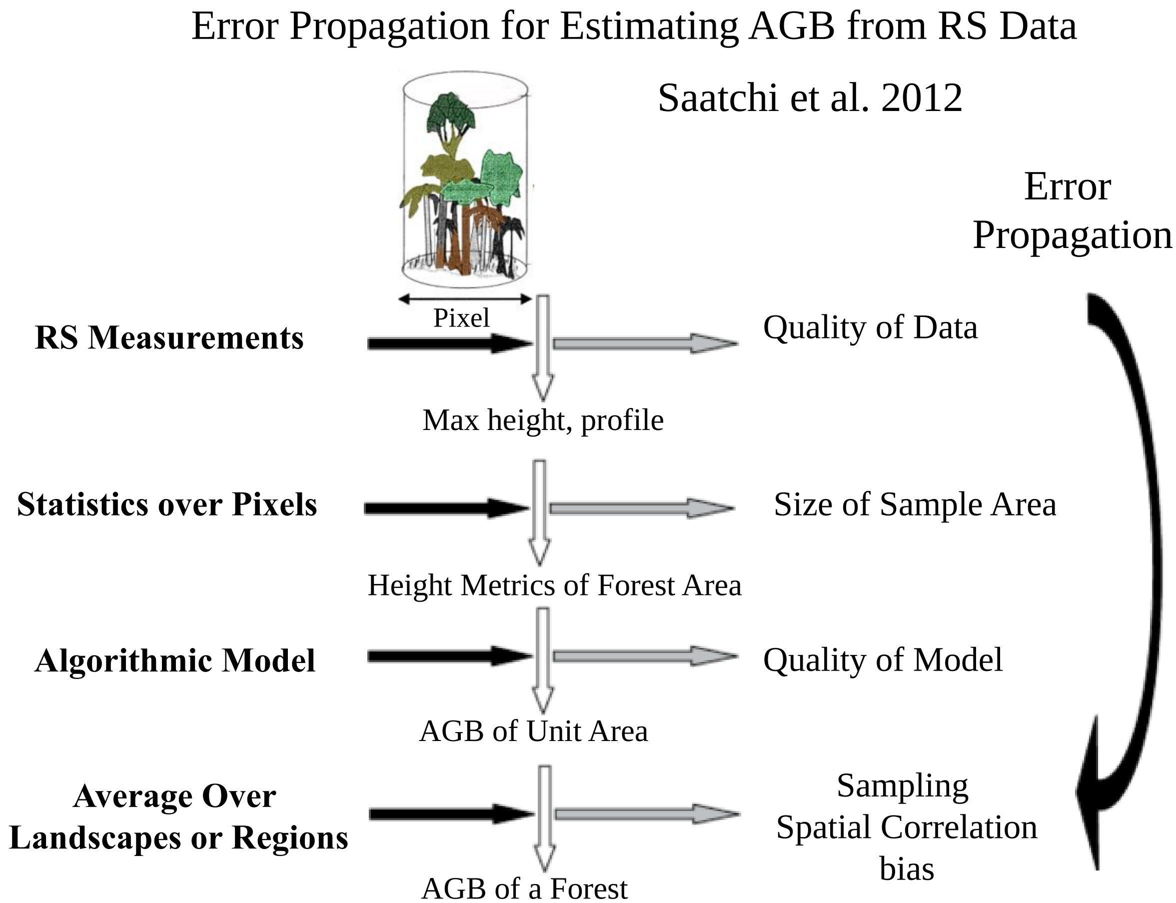


Figure 30. Schematics showing the sources of uncertainty in remote sensing estimation of AGB and the process of error propagation for uncertainty assessment

1. **LiDAR Height Measurement Error**: The LIDAR height measurement error is associated with the estimation of Lorey's height from GLAS Lidar data. For broadleaf forests, the RMSE has been estimated to be 3.3 m (Lefsky, 2010) or a relative error of about ~13.7% over the entire height range. The source of the measurement errors are: 1) the geolocation error causing a mismatch between the LiDAR shot and ground plots, 2) the difference between the size of plots used for comparison and error analysis and the size and shape of LiDAR shots (~0.25-0.5 ha), 3) the effect of surface topography for introducing changes in the waveform and ground detection, and 4) potential effect of cloud and haze causing errors in the height measurements. These errors can be readily minimized over the study are by applying several filters to remove all LiDAR shots with potential cloud or haze effects, remove all LiDAR shots located on slopes greater than 10%, and filter all LiDAR shots with waveforms that do not have strong ground return or do not have the general features of the forests.

2. **LiDAR Sampling Error**: LIDAR sampling have two sources of uncertainty: 1) the samples are collected along the satellite orbits that do not drift significantly on the ground and produce a systematic sampling but clustered along or near the orbital tracks, and 2) the size of the LiDAR shots are smaller than the pixels used for developing the maps causing a sub-sampling the pixels. including the uncertainty associated with the cluster sampling.
3. **LiDAR Biomass Model Error**: The conversion of LiDAR shots to AGB requires the use of calibration plots under the LiDAR measurements. However, the NFI data could not be used for calibrating the GLAS LiDAR data due to their size and location. The ER Program used a calibrated modes developed in Central Africa (Saatchi et al., 2011) to convert all LiDAR data to biomass. This model was developed by a relatively representative sample of forests in Central Africa. The model was recently compared with the ground and LiDAR data collected in DRC as part of their national carbon mapping project and performed with relatively small bias. The use of the model for the ER Program are may introduce systematic errors. However, these errors can be minimized by comparing the LiDAR derived biomass with the NFI data at the map scale and develop a bias-correction approach. The use of NFI data will help to quantify the bias and remove it in order to provide a reasonably unbiased estimate of biomass at the pixel scale.
4. **Spatial Modeling and Mapping Error**: LIDAR-derived biomass estimates were used in a non-parametric machine learning model to estimate and map biomass at 100 m (1-ha) resolution over the entire project area. The model is based on the Maximum Entropy Approach (Saatchi et al. 2011). The map provides a large number of samples for quantifying the mean and variance of biomass estimates over each LULC class. However, the map will have both random and systematic errors at the pixel level that must be included in the uncertainty of biomass estimates for each LULC class in the project area. In addition to random errors that are errors related to the machine learning algorithm and the lack of sensitivity or quality of the remote sensing layers used for mapping biomass. Similarly, potential bias in the estimates may still exit that can be minimized by using the national inventory as a regional reference data.
5. **Spatial Auto-correlation Error:** the spatial auto-correlation at the pixel level introduces uncertainty that must be included in estimating the overall uncertainty or standard error of biomass estimation at the LULC class level or at any scale larger than a pixel. The uncertainty cannot be minimized as it is primarily due to the sensitivity of the remote sensing layers used to extrapolate the LiDAR and plot data, and the application of the estimation technique used in the machine-learning algorithm.

Steps to Minimize Uncertainty

The steps to minimize the uncertainty have been discussed for each source of uncertainty above. The ER program focused on both the uncertainty in inventory and remote sensing data.

Inventory Plots: With the support of FAO and CNIAF, the errors within the inventory plots have been addressed and a significant number of errors associated with the measurements and the use of allometry have been minimized at the national level. The corrected and improved inventory data were delivered to the ER program that used a series of models and calculations to further improve the estimates of forest biomass from inventory plots and to recalculate the errors associated with the ground-based estimates of forest biomass (ANNEX 12. Uncertainty).

Remote Sensing Data: LiDAR samples were used as inventory measurements of forest structure that were converted to aboveground biomass to improve estimation of emission factors. All sources of uncertainty in LiDAR measurements, conversion to biomass, and bias correction have been implemented on the data to reduce the overall uncertainty associated with the LiDAR estimation of forest biomass.

Assessment of contribution of sources of uncertainty

The main sources of uncertainty that can have significant impact on the overall accuracy of the emission factors are due to errors in inventory data and remote sensing measurements. The assessments of the errors for all components of uncertainty are performed in the following sections. The details of validation and uncertainty estimates are also provided in the supplementary material (ANNEX 13. Uncertainty Evaluation of Mapping Products).

12.2 Quantification of Uncertainty in Reference Level Setting

Uncertainties in Deforestation and Forest Degradation

Where uncertainty could not be reduced to zero or close to zero (e.g. by applying conservative values), uncertainty for all activity data and emission factors was quantified. There are two methods for calculating the total uncertainty for a project activity: The first method uses simple error propagation through the root of the sum of the squares of the component errors. According to IPCC (2006), in order to quantify uncertainty using the simple propagation of error method, estimates of the mean and the standard deviation for each input are required, as well as the equation through which all inputs are combined to estimate an output. The following approach was applied. The second method uses Monte Carlo simulations to propagate errors. The advantage of the first method is that it is simple to use and requires no additional computer software. However, the second method should ideally be used where correlations exist between data sets, for example between two carbon pools; or uncertainties are very large (greater than 100 per cent). The principle of Monte Carlo analyses is to perform the summing of uncertainties many times using the uncertain stocks or increments chosen randomly by the computer software from within the distribution of uncertainties that the user initially inputs.

Activity Data

The accuracy assessment of historical LULC classification is conducted for all LULC maps across the entire accounting area. The accuracy has been assessed by comparing predicted classes for a number of reference locations with independently determined LULC classes from a sample of more than 900 points collected from high resolution imagery in Google Maps, limited field surveys, comparison with the FAO national LULC map, and internal classification accuracy assessment using a cross-validation between training and test data within a bootstrapping approach reproducing the classification uncertainty with about 100 iterations for each class type.

The sampling methodology for accuracy assessment of the LULC map and for the historical LULC change classes and the analysis of uncertainty was based on the good practices described by Olofsson *et al* (2013)[129] in three stages: the definition of the sampling system, the adoption of an optimal response system, and analysis. The analysis of accuracy will be based on the following definitions of errors taken from Olofsson et al. 2013.

1. **Overall accuracy** is simply the proportion of the area mapped correctly. It provides the user of the map with the probability that a randomly selected location on the map is correctly classified.
2. **User's accuracy** is the proportion of the area mapped as a particular category that is actually that category "on the ground" where the reference classification is the best assessment of ground condition. If a "user" employs the final change map for locating a particular area of land change, the user's accuracy gives the conditional probability of that map location actually having changed. User's accuracy is the complement of the probability of commission error.
2. **Producer's accuracy** is the proportion of the area that is a particular category on the ground that is also mapped as that category. The producer's accuracy provides the "producer" of the final land change map with the conditional probability of a particular location of actual land change appearing as land change on the map. Producer's accuracy is the complement of the probability of omission error.

The accuracy assessment of the maps was conducted by two groups and chose the most conservative estimates of uncertainty to be included in the final uncertainty analysis.

The first group used two sets of samples to evaluate the map. The first set included 350 random samples provided by FAO and used as part of the national LULC map validation and an extra number of 350 samples randomly selected following the Olofsson et al. 2013 approach. About 258 samples in forest class and 108 in degraded and 110 in non-forest class were included. The validation only included these three classes. The samples were visually interpreted with a combination of google earth high resolution imagery and expert inputs. The overall accuracy of the map was above 96%. This estimate of accuracy was higher than the one performed by the external experts.

[129] Olofsson, P., Foody, g., Stehman, s., Woodcock, c., 2013. Making better use of accuracy data in land exchange studies: Estimating accuracy and area and quantifying uncertainty using stratified estimation. Remote Sensing of Environment 129 (2013) 122-131.

The second group included external consultants from FAO and technical staff from CNIAF who performed an independent validation of the results.

Sampling System for Uncertainty Analysis: The sampling for validation of the map was based on the stratified sampling with sampling following a random allocation of points or pixels in each stratum. With precision expected stable classes 0.9 and 0.5 to change classes, 931 points distributed between classes as shown in the following table and figure. Olofsson et al. (2014)[130] recommends to aggregate classes in the case of complex classification systems and develop the accuracy of LULC change and transitions based on stable and non-stable classes or strata. This approach is particularly valid when the number of transitions are small, for example from non-forest to forest classes. In addition, samples in a buffer region at 1-pixel around the deforested and degraded areas are also selected for uncertainty analysis because of the larger weight associated with the omission errors of the forest class because of the size of the stratum or class. Since omission errors in deforestation and degradation are likely to occur close to observations of deforestation and degradation, it could be useful to stratify the stable classes based on proximity to deforestation and degradation observations so that this issue is avoided.

The uncertainty analysis of the maps are developed at the pixel level. However, each classified pixel is the result of segmentation based on approximately 7 pixels (~0.54 ha), which is approximately the same scale as the minimum mapping unit (MMU) of 0.5 ha. This MMU is achieved both through the processing of the Landsat segmentation through a moving window analysis and through a post-processing filter based on modifying classes based on the classification of 6 pixels around a center pixel. For example, for any pixel at the point (I,j) in the map, the pixels around this pixel are used in the filter. The moving pixel filter eventually filters the entire map and creating classes based on the MMU.

It is worth noting that the mapping for the national baseline minimum unit adopted a threshold of 0.5 ha, below which losses were not considered to be in agreement with the national definition. The detection of losses in our map suggest that there are more than 25% more losses than the national map. The difference was mainly due to detailed change detection of the Landsat imagery on the maps produced in the project area that are not reflected in the national map. In the regional map produced for the project area, each image for a point in time was classified separately potentially producing a more accurate estimate of deforestation and degradation than global maps with general detection approach.

Table 74. Sampling points randomly selected in each strata for validation of LULC map and LULC changes.

Strata	Area (1,000 ha)	Number of Points
Forest	11,475	512
Non-Forest	418	119
Deforestation (Forest Loss)	157	100

[130] Olofsson, Pontus, Giles M. Foody, Martin Herold, Stephen V. Stehman, Curtis E. Woodcock, and Michael A. Wulder. "Good practices for estimating area and assessing accuracy of land change." *Remote Sensing of Environment* 148 (2014): 42-57.

Strata	Area (1,000 ha)	Number of Points
Degradation	162	100
Buffer Zone (Forest Loss)	145	100

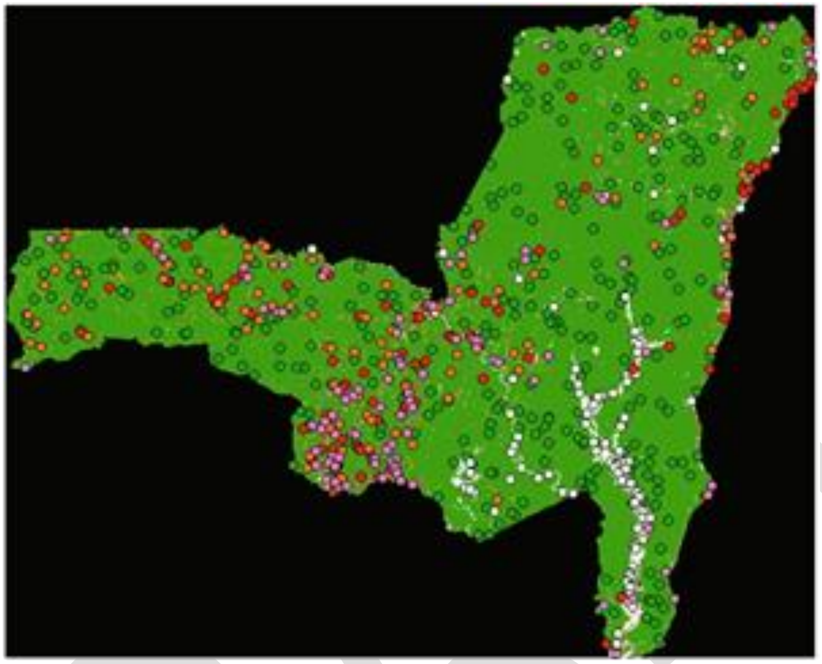


Figure 31. Distribution of sample points in the Accounting Area showing the forest points in hollow circles, non-forest in white solid circles, deforested or forest loss in pink circles, degradation in orange circles.

For quantifying the accuracy of LULC transitions, the following strata were used for validation:

- Forest Stable (all types of forest remaining forest except to secondary forests)
- Degradation (all forest to secondary forest)
- Deforestation (all forest to non-forest)
- Non-forest Stable (all other transitions)

The sample points were visually interpreted for class assignments using several data sources including the high-resolution imagery from the google earth (Figure 32), and SPOT imagery available to the team from 2010 (20 m resolution) and 2015 (10 m resolution). In addition, composite annual Landsat images at 30 m resolution with cloud cover less than 5% have been cut for an area of 1 km around sampling points, to visualize the changes of vegetation (NDVI index used for visualization) during the reference period. The results of the analysis are produced in terms of the confusion matrix. FAO also produced a table of estimated surfaces corrected using an interface developed by FAO with the shiny package in R software. The visual interpretation of points was performed by a mapping team from the CNIAF working closely with the FAO scientists. For each of the 14 members of the Working Group, about 49 points by stratum were awarded:

21 points in forest, 8 in the Non-forest, 6 points in Deforestation, 7 points in the buffer zone near the deforestation and Degradation pixels. Points have been interpreted individually as a first step, and then the results were examined by the whole group and, if necessary, modified and corrected.

The confusion matrix indicates a general precision adjusted 95% (Table 75). The user precision (indicates the likelihood of a class on the map to be properly attributed) presents the differences between classes: it is higher for stable classes (> 85%) and lowest for change classes (~ 40%). The adjusted producer accuracy (the probability that a class of the reference data set is depicted on the map) is better to change classes, indicating low errors of omission.

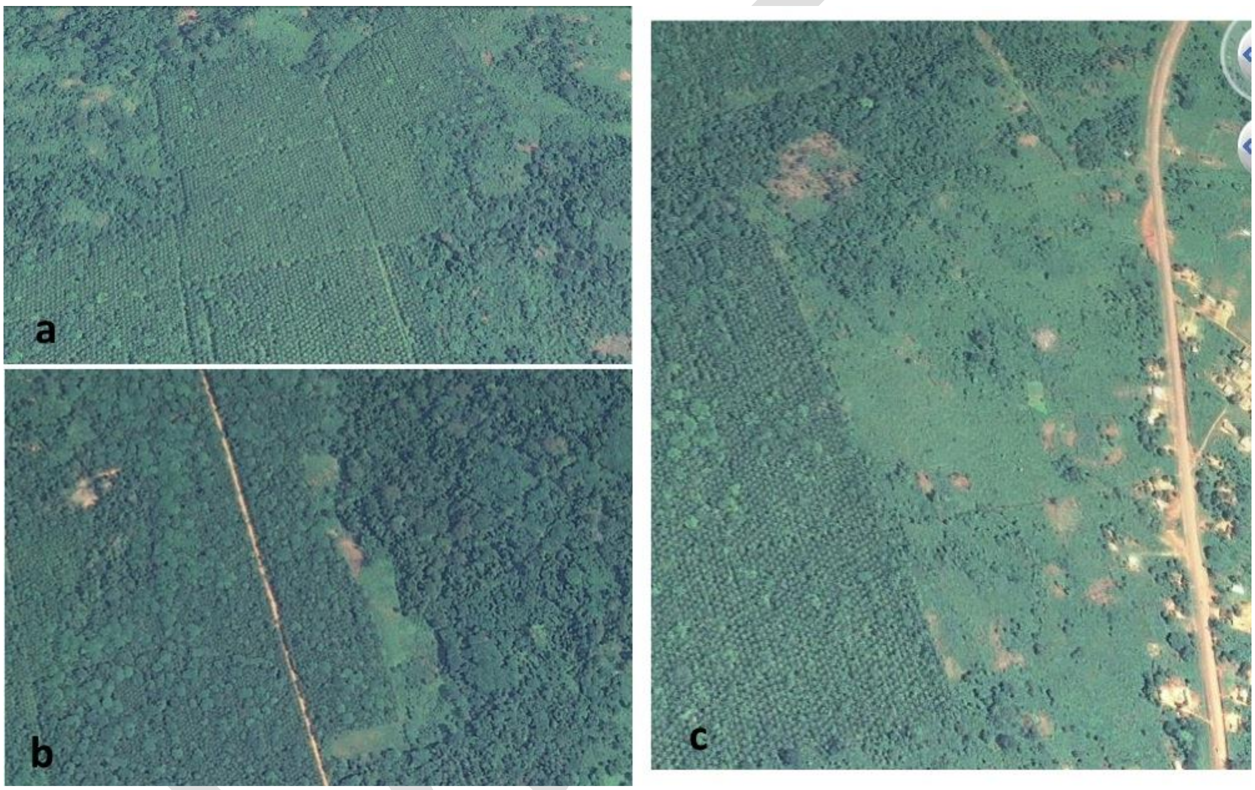


Figure 32. Samples Collected from the High resolution Google Earth for the Validation of the 30 m LULC Map Showing Different Degrees of Forest Degradation, Agroforestry, Deforestation, and Road Development in the Region.

Table 75. Confusion Matrix of Sampling Points on Classified LULC Map

			REFERENCE To Class						
			FF	NF	DF	DG	BF	Total	UA
CLASSIFICATION	From Class	FF	505	6	1	0	0	**512**	**98.63%**
		NF	13	103	0	3	0	**119**	**86.55%**
		DF	39	11	36	14	0	**100**	**36.00%**
		DG	56	0	2	42	0	**100**	**42.00%**
		BF	82	2	3	13	0	**100**	
		Total	**695**	**122**	**42**	**72**	**0**	**911**	
		PA	**72.66%**	**84.43%**	**85.71%**	**58.33%**			

Overall Accuracy: 73.68
Overall Accuracy Adjusted: 95.53%

The evaluation of the accuracy of the map of land for 2003-2012 has been implemented by the CNIAF with the support of FAO. The land use map prepared presents an overall accuracy of 95% for aggregated classes. Between 2003 and 2012, 155,208 ha of forest were lost, an average rate of annual loss of 0.15% for the period. This figure is higher than the rate of deforestation postponed national submission of the Reference level to the UNFCCC.

The difference is less related to the different minimum mapping unit (0.5 ha in the national map and ~0.5 ha in the ER-Program map) and more due to the region specific classification of deforestation and degradation than the use of global datasets as used in the national map.

Table 76. Producer and user accuracy and surface area and adjusted surface area for the LULC map (2003-2012)

	Producer Accuracy	User Accuracy	Area
Forest remaining Forest	97%	99%	11,789,948
Non-forest remaining non-forest	70%	87%	382,656
Deforestation *(forest to non-forest)*	65%	36%	155,208
Degradation *(Primary forest to degraded forest)*	57%	42%	107,341
Total	96%		12,435,153

Sangha and Likouala forest cover is 11,729,979 ha, or 95% of the area of the two departments. As noted above, between 2003 and 2012, 155,208 ha of forest were lost, an average rate of annual loss of 0.14%. These figures for the two departments are in the high range obtained for the reference level at the national level, submitted to the UNFCCC (Congo, 2016), which gave an average of lower 0.052% annual losses for the whole country.

Figure 33. Georeferenced Ground Samples Collected During the Field Survey Showing Examples, Deforestation (a), Development of Plantation after Deforestation (b), Forest Degradation c), and Logging Impacts (d).

The classification accuracy and the overall assessment of uncertainty from the cross-validation of classification map for the year 2015 uses the above samples. The historical maps have also been validated by using the bootstrapping approach and internal training and testing statistics. The overall accuracy of the maps are 86% (2003), 89% (2007), 91% (2012) and 91% (2015).

Table 77. Accuracy Assessment of the LULC map for the Most Recent Year of 2015 Derived From a Combination of Field Data, Google Map, and Comparison with Other Imagery.

LULC Class Type	Omission Error	Commission Error	Overall Class Accuracy
Primary Forest (PRI)	7%	4%	91%
Secondary/Degraded Forest (DGS)	13%	18%	79%
Wetland/Swamp Forest (FWL)	3%	7%	96%
Semi-deciduous/open forest (DEC)	6%	11%	86%
Bare/grassland Non-forest (BAR)	8%	6%	89%
Other wetland Non-forest (OWL)	1%	8%	92%
Agriculture/Tree Plantation (AGR)	16%	7%	81%
Overall Map Accuracy: 91%			

Emission Factors

The forest carbon estimates are produced using a combination of tree level measurements and models. All ground measurements, remotely sensed observations, and process-based and statistical models are all imperfect and no matter how carefully obtained, managed, or processed. After models are fit to data, substantial noise (i.e. residual errors) will certainly remain. This residual noise is due to both measurement and model uncertainty (i.e. noisy data and imperfect models), with model uncertainty potentially due to both parameterization and choice of the functional form of the model. In addition, the variance of these residuals can be heteroscedastic (i.e. not constant with respect to one or more of the independent variables). The bootstrapping approach to uncertainty assessment, also known as resampling with replacement, is more appropriate than conventional analytic methods for data with heteroscedastic and/or non-normally distributed errors. This method assumes that the observed data represent only one possible realization out of many, and reconstructs a large number of alternate realizations based on random resampling of the residuals. Bootstrapping brackets the range of unobserved values conditioned on the assumption of the model and its associated likelihood function[131].

Uncertainty in Forest Inventory Data at the Plot Level

Errors from different sources were propagated into the local allometric model used for the ER-Program and evaluated the ensemble effect of errors on the estimation of plot level forest biomass carbon stock. The following assumes that the measurement and the allometric uncertainties are independent sources of variability. The overall uncertainty on the AGB estimation of a single tree therefore:

$$\sigma = \sigma_A + \sigma_M$$

To estimate the error in tree level biomass estimation, the allometry and measurement errors need to be quantified. The allometry error was defined to be approximately 34% for trees > 10 cm diameter (Chave et al. 2003)

$$\sigma_A = 0.34 < AGB >$$

For measurement errors, different sources of errors were included, including DBH measurement error, height model error, wood density error, and allometric model error. To combine the errors, we first converted the standard errors for each term in units of Mg/ha as the effect they may have on the biomass estimation. Second, these errors were assumed to be independent in nature. The argument in independence is justified as measurement errors for size, wood density, and model errors are not related and can be considered independent source of error. To estimate the ensemble effect, the following error propagation formula was used:

[131] Efron, Bradley; Tibshirani, R.J. An introduction to Bootstrap. New York: Chapman and Hall, 1993.

$$\sigma_M = <AGB> \left[\alpha^2 \frac{\sigma_D^2}{D^2} + \beta^2 \frac{\sigma_H^2}{H^2} + \delta^2 \frac{\sigma_\rho^2}{\rho^2} + 2\alpha\beta \frac{\sigma_{DH}}{DH} \right]^{1/2}$$

$$\alpha = \frac{\partial \ln(f)}{\partial \ln(D)}, \quad \beta = \frac{\partial \ln(f)}{\partial \ln(H)}, \quad \delta = \frac{\partial \ln(f)}{\partial \ln(\rho)}$$

$$f = a\rho D^2 H$$

where the function f represents the general form of the allometric equation and in our case, it is the local equation. For the diameter measurement error, a nominal number was derived from the different between values provided before and after the IFN quality assessment of about 10% (10% of the mean). This estimate of error in DBH may be a conservative estimate as there were large uncertainty in the diameter of large trees and a significant number of missing trees below 20 cm in the data set provided. For height measurement error 6/30=0.2 (20%) was used and for wood density 0.03/0.6=0.05 (5%) (Saatchi et al., 2011; Chave et al. 2003), and a correlation coefficient of 0.60 between diameter and height in the above equation. The correlation coefficient is derived from relating forest height to diameter. These will provide the measurement error of about 23% of the AGB:

$$\sigma_M \approx 0.23 < AGB >$$

The total uncertainty of AGB estimation for a single tree is on the average 57%, partitioned into 34% due to allometric error and 23% due to measurement errors.

The tree-level uncertainties shown in the above model will average out at the plot level when the number of trees in sample plots increases. The above relation also suggests that biomass estimation of individual plots with less 50 trees can be much larger than expected. For example, in a typical plot of 0.5 hectare used in the IFN sampling, the average number of trees are about 46 for trees > 20 cm and about 89 for trees > 10 cm, standard error on the AGB estimate is 6% of the mean or 11% at the 95% confidence interval. In Chave et al. (2003), the uncertainty on AGB estimate was assessed based on limited sampling plots and was shown the AGB held in the sub-plots of a 50 ha plot is not auto-correlated, even for very small sub-plots: two neighboring sub-plots of size 10 m x10 m to 100 m x 100 m are not significantly more similar in their AGB stock than two randomly chosen plots. A test of normality was also developed for the data. This suggests that for ground plot estimate, there is no need to include any spatial auto-correlation error. In addition, the test of normality at plots at difference sizes indicate that the size of one-quarter of a hectare is the minimal size such that the normality criterion is satisfied in this forest, in agreement with other published results in tropical forests. Although this figure might vary slightly with the stem density in the plot, it can be taken as a reasonable guideline. In the Accounting Area, the minimum size of 0.5 ha was used for field surveys and biomass estimation. The uncertainty associated with the ground estimation of biomass for each subplot is assumed to be 11% of the mean at the 95% confidence interval.

Uncertainty in LiDAR Estimates of AGB

The statistical analysis includes evaluating the performance of the model selected above based on regressing a dependent variable (AGB) against one or several independent variables (in our case, WD and H). The general form of the model as shown above is followed by assuming ε as an error term as a normally distributed with zero mean and SD of σ. If the model as the one selected above as p parameters (p=2 for WD and h), then the σ is defined as:

$$AGB = a(WDh_{TCH})^{b} + \varepsilon$$

$$\ln(AGB) = a + b\ln(WDh_{TCH}) + \varepsilon$$

$$RSE = \sigma = \sqrt{\frac{1}{N-p}\sum_{i=1}^{N}\varepsilon_i^2}$$

$$N(\varepsilon) = N(0,\sigma^2): \text{ Distirubtion of errors}$$

The model as shown above can be linearized in the ln form to simplify the model as a linear regression model. The model be used to estimate AGB from the parameters developed at the plot level, i.e. average wood density WD (g cm-3) and hTCH (m). The estimated value of AGB can be written as:

$$AGB_{est} = \overline{\exp\left[a + b\ln(WDh_{TCH}) + \varepsilon\right]} = \overline{\exp(\varepsilon)} \times \exp\left[a + b\ln(WDh_{TCH})\right]$$

where

$$\overline{\exp(\varepsilon)} = \int \exp(\varepsilon) N(\varepsilon)\, d\varepsilon \text{ with } N(\varepsilon) = N(0,\sigma^2)$$

$$\overline{\exp(\varepsilon)} = \exp(\sigma^2/2)$$

then

$$AGB_{est} = \exp\left[\sigma^2/2 + a + b\ln(WDh_{TCH})\right]$$

The last equation provides the unbiased estimator for AGB using the height and wood density. To examine the model, the plot data and calculated the average systematic error (bias) and the coefficient of variation (CV) are used as follows:

$$bias = \frac{1}{N}\sum_{i=1}^{N}\frac{(AGB_{est}(i) - AGB_{obs}(i))}{AGB_{obs}(i)}$$

$$RSE = \sqrt{\frac{1}{N-P}\sum_{i=1}^{N}\left[AGB_{est}(i) - AGB_{obs}(i)\right]^2}$$

$$MAGB = \frac{1}{N}\sum_{i=1}^{N} AGB_{obs}$$

$$CV = \frac{RSE}{MAGB}$$

where RSE is the residual standard error representing the random errors. The standard deviation of estimation error can be computed as: $SD = \sqrt{RSE^2 - bias^2}$.

One allometric model for all forest types is used by changing the average wood density.

The LiDAR data acquired over the Accounting Area followed a stratified random sampling approach where the remote sensing sampling units represented by the GLAS LiDAR shots at 0.25 ha footprint size. There are also spatial correlation between the GLAS shots due to data collection along the orbital tracks and clustering of data. Sampling with LiDAR are designed to provide a balanced random or systematic sample of stratified classes and therefore for each LULC unit or strata j there are ηj sampling units and within each sampling units there are ηij LiDAR grid cells. The LiDAR grid cells within each orbit line are considered clustered and the estimator for the mean and variance of biomass density for each stratum are given as follows:[132]

$$\mu_j = \frac{\frac{1}{n_j}\sum_{i=1}^{n_j} F_{ij}(\alpha_j)}{\frac{1}{n_j}\sum_{i=1}^{n_j} \eta_{ij}}$$

$$\mathrm{var}(\mu_j) = \frac{1}{\bar{\eta}_j^2} \frac{\sum_{i=1}^{n}\left(F_{ij}(\alpha_j) - \mu_j \eta_{ij}\right)^2}{n(n-1)} + \frac{1}{\bar{\eta}_j^2} \sum_{k_1}^{p_j}\sum_{k_2}^{p_j} Cov(\alpha_{k_1 j}, \alpha_{k2j}) \bar{F}'_{k_1 j} \bar{F}'_{k2j}$$

$$where$$

$$\bar{F}'_{k_1 j} = \sum_{i=1}^{n}\sum_{t=1}^{T} \frac{\partial f(x_{it}, \alpha_{k_1})}{\partial \alpha_{k_1}}$$

$$where$$

$$AGB = f(x, \alpha, \varepsilon) = a(WDh_{TCH})^b + \varepsilon$$

where μ_j is the mean carbon density of stratum j, F_{ij} is the carbon density estimates for sample i in stratum j, nj is the number of orbits intersecting stratum j, α_j represents the vector of parameters used in the biomass model (e.g. a and b in LiDAR model in above AGB equation, and η_{ij} is the number of LiDAR biomass units (cluster size) in each sample unit i intersecting stratum j. Note that if LiDAR biomass estimates are at 1-ha units, η_{ij} represents the size of the LiDAR orbital transect in ha. In above equation, $cov(\alpha_{k_1 j}, \alpha_{k_2 j})$ is the covariance of k1 and k2 coefficients of the LiDAR biomass predictive model, represented by function f for stratum j. The

132 Næsset, E. et al. 2013. Model-assisted estimation of change in forest biomass over an 11 year period in a sample survey supported by airborne LiDAR: A case study with post-stratification to provide "activity data". Remote Sensing of Environment, 128, 299–314; Neigh, C et al. 2013. Taking stock of circumboreal forest carbon with ground measurements, airborne, and spaceborne LiDAR. Remote Sensing of the Environment 137: 274-287; Stahl, G. et al. 2011. Model-based inference for biomass estimation in a LiDAR sample survey in Hedmark County, Norway. Canadian Journal of Forest Research 41: 96-107.

first term in equation in variance estimate represents the sampling error and the second term describes the model error for each stratum or forest class. The above relations will be simplified if only one LiDAR model is used for all strata.

The LiDAR model-assisted estimator of biomass (carbon density) is approximately a design-unbiased estimator irrespective of the model of choice when the number of samples collected in each area is large (a valid case for the GLAS LiDAR data over the Accounting Area). The variance estimator also propagates the error from the LiDAR predictive model for estimation at the statra and land cover class scales. The uncertainty of LiDAR derived biomass for each LiDAR footprint (0.25 ha) remains bounded to about 28%.

Uncertainty of Biomass Map

The estimation of the emission factors derived from the biomass map where a large number of pixels are used to estimate the mean and variance of carbon stocks in all LULC classes includes both the errors associated with the prediction of biomass for each pixel and the spatial covariance of the errors associated with pixel level estimation. The uncertainty at each pixel will be estimated using the Bayesian probability density functions associated with each biomass level in Maximum Entropy spatial estimation approach (Saatchi et al. 2011). For the prediction errors from the Maximum Entropy estimation spatial model ($\varepsilon_{prediction}$), $\varepsilon_{prediction}$ is calculated using 20% of the LiDAR samples that were set aside and not used in the MaxEnt model for creating the map. The average uncertainty is estimated to be 27.8% from model prediction of AGB. Spatial uncertainty at the pixel-level is estimated by using the predicted probabilities of the MaxEnt model in

$$\sigma_{\hat{B}} = \sqrt{\frac{\sum_{k=1}^{N}\left(B_k - \hat{B}\right)^2 P_k P(A_k)}{\sum_{k=1}^{N} P_k P(A_k)}}$$

where Bk is the mean biomass of the kth range, $\hat{B}$ is the predicted biomass value, Pk is the MaxEnt generated probability for biomass range k, and P(Ak) is the prior probability of any pixel being in biomass range k as used in SI Equation 2. The relative uncertain for each pixel is then $\varepsilon_{prediction} = \frac{\sigma_{\hat{B}}}{\hat{B}} \times 100$.

In estimating forest above ground biomass distribution everywhere in the ER Accounting Area, each step in the entire process is evaluated for possible sources of error, and associated uncertainties are quantified. The sources of error on AGB value are, in the order of the model procedures, measurement error associated with estimation of LiDAR height (very small error), sampling error associated with representativeness of LiDAR height samples as the true height distribution of the strata, as well as heterogeneity of forest biomass in the 100 m pixels ($\varepsilon_{sampling}$), prediction errors from the Maximum Entropy model ($\varepsilon_{prediction}$), and allometric error when converting LiDAR height metrics to AGB ($\varepsilon_{allometry}$). RMSE for LiDAR measurement of height is < 3 m at each footprint (0.25 ha). The uncertainty from ground estimation of biomass is assumed to be approximately 11% at 0.5 ha scale and about 7% at 1-ha.

Allometric errors for height to biomass equation can be estimated from the relationships in converting LiDAR measurements to ground estimated biomass. This allometry is shown in the above section. The errors associated with ground allometry is approximately are also discussed above. A 28% error is assumed for the LiDAR estimation of biomass.

The enables a calculation of the total uncertainty in estimating AGB, assuming all errors were independent and random, by using

$$\boldsymbol{\varepsilon_{AGB}} = \sqrt{\boldsymbol{\varepsilon^2_{measure}} + \boldsymbol{\varepsilon^2_{allometry}} + \boldsymbol{\varepsilon^2_{sampling}} + \boldsymbol{\varepsilon^2_{prediction}}}$$

where each of the terms are the relative errors at that pixel. Using the above equation, the errors at the pixel level are propagated and a map of the uncertainty at the pixel level is created.

In addition to above uncertainty at the pixel scale, to calculate the uncertainty at the LULC classes for forest biomass, the spatial correlation of the errors at the pixel level much be taken into account. The combined area samples with LiDAR and IFN derived map pixels within each LULC and the spatial correlation derived from semi-variogram analysis will provide the correction to the estimate of the error using the following model.

$$\sigma_L^2 = P^{-1}\frac{1}{m}\left(\sum_{i=1}^{m}\sigma_{ui}^2 + 2\sum_{i=1}^{m}\sum_{j<i}^{m}\rho(d)\sigma_{ui}\,\sigma_{uj}\right)$$

$$\rho(d) = \exp(-\frac{d}{cr})$$

Where:

P = 1 (representing the size of the pixel as 1-ha).

i, j = Generic indices representing pixels in the biomass map

n = Number of pixels within each LULC or stratum.

r = Range from semivariogram estimating the spatial correlation of errors associated with the AGB pixel level errors.

c = Parameter of fit for exponential spatial correlation function derived from semivariogram analysis. c=1/3 is the default value (Chilès & Delfiner 2012) (unitless)

d = Distance between pixels i and j within m (pixels).

$\rho(d)$ = Spatial correlation function in terms of distance d based on exponential semivariogram model. (unitless)

σ_L^2 = Variance derived from a-priori RS data, a pilot study, or default values of AGB density for the LULC class.

m = A dummy large number representing pixels in the map for each LULC The number can be arbitrarily large or at least twice the default value of range (r).

$\sigma_{ui,j}^2$ = Estimated variance associated with AGB values for each pixel 1-ha pixel of the map.

The final uncertainty in the carbon stocks for each class computed from the above method are summarized in the table below in terms of the uncertainty at 95% confidence interval using the above methodology.

Table 78. Biomass in Each LU/LC Type

Vegetation Type	Mean AGB (Mg/ha)	SE AGB (Mg/ha)	Mean BGB (Mg/ha)	SE BGB (Mg/ha)	AGC + BGC (MgC/ha)	SE AGC + BGC (MgC/ha)
Primary Forest (PRF)	316.95	6.95	74.49	8.52	195.75	7.73
Secondary/Degraded Forest (DSF)	209.89	7.79	50.02	9.54	131.45	8.67
Wetland/Swamp Forest (WLF)	214.6	7.46	50.44	9.15	132.55	8.31
Semi-deciduous/ open forest (SDF)	172.56	3.16	40.56	3.87	106.57	3.52
Bare/grassland Non-forest (BGN)	46.88	5.71	9.76	7.01	28.69	6.36
Other wetland Non-forest (OWL)	76.95	6.29	15.86	7.72	46.62	7.01
Agriculture/Tree Plantation (AGR)	103.22	6.42	21.16	7.87	62.19	7.15

Uncertainties of the Reference Level

Uncertainties in deforestation and unplanned forest degradation

The overall uncertainty of emissions from activities during the reference period were calculated from the uncertainties in activities and emission factors. Emissions are calculated by multiplying the emission factors and the forest cover changes for each strata. The uncertainty in emissions will be the joining uncertainty of the emission factors and uncertainty in historical forest cover change and classification. Statistical uncertainty bounds associated with the final forest carbon stock and change estimates are estimated using a randomized, Monte Carlo-style sampling technique.[133] This technique relies on the bootstrapping approach described above. Bootstrapping and its Monte Carlo-style framework avoids making incorrect assumptions about

[133] O'Hagan, A. et al. 2006. Uncertain Judgements: Eliciting Expert Probabilities. Wiley.; Robert, C; Casella, G. Monte Carlo Statistical Methods. New York: Springer, 2004.; Harris, NL et al. 2012. Baseline map of carbon emissions from deforestation in tropical regions. Science 337: 155.

the distribution of the underlying data sets, while combining the individual uncertainties from many different sources (Harris et al. 2012)[134].

A minimum of 1,000 scenarios was constructed, each one generated from randomized alternative data sets, each providing a realistic set of parameters for each model component. At the conclusion of the simulation, each of the 1,000 scenarios will exist as a full resolution gridded map of carbon lost to the atmosphere as a result of forest loss and gain between 2003 and 2012. From these 1,000 scenario maps, the 95% prediction limits are constructed at the pixel, first by aggregating each individual map to the targeted scale (e.g., country, continent) and then selecting the 0.025 and 0.975 percentiles (i.e., 25th and 975th) from the 1,000 sorted simulations. The identification of the percentile values is computed individually for net change of forest cover, carbon stock, and stock changes, such that the low emission value is not simply a combination of the low bound for forest cover change and the low bound for carbon stocks; it is the 50th out of 1,000 sorted simulations that combined change in forest cover and carbon stock.

[134] Harris, N. L., Brown, S., Hagen, S. C., Saatchi, S. S., Petrova, S., Salas, W., ... & Lotsch, A. (2012). Baseline map of carbon emissions from deforestation in tropical regions. Science, 336(6088), 1573-1576.

Table 79. Uncertainty of Reference Emission Levels

Uncertainty of Reference Emission Levels				
Uncertainty Land Use Classification				
Year	**2003**	**2012**	**Overall**	**Overall Adjusted**
Primary (PRF)	12%	9%	10.6%	7.314%
Secondary/Degraded (DSF)	25%	21%	22%	15.18%
Wetland/Swamp (WLF)	8%	5%	7.33%	5.05%
Semi-deciduous (SDF)	16%	13%	14.3%	9.86%
Nonforest (BAR)	9%	11%	10.6%	7.31%
wetland Nonforest (OWL)	9%	7%	9%	6.21%
Agriculture (AGR)	18%	13%	16%	11.04%
Uncertainty (Classification)				*25%*

Uncertainty in Emission Factors				
Land Use Change	**Emission Factor (tCO2/ha)**	**Confidence Interval at 90% tCO2/ha**		**% Uncertainty at 90% CI**
PRI to BAR	608.6	31.7		5.2%
DGS to BAR	373.2	33.0		8.9%
FWL to BAR	377.06	32.2		8.6%
DEC to BAR	281.99	22.43		8.0%
PRI to AGR	489.38	32.43		6.6%
DGS to AGR	253.90	28.65		11.3%
FWL to AGR	258.16	27.87		10.8%
DEC to AGR	162.73	24.33		15.0%
PRI to DGS	235.45	35.56		15.1%
FWL to DGS	0.00	0.00		0.0%
DEC to DGS	0.00	0.00		0.0%
Uncertainty (EF)				*33%*

Uncertainty of Activity Data						
Activity	***Transitions***	***Planned Area Annual (ha)***	***Unplanned Area Annual (ha)***	**Confidence Interval at 90% - Planned (ha)**	**Confidence Interval at 90% - Unplanned**	**Weighted Average CI**
Deforestation	PRI to BAR	749	1,554	10.44	10.48	10.47
	DGS to BAR	1,772	1,588	16.84	16.90	16.87
	FWL to BAR	27	117	8.94	8.86	8.87
	DEC to BAR	365	240	12.18	12.33	12.24
	PRI to AGR	1232	2385	13.16	13.10	13.12
	DGS to AGR	25	25	18.60	18.62	18.61
	FWL to AGR	106	273	12.29	12.19	12.22
	DEC to AGR			8.63	8.68	0.00

Uncertainty of Reference Emission Levels						
Degradation	PRI to DGS	6253	7358	16.72	16.81	16.77
	FWL to DGS	26	52	16.19	16.44	16.36
	DEC to DGS	103	87	18.09	18.08	18.09
Uncertainty (Transitions)						4%

The overall uncertainty for each of the three categories (Emission Factors, Transitions, and LULC images) were calculated as the 90% confidence interval expressed as a percent of the mean, as calculated below:

$$U_{Overall\ Category} = \frac{\sqrt{(CI_1)^2 + (CI_2)^2 + \cdots + (CI_n)^2}}{|Mean_1 + Mean_2 + \cdots + Mean_n|}$$

We combine the uncertainty of each category to estimate the total uncertainty. The overall uncertainty is the square root of sum of each uncertainty squared, as below:

$$\boldsymbol{U_{total}} = \sqrt{\boldsymbol{U^2_{Overall\ Category\ A}} + \boldsymbol{U^2_{Overall\ Category\ B}} + \cdots + \boldsymbol{U^2_{Overall\ Category\ N}}}$$

Where U_{total} is the percentage of uncertainty at 90% confidence level, which is the confidence level required by the Methodological Framework (Indicator 9.2). Using the above table the overall uncertainty of the RL is given by:

$$U_{total} = 41.24\% \text{ at } 90\% \text{ CI}$$

Aggregate Emission Reduction Uncertainty	Adjustment Factor
≤15%	0%
>15% and ≤!30%	4%
>30% and ≤!60%	8%
> 60 and ≤100%	12%
> 100%	15%

Given the above overall uncertainty of the REL, the uncertainty conservativeness factor of 8% is used for evaluating the carbon credits of the ER-Program coming from these activities.

13 CALCULATION OF EMISSION REDUCTIONS

13.1 Methodology to Estimate Ex-Ante Emission Reductions

The calculations of the ER Potential are based on the best data and methods available for each management stratum of the program. Different implementation hypothesis have been considered: actual level of public funding, interest from forest and palm companies to engage in program activities, cost-benefit analysis at the farmer level. The table below provide the rationale and hypothesis of this ER ex-ante estimation for all mitigation activities.

Detailed calculations are included in the individual activity sheets in the Financing Plan spreadsheet.

Table 80. Rationale and hypothesis of ER ex-ante estimation for all mitigation activities

Activity	Datas	Implementation level hypothesis
Reduced Impact Logging (RIL)	Historical logging data and use of a RIL damage factor to estimate future emission with RIL practices	4 concession already FSC certified practice full RIL + 3 new concession during the ERPA period
Logged to Protected Forest (LtPF)	Historical deforestation and degradation data in Forest production area (land-use change analysis)	1 concession already in conservation + 2 new concession during the ERPA period
Reduction of Forest Conversion from Industrial Palm (HCVPalm)	Historical deforestation and degradation data in Palm concession (land-use change analysis)	+ 5% per year of planned deforestation area converted in HCV area
Smallholder shade cocoa in Community Development Zones	No direct emission reduction but effect on conservation	Rationale: The alternative activities are designed to provide revenues to smallholders and reduce deforestation and degradation. Considering the actual level of funding, 47% of the farmers of the program area will be engaged in program activities after a 5-year period. We assume that it will reduce the deforestation and degradation in 47 % of the forested area in unplanned area
Palm Outgrower Schemes in Community Development Zones		
Sustainable agriculture and others livelihoods activities		
Smallholders Conservation Payments	Historical deforestation and degradation data in unplanned areas (land-use change analysis)	

13.2 Ex-ante Estimation of the ERs

To estimate potential net Emission Reductions, the following set-asides were determined in line with the findings of section 10 to 12:

- The risk- and risk mitigation evaluation results in the **set-aside of 23%** of emission reductions in the risk buffer.
- Finally, the uncertainty analysis indicates that the uncertainty amounts is superior to 30% and hence a **set-aside of 8%** (i.e. applicable to overall uncertainties from 30%) applies.

The table below present ER ex-ante estimation per management unit. **The ER-Program may generate 11 million net emission reductions during the term of the ERPA.**

Table 81. ER ex-ante estimation per activity

ER ex-ante estimation per activity						
Year	Reduced Impact Logging (RIL)	Logged to Protected Forest (LtPF)	Reduction of Forest Conversion from Industrial Palm (HCVPalm)	Smallholders program	Set-aside of ERs Risks and uncertainty	Net Emission Reduction (tCO2/year)
1	1 054 046	71 468	65 970	118 745	406 171	904 058
2	1 128 184	792 659	197 911	61 116	675 760	1 504 110
3	1 511 770	792 659	581 191	535 490	1 060 544	2 360 566
4	1 643 947	792 659	812 394	989 284	1 313 868	2 924 416
5	1 643 947	792 659	1 077 746	1 413 263	1 527 560	3 400 054
6	1 643 947	792 659	1 343 098	1 450 799	1 621 456	3 609 047
7	1 643 947	792 659	1 608 450	1 450 799	1 703 715	3 792 139
8	1 643 947	792 659	1 873 802	1 450 799	1 785 974	3 975 232
9	1 643 947	792 659	2 139 153	1 450 799	1 868 233	4 158 325
10	1 643 947	792 659	2 733 195	1 450 799	2 052 386	4 568 213
5-years total	**6 981 893**	**3 242 102**	**2 735 214**	**3 117 898**	**4 983 903**	**11 093 204**
%	43,43%	20,17%	17,01%	19,39%		
10 years total	**15 201 626**	**7 205 394**	**12 432 911**	**10 371 894**	**14 015 666**	**31 196 159**
%	33,62%	15,94%	27,50%	22,94%		

14 SAFEGUARDS

14.1 Description of How the ER-Program Meets the World Bank Social and Environmental Safeguards and Promotes and Supports the Safeguards Included in UNFCCC Guidance Related to REDD+

The Strategic Environmental and Social Assessment (SESA) is currently being conducted in an iterative way together with the finalization of the national REDD+ strategy with participation from civil society and other stakeholders. Draft versions of the SESA report, the Environmental and Social Management Framework (ESMF) and the following five sub-frameworks are available: pesticides management framework, cultural heritage management framework, Indigenous Peoples planning framework, process framework and resettlement policy framework. These frameworks will define the guidelines to be adopted, specific studies that should be conducted, the compensation to be provided, the procedures to allow people to appeal against the proposed activities, the procedures for managing these appeals and the monitoring and evaluation process needed to verify the sound implementation of mitigation measures. Consultations will be held in the next few months in all 12 departments including Sangha and Likouala to finalize all these documents by June. In this context the ER-Program will serve as a practical example and be assessed against the SESA and ESMF. Subsequently, World Bank approval on the ESMF and its sub-frameworks will be sought.

Furthermore, the Republic of Congo has defined its Principles, Criteria and Indicators for social and environmental aspects of REDD+ (PCI REDD+), which are in compliance with the Cancun Safeguards, World Bank Operational Policies as well as FSC Principles and Indicators (see ANNEX 9. PCI). Consultations on the PCI-REDD were held including capacity building activities throughout the country in local languages including the ER-Program Area with representatives of local communities and Indigenous Peoples, civil society, departmental authorities and the private sector. The PCI-REDD+ will be field-tested in the coming months including in Sangha and Likouala for further improvements and will then followed by a regulatory framework for implementation. The remaining work on REDD+ safeguards instruments to be applied for the ER Program is summarized in Congo's work program on readiness, which was prepared as a result of the self-assessment for the Readiness-Package[135]. The finalization of the SESA report and ESMF is planned for December 2016.

The ER-Program's intervention strategy has been developed in alignment with the draft national REDD+ strategy and will apply the safeguards instruments developed at national level (SESA, ESMF, PCI-REDD). Specifically for the ER-Program, the CN-REDD has initiated a risk analysis and development of a mitigation strategy on social and environmental aspects related to ER-Program activities in conjunction with the ongoing SESA consultations and ESMF development. The risk

[135] https://www.forestcarbonpartnership.org/sites/fcp/files/2016/Sep/R-Package%20work%20plan.pdf

analysis is presented in ANNEX 6. Social and Environmental risks and mitigation analysis of the ER-Program. It will be further developed in a consultative way with ER-Program stakeholders.

14.2 Description of the arrangements to provide information on safeguards during the ER-Program implementation

All ER-Program implementing partners will have to comply with the PCI-REDD and its monitoring arrangements, which are being developed in the context of the REDD+ readiness process (see Figure 34. ER-Program SIS) and requirements of the ESMF and its sub-frameworks at every step of implementation. In line with the institutional arrangements designed for the ER-Program, the RME will be responsible for guiding and ensuring compliance with safeguard requirements. That includes for the RME to assist implementers, such as concessionaires, NGOs and communities, in conducting environmental and social impact assessments and developing specific safeguard plans if required.

Data collection on safeguards implementation will be conducted by the implementing partners. The specific requirements will be detailed in the REDD+ Participation Agreements with each program participant (see Chapter 6.1). The RME will be responsible for compiling and analyzing the data and preparing annual safeguards monitoring to be assessed and reviewed by CONA-REDD, and conducting field missions for verification purposes together with LCIPs and civil society representatives. The information provided in the reports will be made publically available and communicated through the national Safeguards Information Systems (SIS), which is under development with readiness and will imply multiple stakeholders. The report will also be used to compile the national report on safeguards to be submitted to the UNFCCC.

If an Independent REDD+ Observer is established (see Chapter 6.1), it will contribute to promote transparency in the monitoring arrangements and report potential failures to the RME and/or CONA-REDD. It would prepare an independent report to be submitted to CONA-REDD as well.

A detail safeguards analysis has been done and is presented in ANNEX 6. Social and Environmental risks and mitigation analysis of the ER-Program . It presents the social and environmental risks of each key activity of the program and the mitigation measures.

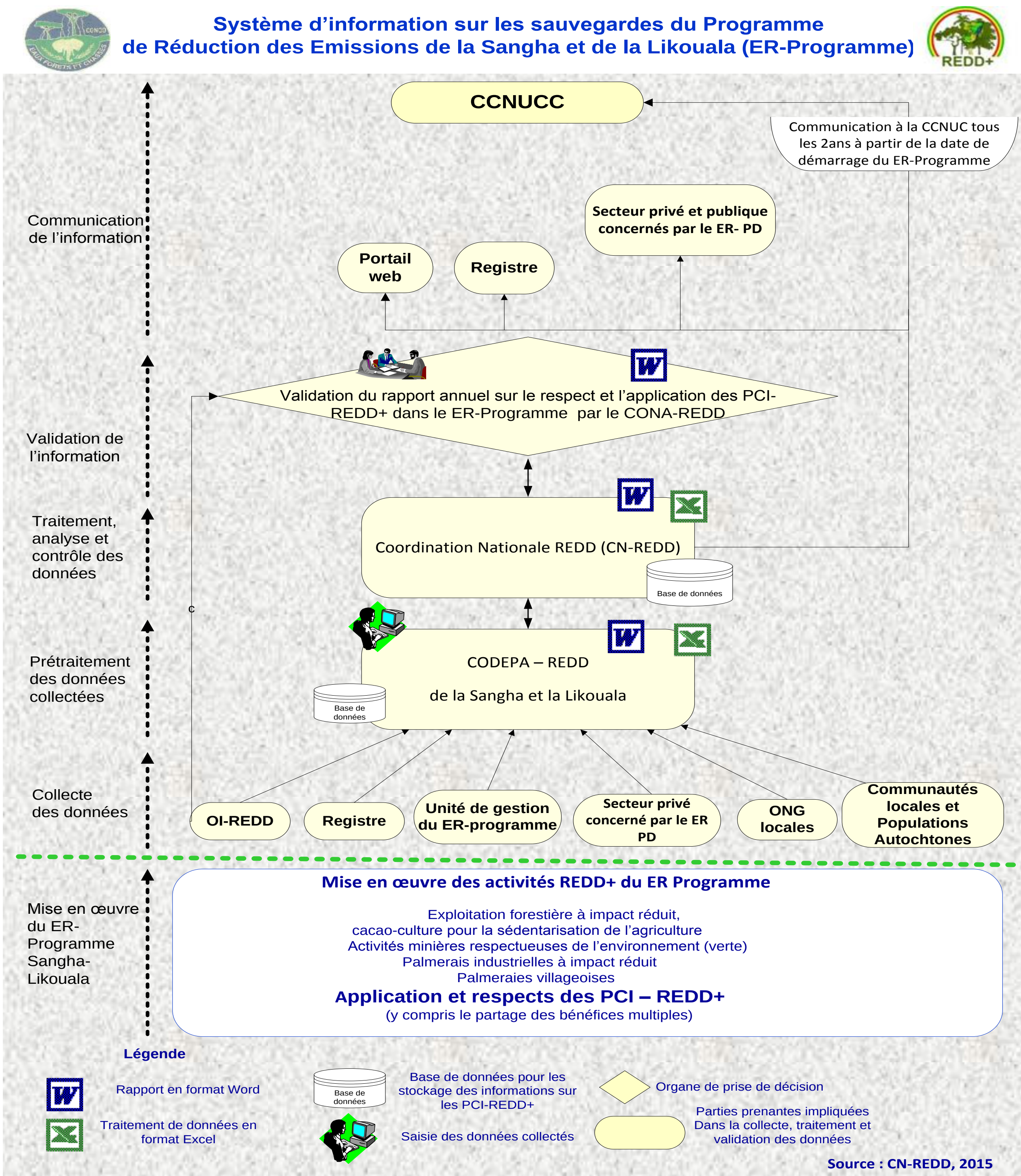


Figure 34. ER-Program SIS

14.3 Description of the Feedback and Grievance Redress Mechanism (FGRM) in Place and Possible Actions to Improve It

The Strategic Environmental and Social Assessment (SESA) process suggests principles and guidelines for the grievance and redress management mechanism. Formal procedures for the Feedback and Grievance Redress Mechanism (FGRM) are currently being developed at the national level. While detailed procedures and an appropriate capacity reinforcement plan still need to be defined, useful mechanisms are already in place (see details below).

The Sangha-Likouala ER-P will be the first to implement the new national guidelines. For this mechanism to be operational and effective, it must ensure the operational capabilities of the cartography process as well as the existing non-carbon benefits and co-benefits sharing plans.

The Program Management Unit and governmental agencies (i.e., CODEPA) will be in charge of the effective implementation of the FGRM while continuing to offer consulting and capacity reinforcement services. The FGRM will be tested, and the national REDD+ register will provide a transparent platform for submitting and monitoring grievances.

Submitting Grievances

Any person, organization, or institution may submit a grievance against the ER-Program using the procedures proposed in Chapter 14.3.4., which will be available through the REDD+ national registry.

The filing of a grievance automatically informs the national authorities in charge of REDD+ and engages the project leaders or implementing agencies. In the case of rural stakeholders with no internet access (i.e., most of the population affected by program activities), dedicated offices could be established. These offices could be equipped with an internet connection that can be used to send grievances to the Registry and inform the CODEPA. Civil society organizations will serve as local focal points for collective or individual grievances.

Reasons for and Types of Grievances

Under the ER-Program framework, various types of grievances can occur. For example, during the preparation of the Sangha-Likouala ER-Program, local stakeholders filed grievances regarding non-compliance with contracts signed with forest concessionaires over project specifications, Local Development Funds (FDL), etc. monitor the proper application of investments provided in the CDZs by FSC-certified concessionaires in Northern Congo. In general, grievances regarding the preparation of the R-PP and ER-Program are identical in that they relate to non-compliance with social and environmental standards in the implementation of infrastructures. Mines and dams represent the core of recurring grievances and redress by the aggrieved LCIPs as a result of lack of consultation, information, and transparency, issues of land and natural resources rights, deficiencies in sustainable living methods, etc. This set of key grievances was noticed and defined during a consultation phase in Sangha and Likouala in September 2015. These consultations were held in villages in Sangha and Likouala departments near concessions (agro-industrial and logging concessions).

In response, the program will ensure that LCIPs are well informed about the grievance mechanisms and particularly about their rights, their related non-carbon benefits in the REDD+ investments, project specifications, and the FDLs. Additionally, among other items, the FGRM will be responsible for grievances arising from the PCI-REDD+ implementation adapted to the ER-Program zone and those resulting from benefits sharing.

Grievance Prevention

Permanent feedback on ER-Program operations, activities and management will is needed to prevent grievances that might be based on incomplete, incorrect or missing information. To ensure this feedback, a permanent consultation platform will be established composed of the local RME, CODEPA, representatives from associations receiving grievances within the districts or district civil servants responsible, the federation offices of the Community Management and Development Committees[136] (CDMC), project leader representatives, and concessionaire and stakeholder representatives (including associations of Indigenous Peoples).

The permanent consultation platform will meet once a quarter. This meeting will be organized by CODEPA. Meetings must rotate throughout the districts of the two *départements*. Their purpose is to clarify the rights and obligations of stakeholders in the REDD+ process. These meetings provide a venue for stakeholders to discuss their concerns and grievances with local personnel, either publicly or in private.

Processing, Analyzing, and Monitoring Grievances

There are several levels and stages in processing, analyzing, and monitoring grievances, as described below.

[136] The Community Management and Development Committee is a promotional organization for community participation and local development. Its mission is (among others): To work with village chiefs to find solutions to problems of space and neighborhood management in the real estate, environmental, educational, healthcare, cultural, and peacekeeping sectors. In accordance with Article 13, a Community Management and Development Committee may be formed within a *département*, municipality, or district.

Processing, Analyzing, and Monitoring Grievances at the Local Level

The local CACOREDD/CDMC will receive grievances on site and then file them with the Program Management Unit. This unit will be charged with processing, analyzing, and monitoring the grievances and will perform the essential steps for the proper operation of the FGRM, as follows:

Receive and record grievances at the local level

(i) There are several channels through which aggrieved stakeholders can convey their grievances (telephone using the toll-free number provided, letter, email, internet, meetings, etc.);

(ii) A centralized database supported by the Program Management Unit will be established and personnel will ensure that all grievances made are recorded in the database according to a specific protocol and method for filing joint grievances.

Acknowledge receipt of the grievance and describe how it will be handled, evaluate eligibility, and determine responsibility within the organization for proposing a response

(i) The Program Management Unit will send a timely response to the complainants within 3–5 days of receiving the grievance (in a standard format letter or email with name and a reference number);

(ii) The Program Management Unit will ensure that all grievances comply with the following eligibility criteria:

- The grievance must state that the program resulted in a negative economic, social, or environmental impact on the complainant or has the potential to cause such impact;
- The grievance must specify the type of impact that occurred (or may occur) and how the program caused or (may cause) such impact;
- The grievance must state that the persons issuing or filing the grievance are in fact those that were (or may be) impacted or that such persons issued the grievance as representatives of stakeholders at the request of such aggrieved stakeholders who are or may be victims of the negative impacts of the program;
- The grievance must provide sufficient information to FGRM personnel to be able to respond to the above conditions.

(iii) Grievances must be sent directly to the institutions or individuals best able to handle them based on simple grievance categories. In this manner, all grievances that do not concern the implementation of the ER-Program or that cannot be resolved through the mechanism in place or the procedure designed to repeal or prohibit the bad practices that generate grievances will be sent to the administrative and legal authorities authorized to receive and handle such grievances. The procedure is identical for grievances or poor management relating to contracts that bind the project itself as well as the local communities or any other entity (administrations, etc.).

Suggest and send a proposed response

The FGRM will issue one of three types of responses: (i) direct action aimed at resolving the grievance; (ii) assessment and broader involvement of the complainant and other parties to jointly determine the best way to settle the grievance, and (iii) dismissal of the grievance as not eligible for FGRM action either because it does not meet the basic admissibility criteria or because another mechanism or entity is better suited to handle the grievance.

The Program Management Unit will send the suggested response to the complainant in a timely manner, in writing in a language easily accessible to the complainant within 14 to 21 days following receipt of the grievance.

Approval of the proposed response: Internal mediation

Where there is agreement between the complainant and FGRM personnel (the ER-Program Management Unit) to go forward with the proposed action, the response will be implemented at the local level.

Refusal of the proposed response: External mediation

Mediator

The role of the mediator is to assist the various parties in arriving at a consensus. The CODEPA will fulfill the mediation function. It brings together 26 delegates from all stakeholders, specifically:

- The public authorities, with 10 delegates;
- Civil society, with 8 delegates;
- Indigenous Peoples, with 5 delegates;
- The private sector, with 3 delegates.

The CODEPA missions include mediating potential conflicts between local stakeholders in the REDD+ process.

The CODEPA has the power to settle stakeholder grievances and is thus in a position to analyze groups of complainants, produce a summary of the reports with recommendations for the Program Management Unit and implementing agencies, and monitor the measures taken by the program. The CODEPA rules on grievances when a quorum of two-thirds of its members is present. Any person involved in the implementation process may call upon the assistance of the mediator.

To fulfill this function the CODEPA will undergo a capacity building/training process to accompany this responsibility. These capacity building activities have already started and are described in chapter 5.

Judicial Authorities

If a consensus is not reached and no action can be implemented to respond to the grievance, the matter is submitted to CONAREDD. CONAREDD rules on grievance when a quorum of two-thirds of its members is present.

If it is equally unable to come to a consensus, it will send the file to the relevant judicial authorities.

Neither the grievance settlement procedure nor an amicable settlement have suspensive effect regarding any judicial procedure.

Monitoring Implementation of Decisions

Currently, the settlement or mediation of grievances regarding the performance of project specifications and Local Development Funds (FDL) is handled by the Sangha and Likouala Departmental Councils.

Settlement or mediation of grievances and appeals are published in the national REDD+ registry.

The local consulting committees, specifically the Community Management and Development Committee, the Program Management Unit, and, if needed, the local decentralized agencies of the MEFDDE will monitor redress and decision implementation.

Decisions in response to grievances may lead to financial penalties or withdrawal of approval for integrated projects.

Monitoring and Evaluation

The public sector and decentralized authorities, private enterprises, and NGOs that monitor and evaluate the implementation of forest policy in terms of production, conservation of ecosystems, and social benefits within the ER-Program area at the national and departmental level are now established and operational.

An independent REDD+ monitoring unit (OI-REDD) designed to monitor the national REDD+ process has been proposed. It would be composed of civil society representatives and will represent minorities.

15 BENEFIT SHARING ARRANGEMENTS

15.1 Description of Benefit Sharing Arrangements

The ER-Program in the departments of Sangha and Likouala will provide a variety of incentives and benefits for the different stakeholders involved. This section describes preliminary arrangements for the distribution of revenues from emission reduction payments, including preliminary principles, definitions and the operational process for the sharing of monetary and non-monetary benefits, to the extent they have been developed. The Republic of Congo is developing a Benefit Sharing Plan to ensure the clear, equitable, effective, efficient, and transparent distribution of costs and benefits incurred by the different stakeholders involved or affected by the ER-Program.

Preliminary Principles

1. Benefit sharing is based on the principle of *equity* and seeks to fairly distribute costs and benefits of the ER-Program between stakeholders that effectively contribute to its implementation, either by addressing drivers of deforestation and forest degradation and/or protecting forests, or by facilitating the implementation of the ER-Program.

This principle reflects the allocation of carbon related titles ("carbon rights" and "carbon credits") under the FC 2016. Under the revised Forest Code, Indigenous Peoples – carriers of customary rights – will be recognized as carbon right holders. In addition, LCIPs will have the possibility to participate in activities targeted in the program area, that are financed either through grants or reinvestments of carbon revenues. Other forest owners, including public bodies, are given direct access to carbon credits (see Chapter 4.4).

2. The design of the ER-Program and benefit sharing is based three types of benefits:

- *Carbon revenues that the ER-Program generates from payments for emission reductions.* Beneficiaries will receive a share of revenues as a reward for their performance and participation in implementing ER-Program activities. Incentives will be distributed in monetary (e.g. through cash payments) and non-monetary form (e.g. through technical, financial and policy incentives).
- *Incentives from investments and donor programs as part of the ER-Program ('investment incentives'*): Beneficiaries will receive direct benefits in form of technical, financial and policy support through different types of up-front investments to incentivize their participation in ER-Program activities. A share of carbon revenues is reinvested into such investments incentives, either by expanding existing activities to new areas or through new activities.

- *Indirect benefits:* Beneficiaries will indirectly benefit from their participation in ER-Program activities and from adopting improved land use practices. Examples for such indirect benefits are livelihood opportunities, increased profitability of land use, improved governance, market premiums, or other social, environmental and economic benefits, most of which are described in Chapter 16 (non-carbon benefits).

3. Benefit sharing is based on the principle of *effectiveness*. The allocation of costs and benefits is designed in a way as to maximize the program's effectiveness towards achieving the following objectives.:

- the objectives of the ER-Program;
- integrating all stakeholders with land tenure (including based on customary practices and community-based positions) and those directly affected by the ER-Program;
- rewarding stakeholders for efforts to reduce emissions;
- encouraging stakeholders to adopt practices that lead to emission reductions, e.g. sustainable land use and forestry practices;
- contributing to the fight against poverty of LCIPs;
- respecting the right of LCIPs to resources and encouraging their contribution to emission reductions;
- encouraging the sustainable use of distributed benefits.

4. Benefit sharing will employ a mix of performance- and non-performance based approaches:

- *Based on carbon performance:* The distribution of benefits will be based on carbon performance as either an amount of carbon not emitted or sequestered compared to the reference level, or based on proxies, such as an area (in hectare) of protected forest land. This approach will be applied, for instance, for communities where ER or proxies are directly measurable/attributable to beneficiaries.
- *Not based on carbon performance:* For some key stakeholders it is generally not possible or too costly to measure and attribute carbon performance. For example, LCIPs as well as government institutions receive benefits without measurement and without approximation of their carbon performance, in recognition of their specific contributions, legal claims, and/or the ER-Program's impact on their holdings, responsibilities, livelihoods, or other.

5. Benefit sharing is based on the principles of *transparency and participation* with respect to access to information, decision-making, contracts and company obligations towards communities, and the measurement or approximation of performance. Human rights will be respected at all times, and FPIC principles will be applied to any contracts with LCIPs. Detailed guidance will be provided in the SESA and ESMF to be finalized in January.

The Benefit Sharing Plan will be made publicly available prior to ER-PA signature and disclosed in a form, manner and language understandable to all affected stakeholders for the ER-Program.

Information on its implementation will be annexed to each Program monitoring report and interim progress report and will be made publicly available.

6. A share of the revenue from emissions reductions revenue will be used by the ER-Program to cover costs for managing the program, such as carbon and safeguards monitoring, FGRM, staffing costs for RME, office costs, legal costs, implementing the stakeholder engagement plan, to the extent they are not covered through other (investment) sources.

7. A share of the revenue from emission reductions payments will be reserved to provide performance buffers, such as for cases when a group outperforms or overachieves its targets, or for cases where any legal claims arise during implementation. The plan will also detail procedures for prioritizing specific activities for the allocation of carbon revenues in case the program leads to more emissions reductions than paid by the FCPF Carbon Fund. A share will also be reserved for re-investments in ER-Program activities.

Beneficiaries

Stakeholders are eligible beneficiaries if their contribution to the implementation of the ER-Program and/or any legal claim to forest areas or forest products (including under general principles and/or customary law) is (i) formalized in a contractual agreement with the government, or (ii) in the absence of a contractual agreement with the government, if they de facto contribute to the implementation of the ER-Program and increase the ER-Program output, or (iii) if they are negatively affected by the ER-Program. The ER-Program intends to conclude formal agreements (see Chapter 6 on institutional arrangements) with all stakeholders concerned.

For that purpose, beneficiaries will be grouped, and specific clauses will be developed concerning tenure titles (formalized and customary rights), individual and collective holdings, and implementation and financial management structures as part of the Benefit Sharing Plan.

This section describes different categories of beneficiaries, their role and contributions for the implementation of the ER-Program, investment incentives they receive and potential indirect benefits they incur as a result of participating.

a. LCIPs address drivers of deforestation by adopting better or new land use practices and alternative livelihood opportunities (See section 4.3 for a detailed description of the different activities). Local Development Funds (LDFs) and Community Development Management Committees (CDMCs), an existing institutional structure that is currently used to share allocations from Concessionaires' obligations towards communities, will provide the basis for benefit sharing at the level of communities. To ensure their functioning for an equitable, effective, efficient and transparent benefit sharing system at community level, these institutions will be strengthened and improved with the support of the ER-Program.

At first, in recognition of their specific contributions, customary rights, and/or the ER-Program's impact on their holdings, responsibilities, livelihoods, or other, LCIPs living in concession areas will receive a small share of carbon revenues from forestry or palm oil concessions. These funds are earmarked for communal investments, and will be channeled through LDFs and CDMCs.

To promote sustainable forest use at a communal and individual level, and to avoid any rebound effects from promoting profitable smallholder activities, LCIPs can further participate in a PES scheme for smallholder conservation. Performance payments will be channeled through LDFs for investments determined by the community. The institutional setup, the amount of payments and proxy indicators (e.g. area of forest conserved) will be determined as part of the preparation activities for the FIP program. The scheme will initially be financed by grants, and will be allocated the majority from reinvestments of carbon revenue.

To support the transition to sustainable land use, LCIPs can receive investment incentives, such as technical and financial assistance implemented as part of the ER-Program through donor programs as well as private companies. In *sustainable agriculture and other livelihoods activities,* LCIPs receive investment incentives for improved practices on individual farmland and alternative livelihood opportunities. For agricultural activities, the program will cover all costs for preparation and maintenance for the duration of 5 years, after which participants are expected to internalize new practices in their own businesses. While support is financed by various grant sources, a share of carbon revenues will be reinvested in these activities to expand the area. In *outgrower schemes for palm and cocoa,* companies provide smallholders with seedlings, other inputs and technical assistance, and enter into offtake agreements. Smallholders that chose to participate in these schemes plant on their own land and sell produce complying with agreed standards to the company.

For both schemes, a conservative economic analysis indicates substantial benefits for smallholders, with a profit increase ranging between 185% and 191% over 5 years (as a percentage of the baseline scenario). Indirect benefits for communities include improved livelihoods, poverty alleviation, local value chain development, improved market access and local environmental protection. Further, ER-Program support for local governance is also likely to increase benefits from the improved implementation of company's obligations towards communities (e.g. by reinforcing the structure of local development funds that disburse funds for communal investments).

b. Private concessionaires in the forestry and palm oil sectors address drivers of deforestation by making their exploitation practices less harmful or invasive (e.g. through better planning, reduced intensity and minimized damage of exploitation) or by setting aside exploitation in some areas (See section 4.3 for a more detailed description of activities RIL, LtFP and HCV Palm activities).

Companies in all three sectors will make investments in improved practices without receiving any direct investment incentives from the program. In addition, one of the palm oil concessionaires (Eco-Oil) will invest in an outgrower schemes for palm oil smallholders, and one of the forestry concessionaires (OLAM) will implement with support from donor programs a technical assistance program for smallholder cocoa, financed by the ER program. In particular for converting production to conservation concessions and for sparing HCV forest in palm oil developments, companies can encounter significant opportunity costs (e.g. literature estimates US$1.70 per ha for LtFP and *up to* US$800 per ha for palm).

At the same time, concessionaires engaging in RIL and HCV palm activities are expected to benefit from their participation. The adoption of RIL practices is expected to provide significant profitability gains. While facing higher opportunities costs, palm concessionaires mainly benefit from new market opportunities through establishing palm outgrower schemes that facilitated by the ER-Program (enabling activities and other investment incentives). All companies are expected to benefit from their participation with access to markets and premiums as well as from reputational benefits. In addition, they will benefit from local governance improvements as a result of enabling activities supported by the ER-Program.

Based on this expectation of costs[137] and benefits, the ER-Program will allocate the majority of net carbon revenues to companies to incentivize their participation and help them overcome investment barriers for these activities. This allocation will be ex-post, performance based and conditional upon compliance with legal requirements (e.g. RIL guidelines, fulfillment of social clauses), due diligence of smallholder support and any other conditions (e.g. compliance with the grievance and redress mechanism and other requirements defined in the ESMF) agreed between the ER-Program and the participant. The terms of engagement will be laid out in dedicated REDD+ Implementation Agreements, that will exclusively allocate carbon rights in exchange for a claim to carbon revenues (see Chapter 17).

c. The government facilitates the implementation of ER-Program activities and contributes directly to its objectives by providing technical assistance, policy incentives and by enhancing the enabling environment for sustainable land use. The government signs the ER-PA and holds the relevant emission reduction rights either as original right holder or as assignee from “communal forest” holders, a category to be created by the future Forestry Code (FC 2016). The government is the recipient of carbon revenues by default, but bound – by general principles of Congolese law as well as under contractual obligation from the REDD+ Implementation Agreements to distribute revenues to stakeholders in accordance with the Benefit Sharing Plan and REDD+ Implementation Agreements (see for further details in Chapters

The government receives assistance from several initiatives, including support for land use planning, community level governance as well as other various sector-specific measures to facilitate the implementation of the ER-Program (see Section 4.3). In recognition of its contribution, the government at department and national level will also receive a small share of carbon revenues.

[137] For opportunity costs, conservative estimates are used to ensure additionality of activities.

Indicators (carbon and other performance)

For beneficiary groups, the distribution of carbon benefits will be conditional upon performance (contribution) or their undergoing of negative effects (in the absence of a REDD+ Implementation Agreement). As a general rule, carbon performance will be directly measured compared to a reference level or as proxies (i.e. area of non-deforested, regenerated, or planted land or other indicators measuring non-carbon types of performance.

Contractual Arrangements for Benefit Sharing

Benefit sharing will be executed through a contractual architecture with the different participants involved in the Program Activities. REDD+ Implementation Agreements are concluded between the government (represented by the RME) and all relevant stakeholders in order to achieve their approval and to secure implementation of the REDD+ activities planned. Contracts will assign emission reductions rights, where stakeholders are primary right holders ("communal forest" holders under FC 2016). Otherwise, contracts will acknowledge the right of the government to transfer emission reductions rights linked to the REDD+ efforts of the stakeholder in question, and commit to strict exclusivity (no double-counting) terms (see further details in Chapter 17).

Institutional arrangements, including procedures for decision-making, participation, financial transactions and allocation of funds, grievance mechanisms, monitoring and evaluation will be elaborated in more detail in the Benefit Sharing Plan.

15.2 Summary of the process of designing the benefit-sharing arrangements

Preliminary benefit sharing arrangements were developed based on expert advice and as part of a transparent and participatory consultation process in the departments of Sangha and Likouala. In addition to the beneficiary groups, as defined above, the consultations included civil society organizations and local authorities.

Sites and participants for consultation were selected based on sampling, taking into account the presence of Indigenous Peoples, accessibility, and the presence of protected areas. In total, more than 1300 people were consulted in 17 meetings. Detailed information on locations and attendance is available in the **ANNEX 4. Tableau récapitulatif des consultations menées dans le cadre de l'élaboration du document du Programme de Réduction des Emissions (ER-P) Sangha-Likouala Nationale REDD+ en 2016**.

The following topics were discussed:

- Types of activities implemented by CPLA
- Analysis of existing relevant mechanisms in the mining and forestry sectors, and for protected areas
- Analysis of community development funds as a structure for transactions for benefit sharing
- Representation of LCIPs during the implementation of the Benefit Sharing Plan
- Institutional arrangements for benefit sharing
- Non-carbon benefits, e.g. for CPLA

The Roadmap for the finalization of the Benefit Sharing Plan that will be - at least as an advanced draft - publicly disclosed prior to the signature of the ER-PA with the Carbon Fund is as follows:

Additional activities	Timeline
1. Consultations at national level, at the level of each department involving representatives of all beneficiary groups, including LCIP in the program area, representatives from organizations that implement Program Activities including through investment programs, or otherwise concerned stakeholders. The purpose of these consultation is: (1) to validate and prepare a final recommendation for the principles for benefit sharing (2) to validate the assessment of beneficiary contributions, investment incentives and indirect benefits (3) to determine and validate the distribution of benefits among beneficiary groups, to transaction costs and for reinvestment in ER-Program Activities (4) To confirm the consent of LCIPs	By January 2017
2. Final draft Benefit Sharing Plan is made publicly available in a form, manner and language understandable to the affected stakeholders	Prior to ER-PA signature
3. Formal/legal adoption of Benefit Sharing Plan	Related to ER-PA signature
4. Formalization of contractual agreements	After ER-PA signature

15.3 Description of the legal context of the benefit-sharing arrangements

Benefit sharing arrangements reflect the legal context. Details are described in Chapter 17.

16 NON CARBON BENEFITS

16.1 Overview of Potential Non-Carbon Benefits and Identification of Priority Non-Carbon Benefits

Identification of non-carbon benefits (NCB) specific to the area covered by the ER-Program (ER-P) was drawn up in a participatory manner from September 21 to October 3, 2016 in Sangha, and from September 28 to October 12, 2016 Likouala , during data collection for the benefit-sharing scheme. The consultative process consisted of individual consultations and focus groups with local authorities, decentralized administrations, and local communities and Indigenous Peoples (LCIP). A total of 596 individuals were consulted (227 in Sangha, 369 in Likouala), including 247 indigenous peoples (74 in Sangha, 140 in Likouala). The consultations' focus was on LCIPs, and the interview results were cross-checked against those with local authorities.

Table 82. List of consultations held on non-carbon benefits

Department	District	Place	Stakeholders consulted
Sangha	• Mokeko • Sembe • Tala Tala • Ouess0 Centre Municipality • Souanke	• Kandeco, urban community of Mokeko, • Madzala, • Zoulabout • Zengabou, • Elongue, • Matoto • Bondzokou • Bomassa • Sembe Center • Kabos • Tala Tala Center • Pokola	• Local authorities (sub-prefecture and mayorality) • Heads of forest economy brigades • Local communities • Indigenous peoples • Private sector (CIB-OLAM, Eco-Oil)
Likouala	• Impfondo • Dongou • Epéna • Enyellé • Bétou	• Mboua, • Toukoulaka • Minganga • Mobangui • Bétou • Epéna district • Sombo • Makao • Lombo (Lopola) • Impfondo	• Local authorities (sub-prefecture and mayorality) • Heads of forest economy brigades • Local communities • Indigenous peoples

Identification also built on previous work carried out operationally by CIB-OLAM and IFO-Danzer, which along with LCIPs had already identified NCBs and have been assisting them in sustainable collection and use. Further efforts in targeted identification, prioritization, and planning to work out NCBs in the area will be carried out during implementation of the ER-P. Additionally, the study entitled Mapping of the Multiple Benefits of the REDD+ Process in the Republic of Congo was ratified in January 2016 and confirms NCB identification at the national level.

The list of potential NCB benefits identified during the consultation phase is as follows.

Table 83. Potential non-carbon benefits

Potential NCBs identified for the ER-Program area	Beneficiaries		
	Government	LCIPs	Private sector
Improved community governance			
Contribution to community development			
Improved and more diversified LCIP incomes from increased investment in technical assistance and support for small-scale production activities (agriculture, livestock farming, aquaculture, beekeeping, etc.)			
Diversification of activities at the level of local populations (agriculture, livestock farming, fish farming, beekeeping, etc.)			
Improved LCIP standards of living (access to drinking water, healthcare, education, greater access to hinterland, other basic infrastructure, etc.)			
Strengthened LCIP capacity (agroforestry, NTFP development and promotion)			
Direct and indirect job creation at the rural level			
Improved forest management			
Contribution to national GDP from the sale of carbon credits			
Creation and strengthening of organizational and institutional capacities of the ER-Program Fund Management Committee			
Support for LCIP rights to access to land and natural resources management			
Improved cross-sector synergy (MEFDDE and other ministries involved in the REDD+ process)			
Strengthened participatory management of forest ecosystems, reduced pressure on forest ecosystems, and maintenance and conservation of biodiversity			
Improved ecosystem services and resistance to climate change			
Protection of river basins and river systems			
Improved use of land and management of land security at the department level			
Better soil conservation practices			
Setting up or rehabilitation of basic infrastructure (schools, health centers, markets, roads)			
Promotion of other non-carbon benefits by the ER-Program Fund Management Committee, etc.			
Promotion of the sustainable collection of NTFPs for food and commercialization			
Improved secure access to NTFPs by forest LCIPs			
Improved water supply			
Improved supply of wood fuel and construction timber for housing with strategies for reducing pressure on forest ecosystems			

The distinctive feature of this program is that it is part of a community development effort aimed at supporting concerted local and sustainable economic development initiatives among all stakeholders. It aims to improve the populations' incomes through social and economic inclusion by means of incentives and with LCIPs taking full responsibility for implementing the REDD+ process. The participation of women in decision-making will be promoted to ensure a positive impact on the role of women in the community and their representation in the program. This will particularly apply in the context of the local development plans that will underpin the community-based agroforestry activities

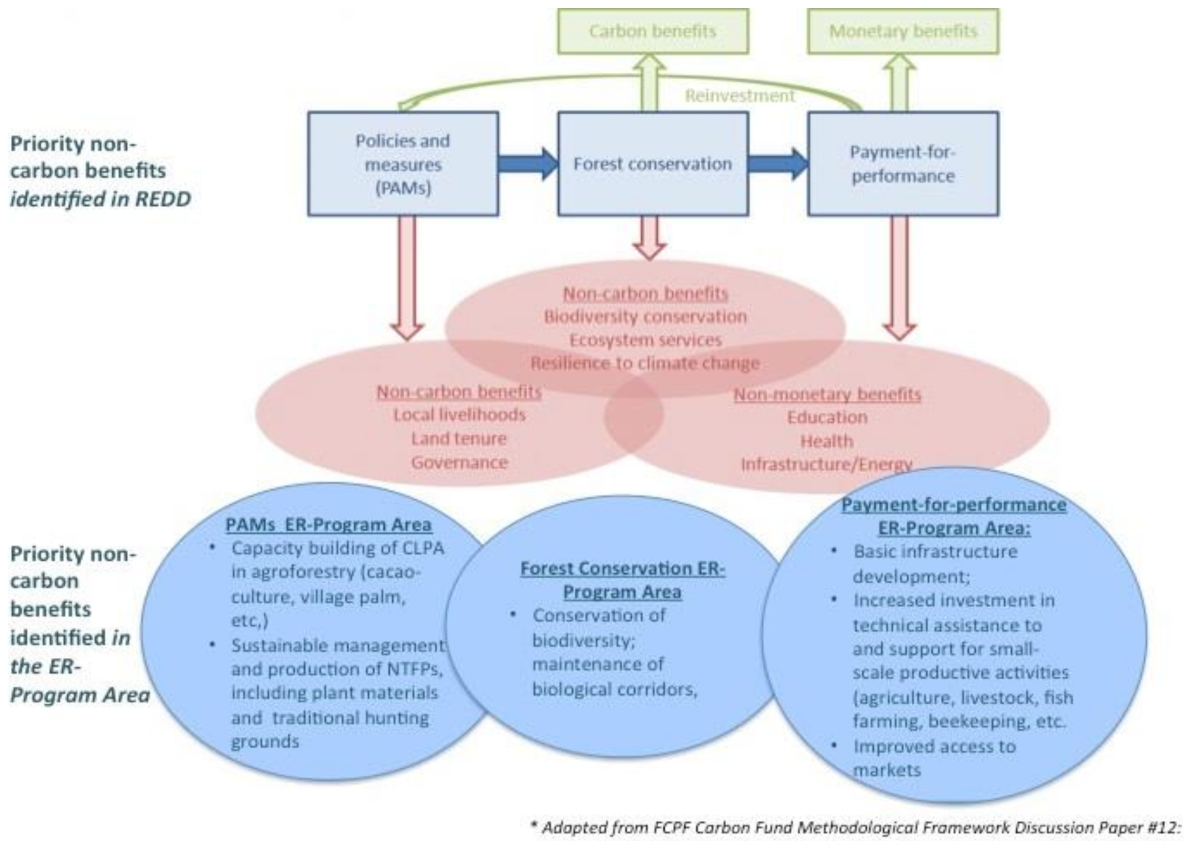


Figure 35. Priority non-carbon benefits

The consultation process described above identified the following NCBs as priorities:

Increased and Diversified Local Livelihoods

Generating additional incomes from perennial crops and higher yields from annual crops as well as diversification of the sources of agricultural incomes is a primary NCB to LCIPs. The program aims to use agroforestry to demonstrate the profitability of limiting the area under slash-and-burn agriculture, independently of carbon revenues.

It is expected that this will lead to a virtuous cycle as reducing deforestation and forest degradation will also help enable improved management of non-timber forest products (NTFPs). NTFPs are an important source of food, medication, and other materials needed for subsistence, particularly for Indigenous Peoples living in the ER-Program area but also for local Bantu communities. NTFPs in the ER-Program area include vegetables, fruit, nuts, grains, roots, bark, insects, mushrooms, arrowroot (Marantaceae), gnetum, caterpillars, herbs, honey, etc.

As a result, particular attention will be paid to improving the management of NTFPs, thereby producing additional income. A planned series of initiatives will strengthen LCIP capacities for the sustainable management, development, and commercialization of NTFPs. Establishing a legal management framework will also ensure improved management. Implementation of guidelines will be financed partly from investment funds (FIP) and partly from LCIP carbon income and government grants supporting local development.

A similar virtuous cycle as for NTFPs is expected for firewood and construction wood for LCIPs. A reduction in the area deforested will yield a more sustainable source of these two subsistence materials.

Lastly, LICPs will be able to invest carbon revenues channeled through the Local Community Fund Management Committees in low-impact income generating activities, including small livestock raising, aquaculture, and apiculture.

In some cases, NCBs will supplant carbon revenues as the primary incentive for pursuing low-carbon development options promoted by the ER-Program. To make these options viable, the program will support agroforestry so as to facilitate production and access to markets, primarily through available investment funds.

Setting Up or Rehabilitation of Basic Infrastructure

The program will invest in establishing and rehabilitating basic and community infrastructure, using a portion of the carbon income for this purpose, with terms of reference (see Chapter 15) established by the ER-Program Fund Management Committee. In compliance with the redistribution of monetary carbon benefits, the portion of the sale of carbon credits that will be returned to LCIPs and to decentralized government units include: (1) share of recognition of traditional land rights and rights to natural resources; (2) share that will revert to LCIPs; and (3) share of government grants supporting local development. This will help finance the setting up or rehabilitation of basic infrastructure (schools, health centers, drinking water, markets, roads, etc.).

These investments will complement the existing benefit-sharing mechanism in the forest exploitation sector, especially the specific terms of reference of forestry concessions and financing for the operation of the Local Development Fund managed by departmental councils. In addition, synergies with other projects and national programs will also support the setting up or rehabilitation of basic infrastructure in the ER-Program area.

Biodiversity Conservation and Other Environmental Benefits

The ER-Program area is home to a great variety of flora and fauna, including endangered or at-risk species such as the great apes, elephants, birds, amphibians, and reptiles. ER-Program activities will preserve the habitat, thereby helping to preserve these species. Furthermore, the reduction in deforestation and forest degradation will enhance broader ecosystem services, increase water retention, and reduce soil erosion.

16.2 Approach to Providing Information on Priority Non-Carbon Benefits

Given the overlap between the pooling of NCBs with safeguard plans, primary NCBs help ensure implementation of the safeguard plans (e.g., the land use regime) as well as the plan for pooling NCBs (e.g., the NTFPs). These NCBs are also prioritized in the REDD+ PCI monitoring system since non-implementation of these NCBs could trigger corrective measures under the terms of the ER-PA.

The Safeguards Information System (SIS) (see Chapter 14) and the MRV system will ensure the monitoring of NCBs. Activities pertaining to NCBs will be subject to activity reports based on predetermined performance indicators. These reports will be included in annexes to the ER-Program monitoring and interim activity reports and communicated to all stakeholders.

17 TITLE TO EMISSION REDUCTIONS

17.1 ER-Program Authorization

Table 84. ER-Program authorization

Name of entity	Ministry of Finance, Budget and Public Portfolio (“Ministry of Finance”)
Contact person	Calixte Nganongo
Title	Minister of Finance, Budget and Public Protfolio
Address	Croisement Avenue de l'Indépendance et Avenue Foch Brazzaville - Brazzaville
Telephone	+242 066688634
Email	cg.minfin@gmail.com
Reference to the decrees, laws or other types of decisions identified by this national authority within the ER-Program.	• Decree no. 2012 - 1154 of 9 November 2012 regarding the competences of the Minister of Economy, Finance, Planning, Public Portfolio and Integration; • Decree no. 2012-1155 of 9 November 2012 regarding the competences of the Minister of Forest Economy and Sustainable Development; • Decree no. 2012-1035 of 25 September 2012 regarding the nomination of members of Government.

17.2 Transfer of Emission Reduction Certificates

The Government of the Republic of Congo will be the signatory of the ER-PA, represented by the Ministry of Finance. The Ministry of Finance is authorized to sign on behalf of the Government under Presidential Decree No 2012 – 1154 of 9 November 2012 (exercising control over the State Finances; undertaking international financial relations). As such it assumes the role as the legal ER-Program Entity.

For operational purposes, internally the Ministry of Finance will designate the Ministry of the Forest Economy and Sustainable Development (MEFDDE) as the entity implementing the ER-Program.

The special REDD+ governance bodies, namely CONA-REDD, CN-REDD and the relevant bodies at the department level, exercise their roles and responsibilities in the administrative remit of MEFDDE. The RME (see chapter 6.1) will be established within the same ministerial authority.

The ability to transfer ERs flows from the legal concept of carbon rights as established by Congolese law (see chapter 4.4 for details). Under the **current legislation**, carbon rights are defined within a contractual relationship alone (the ER-PA).[138] The ER-PA will require the carbon seller – the Government of the Republic of Congo, represented by the Ministry of Finance –to commit to an exclusive, one-off marketable right linked to REDD+ efforts made by the REDD+ stakeholders. This guarantee represents the carbon right, contractually handed under the ER-PA from the seller to the buyer (the Carbon Fund).

The Government of the Republic of Congo replicates, and thus secures, the guarantee (carbon title) through bilateral and multilateral contracts – REDD+ Participation Agreements and potential sub-arrangements (sub-contracts) – concluded between (or through authorization of)[139] the Ministry for Forestry Development and Sustainable Development and the various stakeholders, among them concession holders, local communities (whether located in the Permanent Forest Estate or the Non-Permanent Forest Estate), indigenous people, village association, not-for-profit organizations.

It is noted that, strictly speaking, the existence or non-existence of a contract between the carbon seller and a third party (or any non- or malperformance) does not affect the validity and binding nature of the contractual commitment made by the Government of the Republic of Congo towards the Carbon Fund. This commitment remains a bilateral obligation. If a stakeholder rejects participation in the ER Program, it may do so without repercussion to the contractual obligations made under the ER-PA. Factual implementation and projected achievement of the emission reductions envisaged, however, may be affected, if key stakeholders will not conclude the relevant REDD+ Implementation Agreements. The Government of the Republic of Congo plans, therefore, to complete negotiations and the execution of relevant REDD+ Implementation Agreements prior to ER-PA signature.

The REDD+ Participation Agreements and sub-arrangements will include provisions on the activities to realize the ERs as well as provisions on the carbon rights sale and the participation of the stakeholders concerned in the benefit-sharing structure (including direct rights to the proceeds, where applicable). In return, stakeholders are requested to commit to a no-compete clause, i.e. a firm obligation not to market or claim any ERs related to the activities concerned to any third party (see Box 4. Participation Agreements). Again, it needs to be kept in mind, however, that under the currently applicable Congolese law (for the changes implied under FC 2016 see below), the elements of these contracts secure implementation and do not affect the carbon rights transfer proper between the Government of the Republic of the Congo and the Carbon Fund.

[138] For the future legal regime – relevant after the entry into force of the Forestry Code 2016 – see below.

[139] In case the Govnerment establishes a REDD+ Management Entity (RME), see above chapter 6.

Prepared and negotiated in a rigorously inclusive and transparent stakeholder engagement process, the REDD+ Participation Agreements will comprehensively respond to the particular rights (formalized or under customary law) and practices of the stakeholder(s) concerned and lay down:

- The scope of REDD+ activities planned;
- The list of REDD+ outputs and benefits planned;
- The participation of the stakeholder in question in the REDD+ governance and program transparency;
- The stakeholder's internal and external representation (including for contract execution);
- The concrete REDD+ effort (contribution) of the stakeholder in question;
- Incentives from up-front investments;
- Principles of ex-post benefit-sharing (with concrete revenue quota scenarios);
- The commitment to exclusivity and non-compete (with an obligation not to market the REDD+ efforts as credits or otherwise to any third party); and
- The dual option for the stakeholder to enforce its contractual rights through the domestic courts or the REDD+ program's complaint settlement mechanism.

Box 4. Participation Agreements

Under the **future legislation (FC 2016)**, the holders of communal forests will have a direct claim to a portion of emission reductions that corresponds both to the size of their holdings and the level of efforts made. "Carbon rights" and "carbon credits" will be recognized by Congolese law as specific rights in rem, a priori independent from any contractual arrangement.

For the purpose of the ER-PA for conclusion with the Carbon Fund, this change will require the Government of ROC, represented by the Ministry of Finance or, as the case may be acting through the RME, to acquire the carbon rights and carbon credits from the right holders in question.

Note that in practice, the change of legislation will be anticipated in the contracts negotiated under the current legislation. They will include provisions, conditioned on the entering into force of FC 2016, which allow for the transfer of the respective carbon rights and carbon credits in return for a claim to the proceeds.

For all transactions, whether under the current or under the future legislation, the principle of voluntary engagement will consistently be applied. Stakeholders that decide to reject REDD+ participation will not be required – de facto or by law – to engage, and their program-unrelated actions and efforts – whatever they may be (for the range of available rights, including concerning the claim to benefits in the absence of a contract, see chapter 4.4) – will not translate into creditable positions under the ER-PA (for transfer to the Carbon Fund). Monitoring enactment and implementation will, indeed, be crucial for both the Government of the Republic of the Congo and the Carbon Fund. To enable the parties to react to any delays or gaps in the implementation of the REDD+ Participation Agreements and any sub-arrangements (refusal of stakeholders to participate, withdrawal, non-compliance), it is suggested that the ER-PA between the Government of the Republic of the Congo and the Carbon Fund be built on different sets of condition precedents, the final condition precedent for the actual transfer of ERs and payment being linked to a full and complete compliance check of all REDD+ Participation Agreements and sub-arrangements concerned.

Finally, in 2012 the Government of the Republic of Congo granted permission to a private party to register and implement a REDD+ Project under the Verified Carbon Standard (VCS), and to generate Verified Carbon Units (VCUs) with respect to said project. The project was registered by the VCS in 2013.[140] The project developers in question wish to incorporate their project into the ER Program. This is in line with the terms of the ER Program and the forthcoming ER-PA on the condition that a REDD+ Participation Agreement based on the same principles as outlined above be concluded between the project developers and MEFDDE (or RME). See further below, section 18.1.

[140] Verified Carbon Standard (VCS): North Pikounda REDD+ Project,

http://www.vcsprojectdatabase.org/#/project_details/1052

18 DATA MANAGEMENT AND REGISTRY SYSTEMS

18.1 Participation Under Other GHG Initiatives

The Verified Carbon Standard (VCS) North Pikounda REDD+ Project[141] is within the accounting area. This project is a REDD+ project which consists of protecting a primary unlogged forest which is legally sanctioned to be logged. The proponent of this project is CIB-OLAM. Its Reference Level is based on the approved Forest Management Plan and expected harvesting volumes based on harvesting intensities, and is fully in compliance with Tier 2 IPCC methods. The project has generated carbon credits corresponding to the monitoring period 1 January 2012 to 31 December 2012. As the project is in the ER-Program area it is seeking to be included within the ER-Program and to be eligible for carbon-linked payments.

Other than this project, there are no other AFOLU GHG initiatives present within the Program Area.

18.2 Data Management and Registry Systems to Avoid Multiple Claims to ERs

REDD+ Program and Projects Data Management System

As part of the Readiness process the country has decided to maintain its own national REDD+ Program and Projects Data Management System as required by Indicator 37.1 of the CF MF. This system is currently under development and it will be operationalized through a dedicated software, REGIREDD+[142].

This integrated information system provides information not only on REDD+ projects (defined as initiatives that generate carbon credits), but also on other REDD+ initiatives, sustainable natural resource management, and on institutional and legal arrangements. For REDD+ projects, it functions as a REDD+ Program and Projects Management System and ER Transaction Registry.

The system requires essential information from REDD+ projects, including a full description of the entity that has title to the ERs produced. It allows for the uploading of the Shapefiles with the boundaries of the project, the definition of the scope of the project and, and the Reference Level used. Hence, the management system would provide enough information as required by Indicator 37.2 of the CF MF. The validation commission within the MEFDDE (currently

[141] http://www.vcsprojectdatabase.org/#/project_details/1052

[142] SYSTEME D'INFORMATION POUR LA GESTION FORESTIERE ET LE DEVELOPPEMENT DURABLE(SIFODD). 2016. Logiciel de gestion du registre national REDD+ CAHIER DE CHARGES OPERATIONNEL.

coordinated by CN-REDD decides on whether or not validate the inclusion of a REDD+ program / project in the REGIREDD+.

The system will rely on a web portal that would provide access to basic information in French, ensuring compliance with Indicator 37.3 of the CF MF.

REGIREDD+ is a tailor-made software based on defined procedures, so it ensures standardization of the administrative procedures and that the required information for each REDD+ project is filled out. The system will be subject to verification if needed. Therefore, it would be in compliance with Indicator 37.4 of the CF MF.

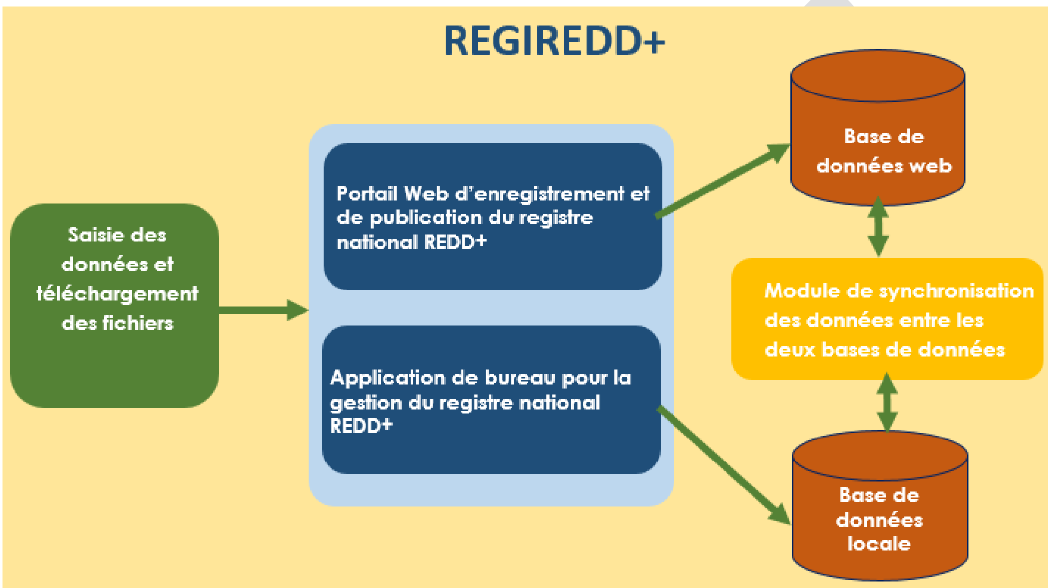


Figure 36. Functional architecture of the management system

ER Transaction Registry

National ER transaction registry

REGIREDD+ will also function as the national ER Transaction Registry. Prior to a ER transaction (i.e. purchase of ER generated by any REDD+ project within the jurisdiction of Congo), REGIREDD+ requires the registration of REDD+ programs and projects as indicated in the previous section, which will be validated by the validation commission. In case of overlapping boundaries, the validation commission will verify whether measures are in place to avoid double counting, and will decide on whether the ERs generated would be shared between the overlapping projects or whether to allocate them to one or another of the projects.

The below diagram shows the process of ER transaction:

1. The ERs reported are verified by an accredited entity[143] which identifies the number of ER reported and ERs to allocate in the buffer;
2. The monitoring and verification report are submitted to the REGIREDD+ by the REDD+ program or project, and REGIREDD+ allocates project ERs and buffer ERs into the specific project ER and buffer account;
3. The buyer creates an account in REGIREDD+ and expresses their interest to buy ERs from a specific project. Upon approval by the buyer, the ERs from the specific project are allocated to the buyer;
4. Upon transfer, the REDD+ program / project and the buyer ensure the reconciliation with external registries in the case the credits are sold through a voluntary market. The condition of cancellation of external credits is ensured as per the contractual conditions set in the REDD+ Participation Agreement.

The specific details of the operationalization of the ER transaction registry side of the software are yet to be defined. As the registry does not include the management of the reversal buffer or the uncertainty buffer, it is unclear how the serialization of ERs will be done to ensure tracking and how the reconciliation process with external registries will occur.

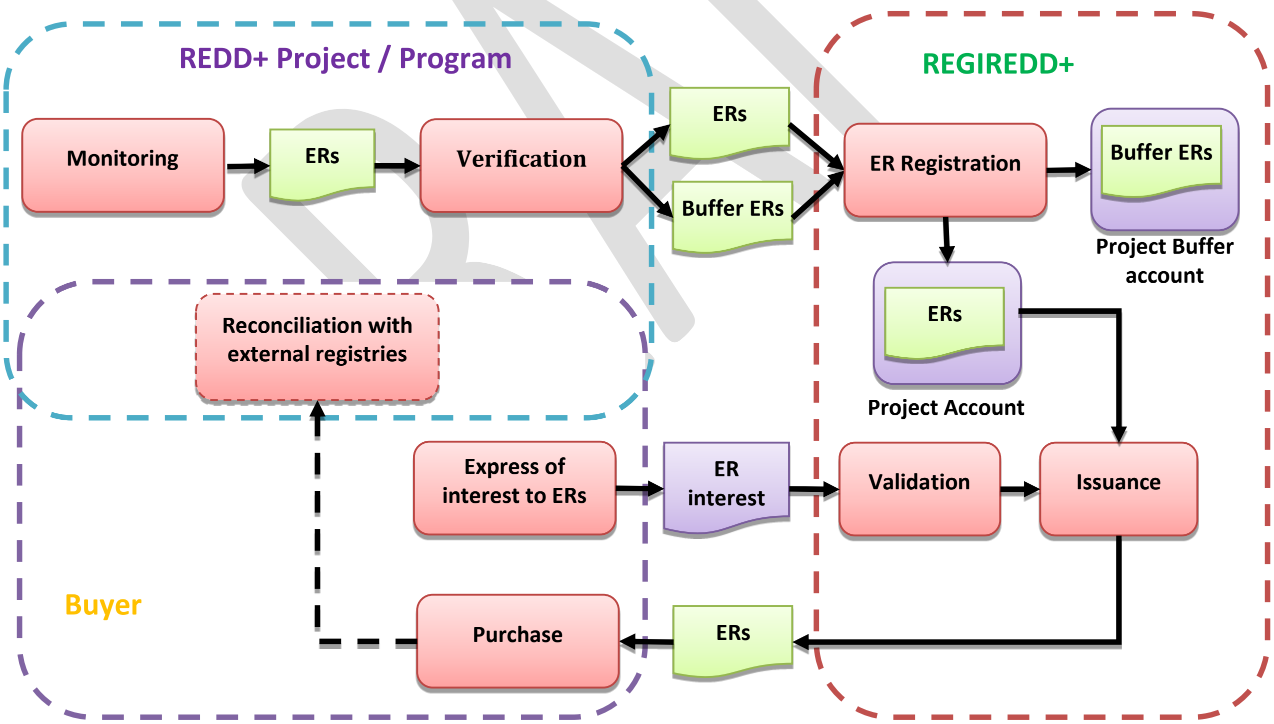


Figure 37. Process diagram indicating the issuance and transfer of ERs by REGIREDD+

[143] Modalities for the accreditation of entities has not yet been defined

Operationalization in the context of the ER-Program

As indicated above, where REDD projects are being registered with overlapping boundaries to the ER-Program the validation commission will determine the project's eligibility to participate in the ER-Program. This participation would allow the project receive carbon-linked payments from revenue generated by the ER-Program sales to the Carbon Fund. The project will be required to meet all the eligibility requirements established by the validation commission and register the project in REGIREDD+, including submission of all the validation and verification related documents from the other GHG program.

The RL and MRV adopted by the ER-Program will determine the emissions reductions that the project is eligible for receiving payments for under the ER-Program. This will also include any deductions for displacement and non-permanence risk and other terms associated with quantification of emission reductions and the resulting carbon-based benefit payments. The RL assigned to the project will be consistent with the methods used to establish the ER-Program RL and that are applicable to the project conditions, drivers of deforestation, and the project interventions designed to reduce deforestation and degradation. This assignment of a RL and the MRV methods will be made at the full discretion of the validation commission and will be tracked in REGIREDD+ and documented in the REDD+ Participation Agreements.

If the project meets the ER-Program requirements as approved by the validation commission, and the project elects to sell credits to the ER-Program, this will be tracked in REGIREDD+. REGIREDD+ it will assign the emission reductions generated within the boundary of the project to the project's registry account when the monitoring and issuance of ER-Program's emission reductions is completed.

To track the transaction where the project sells/delivers emission reductions to the ER-Program, a transaction between the project and the ER-Program will be entered into in REGIREDD+, to transfer emission reductions from the project back to the ER-Program account[144]. The project would need to demonstrate that it had not sold those same reductions under another program to ensure there is no double selling of credits. This will be done by cancelling any emission reduction sold into the ER-Program on the project's other GHG registry (see below).

The process above, allows projects to participate in voluntary markets as well as participate in the ER-Program benefits sharing, while ensuring that the ER-Program or the project does not double sale same emission reductions to multiple GHG programs. Projects participating in the ER-Program benefits will be free to sell vintages prior to the ER-Program and to sell any "excess" emission reductions not compensated for by the ER-Program. In addition to the project cancelling the emission reductions from other GHG programs, the contractual conditions in the REDD+ Participation Agreement provide legal protections to preclude double selling, grant first delivery rights to the ER-Program and require full disclosure of a project's details of registration, issuance, sales and other relevant information under other GHG programs.

[144] Note: This process is still not described in the latest specifications of the REGIREDD+ at the time of this version of the ER-PD.

The process for cancelling emission reductions varies based on whether the project has already verified emission reductions as well as based on the specific rules and standards along with each of their approved registries.

1. **Project ERs with verified vintages prior to the vintages in the Carbon Fund ER-PA**: For projects that have completed the verification of emissions reductions for the monitoring period that includes the vintages that correspond with the ER-Program vintages, the project participants can use the established procedures for issuing and cancelling emission reductions working directly with the standard's approved registries. This process involves the project developer requesting issuance of VCUs and simultaneous cancellation. Then the project developer provides evidence to the ER-Program of the number and vintages of VCUs cancelled to match those being compensated under the ER-Program. This is not the case currently in the ER-Program and it is not expected that it will occur;
2. **Non-verified Project ERs that include the vintages in the Carbon Fund ER-PA**. In case a project is registered under another GHG program, but has yet to complete verification for vintages that will be compensated under the ER-Program, the process is less straightforward because there are no issuable tons to cancel. This is the case today with the Pikounda Nord REDD+ Project which has registered and as verified 2012vintages, but the project has not yet verified vintages for 2015 and beyond, for which it may seek payment for under the ER-Program. But if it provides compensation for emissions reductions in vintages that have yet to be issued under the other program, the ER-Program needs to ensure that at the time these vintages are issued under the other GHG program the number of tons for each vintage paid for under the ER-Program are automatically cancelled. This can be accomplished for projects registered under the VCS.

As part of the development of the REDD+ Participation Agreement, the ER-Program will determine whether a project will be required to establish this future cancellation mechanism or whether the contractual agreement to cancel once the tons are issued will be sufficient to ensure no double selling can occur.

ANNEX 1. SUMMARY OF FINANCIAL PLAN

Financing plan		2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	
Items	**Description**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**TOTAL**
Expected uses of funds												
Costs Related to the Administrative Oversight of the Program	*Cost of the Program Management Unit (staffing, office, travel, Legal, Accounting and RME Trust management costs)*	589,916	779,323	957,195	985,574	1,055,619	1,060,735	1,102,613	1,179,444	1,190,651	1,235,245	10,136,314
Operational and Implementation Costs	*Costs of ER-Program measures (cf. Section 4.3)*	13,664,328	15,648,717	17,280,320	18,849,060	21,299,671	7,096,559	7,503,951	7,824,951	8,244,951	8,244,951	125,657,457
	Sectorial activities											
	Reduced Impact Logging (RIL)	1,177,997	1,420,518	1,234,055	1,108,249	1,225,820	1,225,820	1,225,820	1,225,820	1,225,820	1,225,820	12,295,741
	Logged to Protected Forest (LtPF)	58,350	741,656	647,169	647,169	647,169	647,169	647,169	647,169	647,169	647,169	5,977,358
	Reduction of Forest Conversion from Industrial Palm (HCVPalm)	135,000	-	329,500	131,500	262,500	227,000	259,000	160,000	160,000	160,000	1,824,500
	Smallholder shade cocoa in Community Development Zones (SH Cocoa)	661,218	1,207,737	1,862,210	2,624,637	3,495,019	1,732,641	1,206,980	1,206,980	1,206,980	1,206,980	16,411,380
	Palm Outgrower Schemes in Community Development Zones (SH Palm)	406,002	757,503	1,183,253	1,683,253	2,257,503	1,484,995	1,484,995	1,484,995	1,484,995	1,484,995	13,712,487
	Sustainable agriculture and others livelihoods activities (SH SustainAgr)	241,932	537,475	920,305	1,390,424	1,947,831	1,168,934	1,039,987	1,039,987	1,039,987	1,039,987	10,366,849
	Smallholders conservation payments (SH Cons)	120,000	120,000	240,000	400,000	600,000	610,000	1,640,000	2,060,000	2,480,000	2,480,000	10,750,000
	Enabling activities											
	Biodiversity and protected area management	1,337,283	1,337,283	1,337,283	1,337,283	1,337,283	-	-	-	-	-	6,686,417
	Community level governance	780,475	780,475	780,475	780,475	780,475	-	-	-	-	-	3,902,375
	Land-use planning	1,600,000	1,600,000	1,600,000	1,600,000	1,600,000	-	-	-	-	-	8,000,000
	Forest sector governance	5,946,070	5,946,070	5,946,070	5,946,070	5,946,070	-	-	-	-	-	29,730,350
	Support for developing a sustainable cocoa production	400,000	400,000	400,000	400,000	400,000	-	-	-	-	-	2,000,000
	Support for developing a sustainable palm oil production	400,000	400,000	400,000	400,000	400,000	-	-	-	-	-	2,000,000
	Reduced-Impact Mining	400,000	400,000	400,000	400,000	400,000	-	-	-	-	-	2,000,000
Financing costs (e.g., interest payments on loans)	n/a	-	-	-	-	-	-	-	-	-	-	-
Costs related to development and operation of the MRV	*Cost of Emission Reduction and Safeguards MRV*	95,060	354,907	331,035	320,052	410,052	257,852	272,852	367,852	272,852	222,852	2,905,367
Costs related to the Implementation of Benefit Sharing Plan	*Direct carbon revenues distribution to companies and communities*	-	-	2,373,384	-	13,682,508	-	14,812,144	-	-	-	30,868,036
Costs related to the implementation of the feedback and grievance redress mechanism(s);	*Equipments, control field audit and capacity building*	12,479	51,413	52,956	54,545	56,181	57,866	59,602	61,390	63,232	65,129	534,794
Costs related to stakeholder consultations and information sharing	*Communication support production and dissemination, regular consultative workshop*	281,333	281,333	193,333	-	-	-	-	-	-	-	756,000
Total costs		**14,643,117**	**17,115,694**	**21,188,224**	**20,209,231**	**36,504,030**	**8,473,012**	**23,751,162**	**9,433,637**	**9,771,685**	**9,768,177**	**170,857,968**
Expected sources of funds												
Secured Grant funding	*GEF WB*	1,016,333	1,016,333	1,016,333	1,016,333	1,016,333	-	-	-	-	-	5,081,667
	GEF UNDP	600,000	600,000	600,000	600,000	600,000	-	-	-	-	-	3,000,000
	AFD PPFNC	1,682,850	1,682,850	1,682,850	1,682,850	1,682,850	-	-	-	-	-	8,414,250
	AFD Cocoa	1,209,710	1,209,710	1,209,710	1,209,710	1,209,710	-	-	-	-	-	6,048,550
	PDARP2 WB	-	-	-	-	-	-	-	-	-	-	-
	FIP	3,200,000	3,200,000	3,200,000	3,200,000	3,200,000	-	-	-	-	-	16,000,000
	FIP DGM	900,000	900,000	900,000	900,000	900,000	-	-	-	-	-	4,500,000
	CAFI	1,600,000	1,600,000	1,600,000	1,600,000	1,600,000	-	-	-	-	-	8,000,000
	DFID	1,234,090	1,234,090	1,234,090	1,234,090	1,234,090	-	-	-	-	-	6,170,450
	APV-FLEGT	-	-	-	-	-	-	-	-	-	-	-
	BAD (PACIGOF) (2017-2021)	4,151,030	4,151,030	4,151,030	4,151,030	4,151,030	-	-	-	-	-	20,755,150
Private funds to be confirmed	*(Current status of interest)*	6,019,520	6,019,520	6,019,520	6,019,520	6,019,520	-	-	-	-	-	30,097,600
Revenue from REDD+ activities (e.g., sale of agricultural products)	*Non-carbon revenues*	2,572,381	6,879,948	14,935,524	27,548,755	44,025,219	58,873,178	73,701,266	82,740,853	88,812,467	93,163,373	493,252,965
Revenue from sale of additional Emission Reductions (not yet contracted)	*ERPA with Carbon Fund*	6,500,000	-	5,265,000	-	23,400,000	-	29,835,000	-	-	-	65,000,000
Total sources		**30,685,914**	**28,493,481**	**41,814,058**	**49,162,288**	**89,038,752**	**58,873,178**	**103,536,266**	**82,740,853**	**88,812,467**	**93,163,373**	**666,320,631**
Net revenue before taxes (=total sources – total uses)		16,042,798	11,377,788	20,625,834	28,953,057	52,534,722	50,400,166	79,785,104	73,307,216	79,040,782	83,395,196	495,462,663
Net revenue w/o non-carbon revenue		**13,470,417**	**4,497,840**	**5,690,309**	**1,404,302**	**8,509,503**	**(8,473,012)**	**6,083,838**	**(9,433,637)**	**(9,771,685)**	**(9,768,177)**	**2,209,699**

ANNEX 2. LIST OF CONVENTIONS AND AGREEMENTSS ON ENVIRONMENTAL PROTECTION

The Republic of Congo is a party to several conventions and agreements on environmental protection inter alia:

- African Convention on the Conservation of Nature and Natural Resources
- Convention on Wetlands of International Importance especially as Waterfowl habitat
- Convention concerning the Protection of World Cultural and Natural
- Convention on international trade in species of wild fauna and flora threatened with extinction (amended in 1979, 1983 and 1987)
- Convention on the Conservation of Migratory Species of Wild Animals
- Convention on cooperation for the protection and implementation of the Marine and Coastal Environment of the West Africa region and Central
- United Nations Framework Convention on Climate Change
- Convention on Biological Diversity
- UN Convention on the fight against desertification in countries seriously affected by drought and / or desertification, particularly in Africa
- African Convention on the Conservation of Nature and Natural Resources (Revised)
- 2006 international agreement on tropical timber
- Lusaka Agreement on Cooperative Enforcement Operations Directed at Illegal Trade in wildlife and wild flora
- Agreement relating to the Implementation of Part XI of the United Nations Convention on the Law of the Sea of 10 December 1982
- Agreement on the Conservation of African-Eurasian Migratory Waterbirds
- Voluntary Partnership Agreement FLEGT-VPA between the Republic of Congo and the European Union in the Forest Law Enforcement, Governance and Trade Protocol to amend the Convention on Wetlands of International Importance especially as Waterfowl habitat
- Kyoto Protocol to the Framework UN Convention on Climate Change
- Nagoya Protocol on the equitable sharing of natural resources

The Congo is a member of organizations and mechanisms below:

- Partnership for the forests of the Congo Basin (PFBC);
- Commission of Central African Forests (COMIFAC);
- Conference on the ecosystems of dense rainforests of Central Africa (CEFDHAC);
- International Tropical Timber Organization (ITTO);
- African Timber Organization (ATO);
- United Nations Food and Agriculture Organization (FAO);

- World Conservation Union (IUCN)
- Conservation Organization of African wildlife (OCFSA)
- Monitoring of Forests in Central Africa (OFAC);
- Network of forestry and environmental training institutions in Central Africa (RIFFEAC);
- Network of Protected Areas of Central Africa (RAPAC);
- Ecosystem Conservation Programme in the Congo Basin (PACEBCo).

ANNEX 3. CONSULTATIONS DURING THE IMPLEMENTATION PHASE OF THE ER-PROGRAM

Consultation type	Targeted groups	Comments	Frequency									
			Y1	Y2	Y3	Y4	Y5	Y6	Y7	Y8	Y9	Y10
Workshop *	All stakeholders	1 per year Objective: overview and evaluation of the program	1	1	1	1	1	1	1	1	1	1
CONA-REDD ordinary sessions	CONA-REDD members	2 per year Objective: decision making and reorientations if appropriate	2	2	2	2	2	2	2	2	2	2
Focus group in Sangha *	LCIP	1 per concessions (6) plus one (1) in ECOOIL community development area every 6 months during the first half of the ER-Program term and the every two months. These focus groups will be held by the RME. Objective: collect feedbacks from LCIP on how the program works	14	14	14	14	14	7	7	7	7	7
Focus group in Likouala *	LCIP	1 per concessions (10) every 6 months during the first half of the ER-Program term and the every two months.	20	20	20	20	20	10	10	10	10	10

Consultation type	Targeted groups	Comments	Frequency									
			Y1	Y2	Y3	Y4	Y5	Y6	Y7	Y8	Y9	Y10
		These focus groups will be held by the RME. Objective: collect feedbacks from LCIP on how the program works										
Consultation with private sector in Sangha *	Private sector	1 per quarter for the 1st year and then 2 per year in Ouesso. These consultations will be held by the RME. Objective: collect feedbacks from the private sector on how works the progam	4	2	2	2	2	2	2	2	2	2
Consultation with private sector in Likouala *	Private sector	1 per quarter for the 1st year and then 2 per year in Impfondo. These focus groups will be held by the RME. Objective: collect feedbacks from the private sector on how works the progam	4	2	2	2	2	2	2	2	2	2
CODEPA Working groups in Sangha	CODEPA members	1 per month on each thematic (there are 6 themes) Objective: make sur that the program is well	72	72	72	72	72	72	72	72	72	72

Consultation type	Targeted groups	Comments	Frequency									
			Y1	Y2	Y3	Y4	Y5	Y6	Y7	Y8	Y9	Y10
		implemented with a focus on each key themes										
CODEPA permanent consultation platform on grievances and feedbacks in Sangha *	CODEPA and RME	1 per quarter Objective: prevent grievances and feedbacks based on false information or on a lack of information	4	4	4	4	4	4	4	4	4	4
CODEPA Working groups in Likouala	CODEPA members	1 per month on each thematic (there are 6 themes) Objective: make sur that the program is well implemented with a focus on each key themes	72	72	72	72	72	72	72	72	72	72
CODEPA permanent consultation platform on grievances and feedbacks in Likouala *	CODEPA and RME	1 per quarter Objective: prevent grievances and feedbacks based on false information or on a lack of information	4	4	4	4	4	4	4	4	4	4
EDD group meeting	Financial partners	1 per month Objective: overview of various existent initiatives and possible synergies	12	12	12	12	12	12	12	12	12	12
High level panels	Experts from key REDD+ ministries	1 per month for each key ministry in the REDD+ process	120	120	120	120	120	120	120	120	120	120

Consultation type	Targeted groups	Comments	Frequency									
			Y1	Y2	Y3	Y4	Y5	Y6	Y7	Y8	Y9	Y10
		Objective: Harmonize sectoral policies and seize potential synergies. Make sure that there is no conflict of use or no policies that can threaten the program										

*** Financed by the ER-Program.**

ANNEX 4. TABLEAU RECAPITULATIF DES CONSULTATIONS MENEES DANS LE CADRE DE L'ELABORATION DU DOCUMENT DU PROGRAMME DE REDUCTION DES EMISSIONS (ER-P) SANGHA-LIKOUALA NATIONALE REDD+ EN 2016

Nom ou Thème de l'atelier	Date/Lieu	Objectifs	Approches méthodologiques	Info. préalables	Participants							
					Genre		Parties prenantes				Partners au dvpt	TOTAL
							Pouvoirs publics	Société civile (CACO-REDD)		Secteur privé		
					Hommes	Femmes		Composante société civile	Composante autochtone			
Atelier de consolidation du Document de l'ER-P Sangha-Likouala	1er Février 2016 à Brazzaville	Consulter les parties prenantes sur le document de l'ER-P Sangha-Likouala	- Rencontres ciblées avec certaines acteurs ou personnes ressources ; - Atelier de consolidation de l'ER-PD	Les parties prenantes avaient déjà appris l'avènement en République du Congo d'un programme de réduction des émissions dans la Sangha et la Likouala	35	13	35	02	02	02	07	48

Atelier de consultation sur les aspects sociaux environnementaux dans les départements de la Sangha et la Likouala	Du 31Mai au 5 Juin 2016	Consulter les parties prenantes sur les aspects sociaux environnementaux à prendre en compte dans le cadre du ER-P	Identification des cibles représentant le comité départemental REDD, les représentants populations autochtones	Les supports de ont été transmis aux parties prenantes avant la tenue de l'atelier	32	8	30	5	5	-	-	40
Atelier de consultation sur les aspects sociaux environnementaux dans le département de la Likouala	Du 31 Mai au 5 Juin 2016	Consulter les parties prenantes sur les aspects sociaux environnementaux à prendre en compte dans le cadre du ER-P	Identification des cibles représentant le comité départemental REDD+, les représentants populations autochtones	Les supports de ont été transmis aux parties prenantes avant la tenue de l'atelier	33	7	30	5	5	-	-	40
Atelier de consultation sur les aspects de partage de bénéfice pour la mise en place du plan de partage des bénéfices du ER-P dans le Département de la Sangha	Du 21 Septembre 2015 au 03 octobre 2015.	Consulter les parties prenantes sur les approches de partages des bénéfices existant et l'approche de partage de bénéfice du ER-P	Définition de la taille de l'échantillon ; Identification des districts et villages à consulter Consultations des autorités locales, communautés locales et populations autochtones	Présentation du contexte de consultation ; Tenu de focus groupe homme, femme	145	80	50	-	74	-	-	227

Atelier de consultation sur les aspects de partage de bénéfice pour la mise en place du plan de partage des bénéfices du ER-P dans le Département de la Likouala	Du 04au 12 octobre 2015	Consulter les parties prenantes sur les approches de partages des bénéfices existant et l'approche de partage de bénéfice du ER-P	Définition de la taille de l'échantillon ; Identification des districts et villages à consulter Consultations des autorités locales, communautés locales et populations autochtones	Présentation du contexte de consultation ; Tenu de focus groupe homme, femme	269	100	30	-	140	-	-	369
Atelier de consultation des parties prenantes pour la restitution de la mission de consultation des parties prenantes pour la mise en place du partage des bénéfices dans le département de la Likouala		Restitution des résultats de consultation et présentation du draft du plan de partage de bénéfice du ER-P	Identification des cibles représentant le comité départemental REDD+, les représentants populations autochtones	Les supports de ont été transmis aux parties prenantes avant la tenue de l'atelier	34	6	25	5	10	-	-	40
Atelier de consultation des parties prenantes pour la					35	5						40

restitution de la mission de consultation des parties prenantes pour la mise en place du partage des bénéfices dans le département de la Sangha												
Atelier de consolidation du Document de l'ER-P Sangha-Likouala	2 Février 2016 à Brazzaville	Consulter les parties prenantes sur le document de l'ER-P Sangha-Likouala	- Rencontres ciblées avec certaines acteurs ou personnes ressources ; - Atelier de consolidation de l'ER-PD	-Prise de connaissance de l'ER-PD - Connaissance sur le R-PP et d'autres documents tels que le PND, DSRP, etc.)	24	13	27	02	02	02	04	37
Atelier de consolidation du Document de l'ER-P Sangha-Likouala	3 Février 2016 à Brazzaville	Consulter les parties prenantes sur le document de l'ER-P Sangha-Likouala	- Rencontres ciblées avec certaines acteurs ou personnes ressources ; - Atelier de consolidation de l'ER-PD	-Prise de connaissance de l'ER-PD - Connaissance sur le R-PP et d'autres documents tels que le	22	09	22	02	02	00	05	31

				PND, DSRP, etc.)								
Session de haut niveau pour consolider le document de l'ER-P Sangha-Likouala avec CACO-REDD	22 Février 2016 à Brazzaville	Consulter la société civile et populations autochtone (CACO-REDD-Brazzaville) sur des questions précises relatives à l'ER-Programme	Atelier de consultation des parties prenantes (Ministères clés de REDD+ et CACO-REDD) sur l'ER-PD sur fond de questions à y répondre	- Notes d'information sur l'ER-PD ; - Notes d'information sur les options stratégiques ; Questionnaire sur la mise en œuvre de l'ER-Programme	36	06	25	12	05	00	00	42
Session de haut niveau pour consolider le document de l'ER-P Sangha-Likouala avec les Ministères en charge de l'Agriculture, de l'Environnement, des Mines, de l'Energie et des Affaires foncières	24 Février 2016 à Brazzaville	Consulter les Ministères clés du processus REDD+ sur des questions précises relatives à l'ER-Programme	Atelier de consultation des parties prenantes (Ministères clés de REDD+ et CACO-REDD) sur l'ER-PD sur fond de questions à y répondre	- Notes d'information sur l'ER-PD ; - Notes d'information sur les options stratégiques ; Questionnaire sur la mise en œuvre de l'ER-	36	06	69	00	00	00	00	69

				Programme								
Session de haut niveau pour consolider le document de l'ER-P Sangha-Likouala avec les Ministères en charge de l'Intégration, des Grands travaux et des Finances	26 Février 2016 à Brazzaville	Consulter les Ministères clés du processus REDD+ sur des questions précises relatives à l'ER-Programme	Atelier de consultation des parties prenantes (Ministères clés de REDD+ et CACO-REDD) sur l'ER-PD sur fond de questions à y répondre	- Notes d'information sur l'ER-PD ; - Notes d'information sur les options stratégiques ; Questionnaire sur la mise en œuvre de l'ER-Programme	65	06	71	00	00	00	00	71
Atelier de sensibilisation des parties prenantes départementales de la Sangha sur l'ER-Programme Sangha-Likouala	25 Février 2016 à Ouesso	Sensibiliser les parties prenantes de la Sangha sur l'ER-P sangha-Likouala	Atelier de sensibilisation des parties prenantes des départements de la Sangha et la Likouala	- Présentation de l'ER-programme ; - Présentation de l'état d'avancement du processus REDD+	38	09	33	08	06	00	00	47
Atelier de restitution de	26 Février	Organiser une restitution de	Atelier de restitution sur	Rapport de mission								

la mission des consultations des parties prenantes départementales pour la mise en place d'un plan de partage de bénéfices de l'ER-P Sangha-Likouala	2016 à Ouesso	la mission de consultation des parties pour la mise en place d'un plan de partage de bénéfices de l'ER-P Sangha-Likouala	la mission de consultation relative au plan de partage de bénéfices	des consultations pour la mise en œuvre d'un plan de partage de bénéfices	42	08	37	08	05	00	00	50
Atelier de restitution de la mission des consultations des parties prenantes départementales pour la mise en place d'un plan de partage de bénéfices de l'ER-P Sangha-Likouala	27 Février 2016 à Ouesso	Organiser une restitution de la mission de consultation des parties pour la mise en place d'un plan de partage de bénéfices de l'ER-P Sangha-Likouala	Atelier de restitution sur la mission de consultation relative au plan de partage de bénéfices	Rapport de mission des consultations pour la mise en œuvre d'un plan de partage de bénéfices multiples	43	04	33	07	07	00	00	47
Atelier de sensibilisation des parties prenantes départementales sur l'ER-P Sangha-Likouala	1er Mars 2016 à Impfondo	Sensibiliser les parties prenantes Sangha-Likouala sur l'ER-Programme	Atelier de sensibilisation des parties prenantes Sangha-Likouala sur l'ER-P	- Présentation de l'ER-programme ; - Présentation de l'état d'avancement du	33	03	20	12	03	00	01	36

				processus REDD+								
Atelier de restitution de la mission de consultations des parties prenantes départementales pour la mise en place d'un plan de partage de bénéfices de l'ER-P Sangha-Likouala	2 Mars 2016 à Impfondo	Organiser une restitution de la mission de consultation des parties pour la mise en place d'un plan de partage de bénéfices de l'ER-P Sangha-Likouala	Atelier de restitution sur la mission de consultation relative au plan de partage de bénéfices	Rapport de mission des consultations pour la mise en œuvre d'un plan de partage de bénéfices multiples	45	14	21	23	14	01	00	59
Atelier de restitution de la mission de consultations des parties prenantes départementales pour la mise en place d'un plan de partage de bénéfices de l'ER-P Sangha-Likouala	3 Mars 2016 à Impfondo	Organiser une restitution de la mission de consultation des parties pour la mise en place d'un plan de partage de bénéfices de l'ER-P Sangha-Likouala	Atelier de restitution sur la mission de consultation relative au plan de partage de bénéfices	Rapport de mission des consultations pour la mise en œuvre d'un plan de partage de bénéfices multiples	47	15	20	23	17	00	02	62

ANNEX 5. COMPLEMENTARY PROGRAMS

Congo has secured access to US$24 million from the **Forest Investment Program (FIP)**. In its expression of interest, the government committed to using a portion of these funds to directly support the ER-Program through support for agroforestry approaches. These funds are to be planned through the incipient National REDD+ Investment Plan that is a pre-condition for accessing FIP financing. This plan will also serve to apply for funds from the **Central African Forest Initiative (CAFI)**, which the government has joined. The government intends to use CAFI funding to implement a National Land Allocation Plan to facilitate land-use planning at a national level.

The Forest and Economic Diversification Project (FEDP), with $22.6 million in government funding and $10 million from the International Development Association, aims to strengthen the capacity of the government, local communities, and Indigenous Peoples to co-manage forests. A number of the project's activities are aligned with the ER-Program, including the project's support for MEFDDE's operational and management capacity, including by providing hardware needed to implement the Voluntary Partnership Agreement for Forest Law Enforcement, Governance, and Trade (FLEGT); the development of application texts for the new Forest Code; the development of simplified management plans for the community development areas of forest concessions; and support and training to farmers seeking to grow cocoa in degraded forest areas.

US$ 6.6 million in additional financing to the FEDP is available from the **Global Environment Facility**. A portion of this grant will further support agroforestry on degraded land in the accounting area, and will establish a management structure for Ntokou-Pikounda National Park.

In addition, the **French Development Agency** is preparing a project that will support the cocoa sector and sustainable forest management in the accounting area.

With support from the **European Union**, Congo is in the process of developing the systems needed to control, verify and license legal timber as part of its FLEGT process. Though FLEGT is conducted through a voluntary partnership agreement with the EU, Congo will be able to use these systems to cover timber and timber products exported not only to the EU, but also to other destinations worldwide. The FLEGT agreement provides platforms for coordination and strategy and will support the ER-Program in achieving progress on SFM in industrial logging concessions.

ANNEX 6. SOCIAL AND ENVIRONMENTAL RISKS AND MITIGATION ANALYSIS OF THE ER-PROGRAM

Analyse des risques et identification des mesures d'atténuation/optimisation /compensation					
Options Stratégiques	**Activités**	**Actions**	**Risques / Impacts**	**Mesures d'atténuation/Optimisation /compensation**	**Mise en application**
AXE : FORÊT					
OS2 Gestion durable des forêts	**SA1.** Exploitation à impact réduit	Appui à l'exploitation forestière à impact réduit	Contribution à la réduction de la dégradation des forêts ;	Renforcement des capacités des ressources des concessions forestières	Concessionnaires forestiers Gouvernement
			Les incitations pourront ne pas couvrir les coûts de mise en œuvre de l'EFIR	Accompagnement intensif de la sensibilisation et appui sur les activités planifiées afin de maintenir les prévisions de résultats ; -appui au MRV, -vulgarisation des grilles de conformité des exploitants devant servir d'outil d'auto- évaluation avant MRV et CODEPA REDD,	
			Optimisation du temps de production	Respect des règles d'exploitation dans le cadre de l'EFIR	Concessionnaires forestiers
			Préservation des tiges d'avenir (garantie du potentiel de régénération)	Mise en place d'audits internes sur les respect et la mise en application de l'approche EFIR	Concessionnaires forestiers

			Réduction des impacts sur les zones sensibles, arbres sacrés zones protégés		
			Augmentation de la production de bois	Renforcement des capacités des (formation ou remise à niveau selon niveau de performance)	Concessionnaires forestiers
	SA2. Concessions de conservation	Renforcement des concessions de conservation	Contribution à la conservation de la biodiversité (faune et autres)		ONG, Partenaires aux développements ; CDMC, CODEPA
			Augmentation des restrictions d'accès des CLPA aux ressources naturelles	Mise en place des plans d'aménagements des concessions de conservation	ONG, Partenaires aux développements, Collectivités locales et les CLPA, CODEPA
				Appui et suivi de la mise en œuvre des projets des CLPA	ONG, Partenaires aux développements, Collectivités locales et les CLPA, CODEPA
				Règlementation de l'accès aux ressources naturelles en cas de nécessité	
			Augmentation des conflits homme faune	Appui aux activités alternatives Identification des mesures d'atténuation dans la cadre des conflits hommes faunes Compensation des dommages auprès des communautés locales	Gestionnaire des aires protégées, Gouvernement
	SA3. Paiements pour conservation (pour les populations et petits planteurs)	Redistribution aux CLPA des revenus issus des paiements des services environnementaux	Contribution à l'amélioration des revenus des communautés locales et populations autochtones (CLPA)	Mise en œuvre du plan de partage des bénéfices	ONG, Partenaires aux développements, Collectivités locales et les CLPA, CODEPA

			Contribution à diversification des sources de revenus	Appui à l'identification et la mise œuvre des des activités génératrices de revenus (AGR) des CLPA.	ONG, Partenaires aux développements, Collectivités locales et les CLPA, CODEPA
			Contributions aux changements des pratiques destructives de la forêt des communautés locales et populations autochtones	Sensibilisation des communautés locales et populations autochtones (CLPA) sur leur implication dans la conservation du couvert forestier et le paiement des services environnementaux	Organe de gestion du programme de réduction des émissions de la Sangha et la Likouala, ONG, CODEPA REDD
	EA4. Gouvernance forestière	Appui à l'amélioration de la gouvernance forestière	Contribution à la gestion durable des forêts	Renforcement des moyens de suivi des activités et engagements des concessionnaires (humains, matériels et financière)	- Gouvernements - Partenaires aux développements ; - ONG
			Mise en place des cadres de concertation de toutes les parties prenantes de la zone intéressée	Implication des toutes les parties prenantes dans la gestion des concessions forestières	Gouvernements - Partenaires aux développements ; - ONG et CODEPA
				Mise en œuvre du mécanisme de règlement des conflits	
	EA5. Amélioration de la gestion des aires protégées	Mise en place des plans d'aménagements des aires protégées	Prévention des conflits et des plaintes	Vulgarisation des outils y afférents	Gouvernements - Partenaires aux développements ; - ONG et CODEPA
			Mise en place du mode de gestion participative		

AXE : COMPOSANTE AGRICULTURE					
OS3 Amélioration des systèmes agricoles	**SA4.** Conversion évitée dans les HCV des palmeraies industrielles	Mise en place des palmerais industrielles dans les zones dégradées	Contribution à la conservation de la forêt primaire (Conservation de la biodiversité)	Appui à l'adaptation des palmerais dans les zones dégradées	Gouvernements - Partenaires aux développements ; - ONG et CODEPA
			Sources des conflits des industrielles et les CLPA	Délimitation et cartographie participatives des superficies utilisable - mise en œuvre des mécanismes de prévention et résolution des conflits	
	SA5. Cacao sous ombrage durable dans les SDC	Mise en place du cacao culture sous ombrage durable dans les SDC	Naissance des conflits du fait des superficies insuffisantes des SDC par rapports aux besoins en terre des CLPA	- Mise en place d'une cartographie participative/plan local d'usage des terres - l'identification des zones de développement agricole - mise en œuvre des mécanismes de prévention et résolution des conflits; -appui et accompagnement agricole des ménages à travers par les structures habilitées.	Gouvernements (Ministères : Agriculture, Economie Forestière, Développement Durable et de l'Environnement) - Partenaires aux développements ; - ONG et CODEPA - Unité de gestion de l'ER-P.
			Déforestation des autres zones des couverts forestiers du fait de la valeur ajoutée de la culture de cacao	Sensibilisé les CLPA sur la cacao Culture sous ombrage durable dans les SDC Définir des critères de performances pour les bénéficiaires dans le cadre de	

				l'appui à la cacao Culture sous ombrage durable dans les SDC	
	SA6. Palmeraies villageoises dans les SDC des palmeraies industrielles	Appui à la mise en place des palmeraies villageoises dans les SDC	Naissance des conflits du fait des superficies insuffisantes des superficies des SDC par rapports aux besoins en terre des CLPA	- Mise en place d'une cartographie participative/plan local d'usage des terres - l'identification des zones de développement agricole - mise en œuvre des mécanismes de prévention et résolution des conflits; -appui et accompagnement agricole des ménages à travers par les structures habilitées	Gouvernements (Ministères : Agriculture, Economie Forestière, Développement Durable et de l'Environnement) - Partenaires aux développements ; - ONG et CODEPA
	SA7. Agriculture durable et autres moyens de subsistance (miel, etc.)	Appui à la mise en place de l'agriculture de conservation	Accroissement de la production agricole au niveau de l'agriculture famille et des ménages fait augmenter les besoins en main d'œuvre agricole surtout celles des femmes.	- Appui à la transformation et conservation des produits agricoles -accompagnement d'une réflexion collective sur les questions du genre dans la production agricole	Gouvernements (Ministères : Agriculture, Economie Forestière, Développement Durable et de l'Environnement) - Partenaires aux développements ; - ONG et CODEPA
		Appui à la promotion de la chaine de valeur des PFNL à haute valeur ajoutée	Diversification des sources des revenus des CLPA Contribution à l'amélioration des conditions de vie des communautés locales et populations autochtones Création d'emploi au niveau locale	- Renforcement des capacités des CLPA à la valorisation des PFNL à haute valeur ajoutée	Gouvernements (Ministères : Agriculture, Economie Forestière, Développement Durable et de l'Environnement) - Partenaires aux développements ; - ONG et CODEPA.

	EA6. Appui au développement d'une production durable d'huile de palme	Appui au développement d'une production durable d'huile de palme	Diversification des sources des revenus des CLPA	Insérer dans les contrats de programme ER-PD avec les concessionnaires agricoles les clauses d'incitation autour de leurs concessions, des carrés d'agriculture familiale sous leur accompagnement. -Appui au développement du partenariat foncier entre les exploitants agricoles et les populations riveraines,	Gouvernements (Ministères : Agriculture, Economie Forestière, Développement Durable et de l'Environnement) - Partenaires aux développements ; - ONG et CODEPA
			Risque de surproduction d'huile de palme	Appui l'identification des marchés d'écoulement (Contractualisation des CLPA avec les agroindustrielles et autres débouchés)	- Partenaires aux développements ; - Collectivités locales ; - Partenaires Privés - ONG et CODEPA
	EA7. Appui au développement d'une production durable de cacao	Appui au développement d'une production durable de cacao	Naissance des conflits superficies insuffisantes	-sensibilisation des concessionnaires agricoles des cultures pérennes à adhérer au contrat de performance de l'ER-PD, - Les appuis du programme à cette activité seront totalement conditionné à ne pas ouvrir des champs en forets, -Développement des cadastres agricoles en respectant les différents plans directeurs d'aménagement rural du territoire au niveau des départements	Gouvernement - Partenaires aux développements ; - Collectivités locales - ONG et CODEPA
			Temps d'adaptation au développement d'une production durable de cacao		
	EA8. Appui à la chaine de valeur de l'agriculture durable	Appui à la chaine de valeur de l'agriculture durable	-Accroissement de la production et sans avoir nécessairement des marchés d'écoulement,-conséquemment une	- appui de l'ER-PD aux activités d'aménagement des pistes agricole -appui à l'entreprenariat rural dans la commercialisation des produits agricoles	Gouvernement Services techniques ; Collectivités locales ; - Partenaires aux développements ;

			baisse des prix agricoles au niveau local		- ONG et CODEPA
COMPOSANTE GOUVERNANCE					
OS1 Renforcement de la gouvernance	**EA1.** Aménagement du territoire (ou utilisation des terres) national	Appui à la mise en place du Plan National d'Aménagement du territoire (PNAT) (ou utilisation des terres)	Risque de délocalisation des zones de mise en œuvre des activités et le temps d'adaptation sera long	Le PNAT, fera éviter les superpositions d'usages pour ce faires les actions de sensibilisations, diffusions et vulgarisations doivent être mené.	Gouvernement Services techniques ; Collectivités locales ; - Partenaires aux développements ; - ONG et CODEPA
	EA2. Aménagement du territoire (ou utilisation des terres) local	Appui à la mise en place d'un Plan Départemental d'Aménagement du Territoire (PDAT) (ou utilisation des terres) local	- Risque de délocalisation des zones de mise en œuvre des activités et le temps d'adaptation sera long ; - Non prise en compte des sites sacrés (cultuels et culturels)	Les PDATs seront approuvé suivant des critères garantissant (i) que les espace de développement communautaires sont garanties (comme dans le cas des concessions forestières) (ii) que les sites sacré (cultuel et culturels) sont respectés et préservés du développement d'activité.	Gouvernement Services techniques ; Collectivités locales ; - Partenaires aux développements ; - ONG et CODEPA
	EA3. Gouvernance au niveau des communautés	Appui à la gouvernance au niveau des communautés	Contribution à la gouvernance forestière et à la coordination efficace des actions au niveau local	Sensibilisation et renforcement des capacités des CLPA	Gouvernement Services techniques ; Collectivités locales ; - Partenaires aux développements ; - ONG et CODEPA
COMPOSANTE MINES					
OS5 Développement	EA9. Exploitation minière à impact réduit	Appui à l'exploitation et au développement d'un secteur minier vert	Réduction de la destruction massive par la pratique d'exploitation des mines à ciel ouvert	- Contractualisation avec les communautés sur la réhabilitation des sites après exploitation	Exploitants et communautés

d'un secteur minier vert			Conservation de la biodiversité	- Promotion du label vert	
COMPOSANTE ENERGIE					
OS4 Rationalisation de la production et l'utilisation du bois de chauffe et promotion d'autres énergies propres	EA10. Bois de chauffe	Appui à la rationalisation de la production et l'utilisation du bois de chauffe et promotion d'autres énergies propres.	Réduction de la pression sur le massif forestier	- Utilisation des déchets d l'exploitation forestière ; - appui à l'utilisation des foyers améliorés ; - Appui des CLPA dans le recyclage des déchets de bois	

ANNEX 7. NON-EXHAUSTIVE TAXONOMY OF ANIMAL AND VEGETABLE NTFPS IDENTIFIED IN CONSULTATION WITH LCIPS IN THE ER-PROGRAM AREA

Table 85. NTFPs identified by stakeholders in the ER-Program area

Name	Family	Description/Use
Macrostachyum Megaphrynium,	Marantaceae	Leaf, leaf blade: used as construction materials
Aframomum sp.	Zingiberaceae	
Elaeis guineensis	Arecaceae	Nuts (fruit): sold
Dacryodes edulis		Fleshy fruit: commercialized
Raphia sp.	Arecaceae	Sap producing palm wine: commercialized
Cola acuminata	Sterculiaceae	Nuts, fruit: consumed
Gnetum africanum, Gnetum buccholzianum	Gnetaceae	Commercialized
Elaeis guineensis	Arecaceae	
Dioscorea sp.	Dioscoreaceae	Tubers: consumed
Piper guineense	Piperaceae	Fruit: used, commercialized
Eremospatha sp. (Rattan)	Arecaceae	Stalk for rope, basket weaving: commercialized
Lepidoptera caterpillar, Kongo	Several species of Lepidoptera	Larva: consumed, commercialized
Actinia sp (Snail)	Gastropoda	Consumed
Mushrooms		Mushrooms: consumed, commercialized
Ancistrophyllum secundiflorum	Arecaceae	Final bud: consumed; stalk: used in basket weaving, commercialized
Medicinal plants		Used as medicine

ANNEX 8. GUIDELINES FOR MANAGING NTFPS

Based on consultation with stakeholders in the ER-Program area, guidance documents provided by the UNFCCC and the Convention on Biological Diversity, and other relevant documents, the CN-REDD has put forward guidelines that will be used as a basis for optimizing the management of NTFPs:

1. Education and training of LCIPs in the ER-Program on NTFP harvesting and sustainable management, e.g., an approach to sustainable management of the environment, poverty reduction, and sustainable means of subsistence, following the UNFCCC Bonn Agreement and the REDD+'s Principle 3;
2. Participation by women and youth in community discussions and decision making on NTFP evaluation;
3. Participatory mapping and identification of co-benefits in the ER-Program area;
4. Implementation of participatory activities for the prioritization of co-benefits and studies of the value-added chains of forest products deemed most important;
5. Consultation with LCIPs over current NTFP collection methods and possible improvements to ensure the sustainable supply of NTFPs;
6. Participatory and concerted reflection with LCIPs in the ER-Program area to develop a plan for the harvesting and sustainable management of NTFPs;
7. Development, validation, and formalization of the plan for exploiting and managing co-benefits in the ER-Program area with the participation of regional LCIP stakeholders;
8. Establishment of NTFP development projects, to be launched with ceremonies (traditional community rituals in the presence of the appropriate authorities, etc.), taking account of and respecting cultural heritage. Minutes must be signed by the community and countersigned by the appropriate authorities and potential partners.

ANNEX 9. PCI

Coverage of World Bank Operational Policies in the PCI-REDD

PCI-REDD	World Bank Operational Policies (OP)
Principle 1 - Comply with the standards of democratic governance, including those contained in national and multilateral commitments	**OP 4.10 Indigenous People** *10. Consultation and participation: When the project in question has an impact on Indigenous Peoples, the borrower undertakes a prior consultation of these peoples, free and based on the communication of information required.*
Principle 2 - Respect and protect the rights of stakeholders in compliance with international obligations.	**OP 4.01 Environmental Assessment;** **OP 4.12 Involuntary Resettlement** 2. If *appropriate measures are not carefully planned and implemented, involuntary resettlement may cause harmful consequences in the long term depletion and environmental damage. Therefore the overall objectives of the Bank's policy on involuntary resettlement are:* *a) We will strive to avoid, as far as possible, or minimize involuntary resettlement by exploring all feasible alternatives in the project design.* *b) Where population displacement is unavoidable, resettlement activities should be conceived and executed as development programs providing the displaced by sufficient investment project means to enable them to enjoy the benefits of the project. The déplacées3 populations should be consulted in a constructive manner and have the opportunity to participate in planning and implementing resettlement programs.* *c) Displaced persons should be assisted in their efforts to improve, or at least restoration of livelihoods and living standards, these are considered in real terms, to the levels prevailing at the time the phase preceding the movement or that of the implementation of the project, according to the most advantageous formula.* **OP 4.10 Indigenous People** 1. This *policy contributes to the mission of reducing poverty and promoting sustainable development pursued by the Bank in ensuring a development process that fully respects the dignity, human rights, economic systems and cultures Indigenous Peoples. Whenever the Bank is sought for a project directly affecting Indigenous Peoples, it requires that the borrower agrees to proceed beforehand with a free consultation and based on the communication of information to the populations concerned.The Bank financing will only be granted if during the free consultation and based on the information necessary to form an opinion, the project gets massive support in the community by the people.*
	OP 4.04 Natural Habitats 10. *The Bank expects borrowers to take into account the views, roles and rights of different groups, including non-governmental organizations and locales6 communities affected by projects involving natural habitats and finance Bank; and involve and engage the population in the planning, design, implementation, monitoring and evaluation of such projects. The involvement of people in the project may include identifying appropriate conservation measures, managing protected areas*

PCI-REDD	World Bank Operational Policies (OP)
	and other natural habitats and the monitoring and evaluation of specific projects. The Bank encourages governments to provide the people needed information and to provide appropriate incentives for habitat protection.
Principle 3: Promote and strengthen sustainable livelihoods and poverty reduction.	**OP 4.10 Indigenous People** *The projects financed by the Bank are also designed to ensure that Indigenous Peoples derive culturally appropriate social and economic benefits that benefit the female population as the male population and all generations.*
Principle 4: Contribute to a policy of sustainable low carbon development, climate resilient and consistent with national development strategies, national forest programs and commitments under the international conventions and agreements.	
Principle 5: Make sustainable use of high political priority forests for REDD +	**OP 4.01 Environmental Assessment** *1. The Bank1 requires projects presented to it for financing are subject to an environmental assessment (EA) that helps ensure they are environmentally sound and sustainable, and thus improves the decision making process.*
Principle 6: Maintain and enhance multiple functions of forests, in particular to ensure benefits such as the preservation of biodiversity and the services provided by ecosystems.	**OP 4.04 Natural Habitats** *3. The Bank promotes and supports natural habitat conservation and improved land use by financing projects designed to integrate into national and regional development strategies the protection of natural habitats and the maintenance of ecological functions. In addition, the Bank promotes the rehabilitation of degraded natural habitats.* *OP 4.09 Pest Management* *1. In projects financed by the Bank, the Borrower covers Pest Management as part of the environmental assessment conducted at the project.*
Principle 7 - Avoid or minimize adverse effects on the services rendered by non-forest ecosystems and biodiversity	**OP 4.09 Pest Management** *1. In projects financed by the Bank, the Borrower covers Pest Management as part of the environmental assessment conducted at the project.* **PO 404 Natural Habitats** *5. Wherever possible, projects financed by the Bank are located in territories which naturally has been changed (to the exclusion of all natural areas converted in the eyes of the Bank, in anticipation of the project). The Bank provides assistance to projects involving significant degradation of natural habitats is there is no realistic alternative to the project and its location, and that provided a comprehensive analysis has shown that the benefits of project will substantially outweigh the environmental costs. If the environmental assessment 4 shows that a project will change significantly or degrade natural habitats, the project in*

PCI-REDD	World Bank Operational Policies (OP)
	question incorporates mitigation measures acceptable to the Bank. Such mitigation measures include, as appropriate, minimizing habitat loss (eg, a strategic plan for conservation and restoration after development) and the creation and management of a protected area ecologically similar. The Bank accepts other forms of mitigation measures, on the strict condition that they are technically justified.
Principle 8: Promote incentives actors that contribute to achieving the outcomes of REDD +.	

Coverage of Cancun Safeguards in PCI-REDD

PCI-REDD+	Cancun Safeguards
Principle 1 - Comply with the norms of democratic governance such as those ongoing in the national and multilateral commitments	B - Transparency and effective forest governance structures; D - Full and effective participation of stakeholders
Principle 2 - Respect and protect the rights of stakeholders in compliance with international obligations.	C - Respect for the knowledge and rights of Indigenous Peoples;
Principle 3 Promote and strengthen sustainable livelihoods and poverty reduction.	
Principle 4 Contribute to a sustainable low carbon development policy, climate resilient and consistent with national development strategies, national forest programs and commitments under the international conventions and agreements.	A - Complementarity and compatibility with national forest programs and international agreements.
Principle 5 - Make sustainable use of high political priority forests for REDD +	
Principle 6 - Maintain and enhance multiple functions of forests, in particular to ensure benefits such as the preservation of biodiversity and the services provided by ecosystems.	E - Preservation of natural forests, biodiversity and eco systemic services
Principle 7 - Avoid or minimize adverse effects on the services rendered by non-forest ecosystems and biodiversity	E - Preservation of natural forests, the biodiversity and eco systemic services; F - Measures to take into account the risks of reversals
Principle 8 - Promote incentives actors that contribute to achieving the outcomes of REDD +.	

Coverage of FSC Principles, Criteria and Inidicators in PCI-REDD

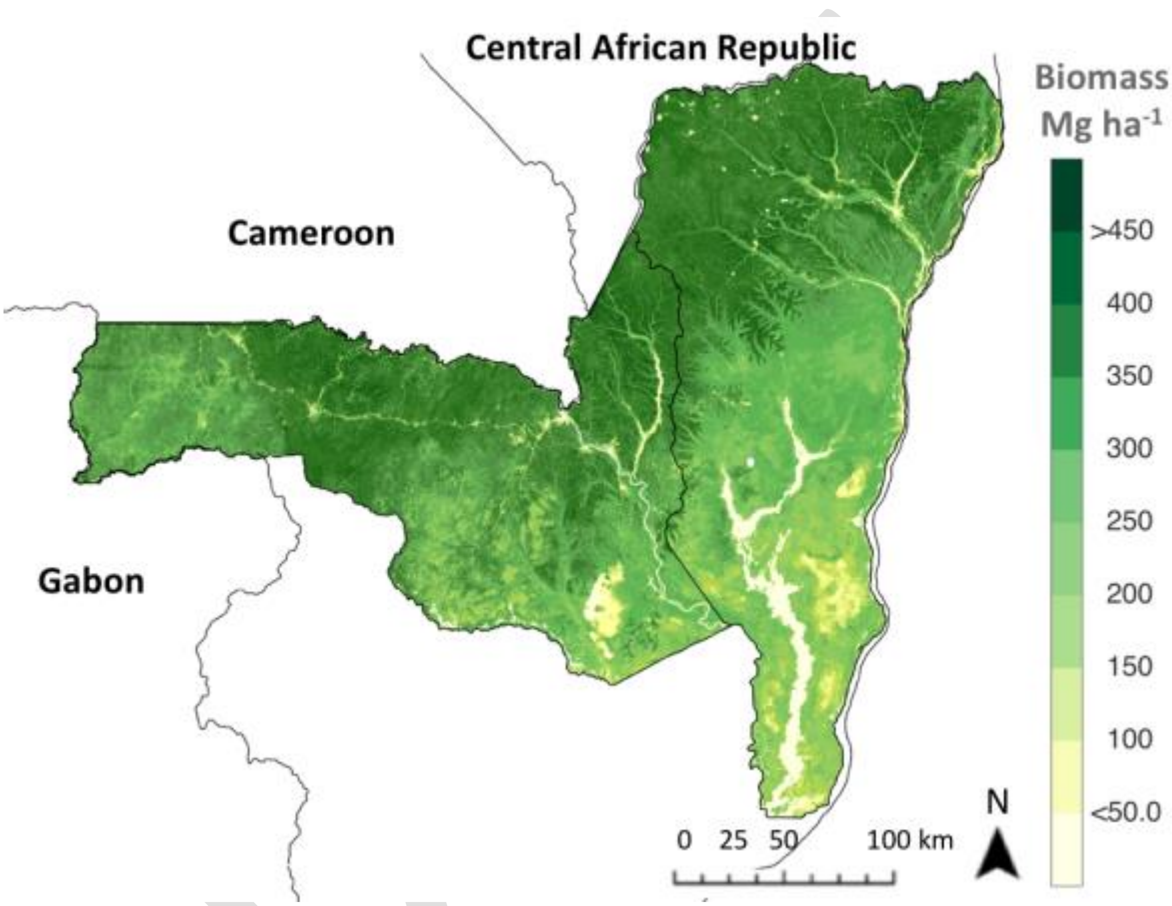
PCI-REDD	FSC Principles, Criteria and Indicators
Principle 1 - Comply with the standards of democratic governance, including those contained in national and multilateral commitments	Principle 1: Compliance with laws and FSC Principles Forest management shall respect all applicable laws in the countries where it is practiced and the international treaties and agreements to which the country is a signatory and must comply with all FSC Principles and Criteria.
Principle 2 - Respect and protect the rights of stakeholders in compliance with international obligations.	Principle 2: Tenure and use rights and responsibilities Land rights and the rights of long-term use of land and forest resources shall be clearly defined, documented and legally established. Indicator 2.1.6 The forest manager must develop and implement a policy vis-à-vis respect for customary rights, customary or legal in each community and present it to all workers and their families and make it available to its customers and the public . Principle No. 3. RIGHTS OF INDIGENOUS PEOPLES The legal and customary rights of Indigenous Peoples to the ownership, use and management of their lands, territories and resources shall be recognized and respected
Principle 3: Promote and strengthen sustainable livelihoods and reducing of poverty.	Principle 4: Community relations and workers' rights Forest management operations shall maintain or enhance the social well-being and long-term economic development of forest workers and local communities.
Principle 4: Contribute to a policy of sustainable low carbon development, climate resilient and consistent with national development strategies, national forest programs and commitments under the international conventions and agreements.	
Principle 5: Make sustainable use of high political priority forests for REDD +	
Principle 6: Maintain and enhance multiple functions of forests, in particular to ensure benefits such as the preservation of biodiversity and the services provided by ecosystems.	Principle 5: Forest Benefits Forest management operations shall encourage the efficient use of different forest products and services to ensure economic viability and a wide variety of environmental and social benefits. Criterion 5.6 The Forest Products sampling rate can not exceed the levels to ensure the sustainability of resources. Principle No. 1: Indicator 1.3.6 The forest manager has knowledge of strategies, plans or programs for the conservation and sustainable use of biodiversity in the country where he practices and demonstrate how the administration of the country contributes to the implementation of these national obligations.

Principle 7 - Avoid or minimize adverse effects on the services rendered by non-forest ecosystems and biodiversity	Principle 6: Environmental impacts Forest management shall conserve biological diversity and its associated values, water resources, soils and ecosystems and unique and fragile landscapes, in order to preserve the ecological functions and the integrity of the forest.
Principle 8: Promote incentives actors that contribute to achieving the outcomes of REDD +.	

ANNEX 10. ESTIMATION OF CARBON STOCKS

Estimation of Carbon Stocks

Emission Reductions Program in Sangha and Likouala, Republic of Congo



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May 10, 2016

1. SUMMARY

We report the methodology to estimate the emission factors for the carbon pools identified in the ER-Program for computing emissions from activities in the accounting area. Carbon stock densities are derived from several data sources including the national forest inventory data provided by CNIAF, satellite LIDAR (Light Detection and Ranging) forest structure samples converted to forest biomass, the VCS tool VT0005, and the forest biomass mapping approach as outlined in Saatchi et al. (2011). The emission factors were chosen in order to represent the variability and characteristics of forest structure and biomass of the accounting area in northern Congo. We developed a LIDAR aboveground biomass allometry by using the national forest inventory plots and using a combination of plots and LIDAR data to map the forest biomass using an unbiased estimator based on a machine learning approach. The methodology provided estimates of forest aboveground biomass over the entire study area. The belowground biomass was estimated using established allometry and the uncertainty of estimates for the total vegetation carbon pool was calculated using standard methodology recommended by the IPCC guidelines and the peer-reviewed journal publications.

2. BACKGROUND

Accurate and precise quantification of emissions from deforestation has become a key policy issue in light of recent developments relating to reducing emissions from deforestation and degradation (REDD+) as a climate mitigation strategy. In a national REDD+ policy framework, historical reference emission levels (potentially modified by one or several adjustment factors) will need to be set, and future emissions will be evaluated against the reference level as part of a monitoring, reporting and verification (MRV) system to determine whether a country has or has not made significant emission reductions. The uncertainty around reference emission levels and actual monitored emissions, must also be quantified, because the principle of conservativeness results in the use of the lower uncertainty bound around the reference scenario to avoid over crediting future reductions.

Many important technical and political questions remain to be answered regarding how REDD+-based emission offset projects and programs will be implemented and work at the jurisdictional or national levels. Emission estimates from land cover change require information on both the area of change and the corresponding carbon stock changes of the lands that are cleared. Much of the emphasis on tropical deforestation to date has focused primarily around improving the area estimates; yet significant errors exist in the carbon stock element, with this uncertainty becoming more problematic as larger regions are considered (as will be necessary for regional or national programs).

In order to map biomass, and therefore carbon at national and regional scales, a combination of in situ field sampling paired with remote sensing methods (satellite or aerial) are currently the only available options. In a recent effort, a tool for measuring aboveground live forest biomass using remote sensing techniques has been approved with the AFLOU-REDD+ sectorial scope (VT0005). With this tool as part of the official VCS methodology, countries can develop carbon emission factors and stocks at national and regional scale. The tool was developed by Sassan Saatchi and was prepared and registered by Terra Global Capital..

3. DATA SOURCES

3.1 Study Region

The ER-Program boundary in northern Republic of Congo is composed of two administrative jurisdictions made up of the departments of Sangha and Likouala. The Sangha covers an area of 5.78 million hectares, or 57,800 km^2 and has an estimated total population in 2014 of about 109,000 persons mainly concentrated around the capital city of Ouesso. Forest covers 5,723,744 hectares or 99% (FACET, 2013) of the total area and is made up of: 6 forestry concessions (already granted to concessionaires); and three protected areas: National Parks Nouabalé-Ndoki, Ntokou-Pikounda and Odzala- Kokoua.

The Department of Likouala which covers an area of about 6.57 million hectares to either 65.700 km2, has a total estimated population in 2014 of about 196,000 inhabitants, mainly concentrated around the city of Impfondo, the capitol of the department. The forest area that covers 6,271,966 hectares or 95% (FACET, 2013) of the total area of the Department of Likouala is divided between: 9 Forest Management Units (FMU) for industrial logging; two protected areas namely: The Lac Télé Community Reserve and Nouabalé- Ndoki National Park, part of which is in the Sangha. Therefore, the program area covers an area of 12.35 million hectares or 123,500 km^2 (FACET, 2013).

The climate in the Departments of Sangha and Likouala is equatorial characterized by a rainfall of 1,500 with only 1 or 2 months of rainfall less than 50 mm (February and December). The vegetation in the terra firmed forests is dominated by moist semi-evergreen rainforest of the central equatorial Africa (White, 1983). The predominant vegetation is 'mixed species terra firma forest' described in details in the ER-PD document. Other distinct vegetation types in the area include monodominant *Gilbertiodendron dewevrei* forest, seasonally flooded forest, open swamp forest and monodominant Marantaceae patches. In addition, the region is covered by large areas of selectively logged and degraded forests, and regions dominated by agro-forestry cultivations, particularly oil palm plantations.

3.2 National Inventory Data

National Forest Inventory (IFN) data for the two provinces of Sangha and Likouala were delivered to the ER-Program for developing emission factors. The field data collection is based on the approach developed by the Forestry Department of FAO (FRA) forest resource assessment program. The methodology is based on a sampling of the country and uses permanent plots of land. The approach has been tested and implemented in several countries since 2000 (Costa Rica, Guatemala, Philippines, Cameroon, Lebanon, Bangladesh, Honduras and Zambia).

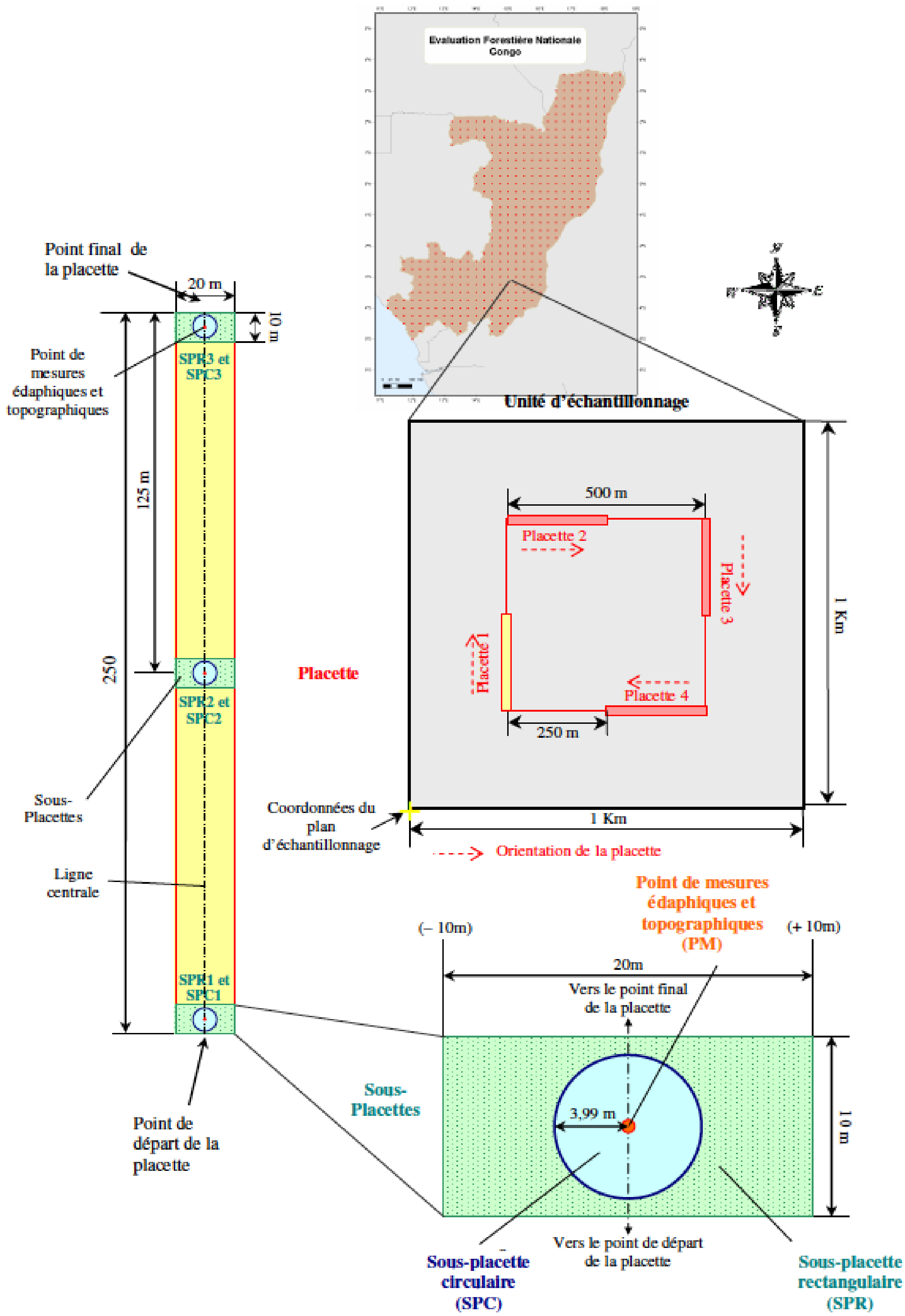


Fig. 1. Design of the permanent forest inventory plots in the Republic of Congo.

The sampling plan adopted for the national assessment of forest resources is systematic. A sampling unit (EU) is selected every 15 minutes in latitude and longitude or about every 25 km. There are 450 locations for sample units in the entire country and about 213 samples within the northern Congo region in departments of Sangha and Likouala (Fig. 1). Each sampling unit represents an area of about 1 km x 1km covered by four sub-plots. The sub-plots are 250 m long and 20 m wide and are separated from each other along the vertical and horizontal angles of a square 500 m on each site of the central location of the plot as shown in Figure 1.

Measurements in the plot follows a nested approach with large trees > 20 cm measured in the main plots and smaller trees measured in the sub-plots as shown in Table 1. Within each plot, there were commercial height measurements of trees to the first large branching and not the total height of the trees. These height measurements could not be used in the allometric models.

Table 1. National Forest Inventory (IFN) plot level measurements.

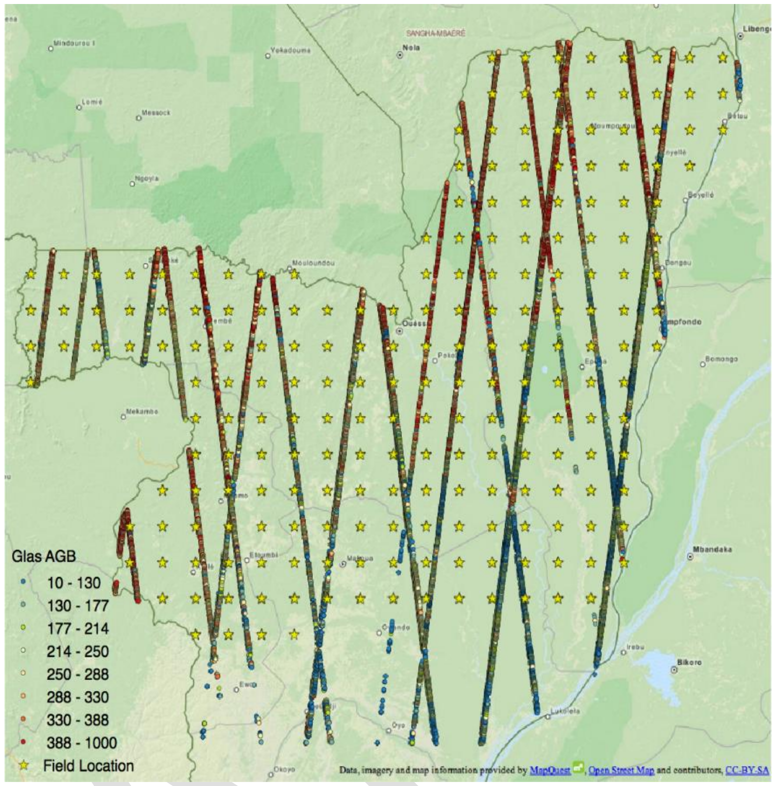
Unit	**Shape**	**Size**	**Number**	**Measurements**
Sampling Unit (EU)	Square	1 km x 1 km (1 km^2)	1	N/A
Plot	Rectangle	250 m x 20 m (5000 m^2)	4 per EU	D > 20 cm
sub-plots (SPR)	Rectangle	20 m x 10 m (200 m^2)	3 per plot	10 cm < D< 20 cm
Sub-sub-plots (SPC)	Circular	3.99 m radius (50 m^2)	3 per sub-plot	D< 10 cm, H> 1.3 m
Section of Land Use	Variable	Variable	Variable	N/A

3.3 GLAS Lidar data

We used data from the Geoscience Laser Altimeter System (GLAS), onboard the Ice, Cloud, and land Elevation Satellite (ICESat), acquired in 2004-8 to develop widespread samples of height structure of forests of the ER program area in northern Congo (Fig. 2). GLAS is a waveform sampling Lidar sensor; it emits short duration (5 ns) laser pulses towards the land surface and records the echo of those pulses as they reflect off the ground surface (Harding et al., 2005). When the surface is vegetated, the return echoes, or waveforms, are a function of the vertical distribution of vegetation and ground surfaces within the area illuminated by the laser (the footprint). For forests, stand height can be calculated as the difference between the elevation of the first returned energy minus the mean elevation of the ground return (waveform extent) (Lefsky et al., 2007). Lidar waveforms can provide several height metrics such as the top canopy height (TCH) as the most direct measurement of the LIDAR, percentiles of waveform energy, and model derived lorey's height as the basal area weighted height of the canopy (Lefsky, 2010; Saatchi et al., 2011). Lorey's height is a ground based height metric strongly correlated with forest biomass (Saatchi et al., 2011).

We processed more than 65000 GLAS shots over forests of the ER program area and developed a dataset including maximum height, estimates of Lorey's height, ground elevation and surface slope from 30 m Shuttle Topography Radar Mission (SRTM) digital elevation data, other ancillary information such as the signal-to-noise ratio (SNR) and the land cover type from the GlobCover Data at 300 m resolution. All GLAS shots were filtered for low SNR (< 50), slopes >10%, and large difference between elevation detected by Lidar and SRTM (>50 m). The remaining 60929 GLAS shots were used in the data analysis over the project area (Fig. 2). Each shot has an effective footprint of approximately 0.25 ha (0.16-35 ha) depending on the vegetation cover and GLAS laser characteristics (Urban et al., 2008). The data are collected along ICESAT orbital tracks separated by ~80 km at the equator and with footprint spacing of about 170 m along tracks. The geo-location accuracy of GLAS LIDAR footprint is about 25 m but can range from 10 to 100 m (Popescu et al., 2011), indicating the difficulty of locating the footprint on any ground plots or high-resolution airborne LIDAR due to the large heterogeneity of the structure of tropical forests.

Here, we consider the collection of GLAS LIDAR over the Sangha and Likouala region as an approximately systematic inventory sampling from space. By definition, systematic sampling implies that the sample units are not randomly distributed across the national forestlands, but are drawn from a sample frame according to some systematic procedure, such as satellite orbital tracks. The best template for the systematic procedure is based on a regular grid square or equilateral triangular network cells such as the ICESAT tracks. Systematic sampling has been used extensively in national forest inventory because it is easy to locate the plots, the population is uniformly covered, and the estimates of the mean and total forest carbon are unbiased (Kohl et al., 2006). However, GLAS LIDAR samples are taken over a period of time along orbits that do not follow exactly a regular pattern. As a result, GLAS LIDAR samples may be considered a spatially biased or a pseudo systematic sampling (Healey et al., 2012).



Fig, 2. Location of the IFN plots and the GLAS lidar shots in northern Congo and with the the ER project area. The total number of GLAS footprints used for the region is about 60929 samples after filtering for any SNR and topographic effects.

4. GROUND BIOMASS ESTIMATION

In this study, we use the Chave et al. (2014) model to estimate forest biomass from ground inventory plots. For forest biomass estimation, we used the African tree species dataset from the FAO and global data sets to look up the wood density (ρ) for all trees at species or genus level (if species were not known), and used the average plot level wood density for those trees that were not identified accurately in the field.

Using the Chave et al. (2014) with height, we calculated forest biomass using the equation with measured height and the equation with height estimated globally using environmental factors. The equation with height is:

$$AGB_{est} = \frac{10^{-3}}{A} \sum_{i=1}^{N} 0.0673 \times (\rho_i D_i^2 H_i)^{0.976} \quad (1)$$

Where AGB_{est} is the above ground biomass in units of Mg ha^{-1}, A is the area of the plot in hectare (ha), D_i is the diameter of each tree in the plot in centimetre (cm), H_i is the height of each tree in meter (m), and ρ_i is the wood density of each tree in g cm^{-3}.

Since total tree height measurements were not available in the field, we estimated tree height from limited data available from some research plots elsewhere in DRC and Gabon. However, this approach provided estimates that may have large uncertainty due to differences in the height –diameter allometry. We decided to use Chave et al. (2014) model without the height measurements but with E-factor that includes a pan-tropical generalized height diameter allometry. The E-factor was extracted from a global map produced by Chave et al. (2014) and used in the following equation to estimate the aboveground biomass: at each plot for all trees > 20 cm.

$$AGB_i = exp\{-1.803 - 0.976E + 0.976\ln(\rho) + 2.673\ln(D) - 0.0299[\ln(D)]^2\} \quad (2)$$

$$AGB_{est} = \frac{10^{-3}}{A} \sum_{i=1}^{N} AGB_i \quad (3)$$

Where AGB_i is the aboveground biomass of individual trees and AGB_{est} is the above ground biomass in units of Mg ha^{-1}.

A relationship between biomass of trees > 20 cm and trees > 10 cm were developed using the ground data and plots elsewhere in the region and used to adjust the biomass for all trees > 10 cm for each plot. We did not find the data in the nested plots for trees > 10 cm satisfactory and therefor was not used. The alternative process allowed reliable estimate of biomass for all trees between 10 to 20 cm in the plot (approximately 11% on the average). The equation below converts the AGB estimates for trees > 20 cm ($AGB_{>20cm}$) to AGB estimate for all trees with DBH > 10 cm ($AGB_{>10cm}$).

$$AGB_{>10cm} = 2.246 \times AGB_{>20cm}^{0.8726} \tag{4}$$

The aboveground biomass was further augmented for all trees with DBH < 10 cm. Trees < 10 cm in diameter and height > 1.3 m were also measured as part of the IFN nested plot data. However, the data provided to the ER team did not include a complete set with all trees < 10 cm. We used an equation developed from plots in DRC and Gabon where trees with DBH > 1cm have been measured in the field. Small trees will add approximately 3-7% on the average to the aboveground biomass values. The equation below converts the AGB estimates for trees > 10 cm ($AGB_{>10cm}$) to AGB estimate for all trees with DBH > 1 cm ($AGB_{>1cm}$).

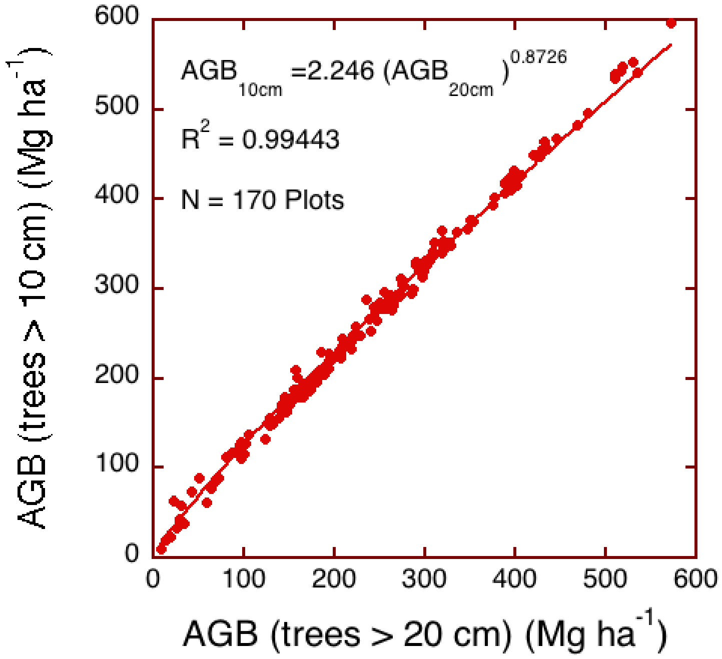


Fig. 3. Model to scale the forest biomass to all trees > 10 cm in diameter from measurements of trees > 20 cm in diameter. Plots inlcude data from ROC forest inventorya and research plots in Congo (Afritron) and border regions in Gabon and DRC in similar forest types . The plots include both terra firme and swamp

$$AGB_{>1cm} = 1.872 \times AGB_{>10cm}^{0.906}$$
(5)

For belowground estimation of tree biomass and carbon stocks, we used established allometry based on the aboveground biomass using root to shoot ratios. It is not practical to measure below ground biomass in most tropical forests on a routine basis. It is also very difficult to develop an appropriate, country-specific allometric equation for root biomass. Instead below-ground biomass is estimated from a well-accepted ratio for moist tropical forests, developed by Mokany et al. (2006; also reported in the IPCC 2006 GL), which reliably predicts root biomass based on shoot biomass. The equations below show how the belowground biomass (BGB) can be estimated from AGB.

$$BGB = 0.235 \times AGB \;\; if \; AGB > 125 \; Mg \; ha^{-1}$$

$$BGB = 0.205 \times AGB \; if \; AGB \; \leq 125 \; Mg \; ha^{-1} \tag{6}$$

5. LIDAR BIOMASS MODEL

All LIDAR samples from the satellite ICESAT GLAS sensor were estimated using a model developed by ground plots in forests of Central Africa and adjusted by the IFN plots in primary and wetland forests in both Sangha and Likouala departments. We adopt a two-step approach in estimating forest biomass from GLAS LIDAR samples:

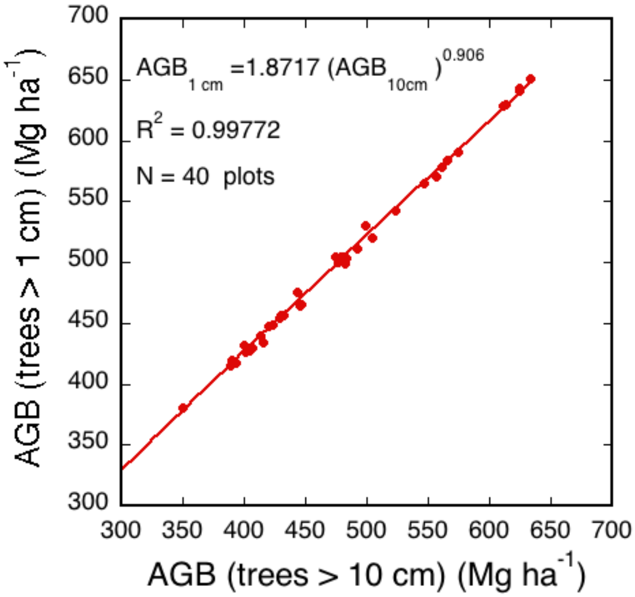


Fig. 4. Model to scale forest biomass of all trees > 10 cm to the total biomass of all trees > 1 cm diameter and minimum height of 1.3 m. Data includes plots in ROC and neighboring countries in DRC and Gabon over similar terra firme and

1. In the first approach we use the model developed from ground plots between Lorey's height and forest biomass at 0.25 ha plots distributed in the republic of Congo and forests in regions (Saatchi et al. 2011). Recently this model was compared to a similar model developed for airborne LIDAR measurements in DRC and showed a very good agreement over the entire range of biomass. The GLAS LIDAR model is given by:

$$AGB = 0.2788\gamma\ H^{2.12} \qquad (7)$$

where H is the GLAS derived Lorey's height and γ is the scaling factor to adjust for the wood density variations of different forest types and is the ratio of the average wood density of forest type to the average wood density of the plots used in the model: $\gamma = \frac{WD}{0.61}$.

2. To estimate the WD for each forest class types, we use the IFN data and LULC map for the project area and average the average WD for each plot over the LULC types. We extracted the vegetation class of the IFN data from the 2012 LULC map and averaged the wood density of plots within each class. The WD values are used to adjust for the biomass estimates using the Saatchi et al. (2011) model for Africa. Note that the average wood density refers to trees or patches of forests within each vegetation class and it does imply wood density of the vegetation types. The average wood density of the trees in all classes are approximately 0.59 gr/cm^3, suggesting small variations in average forest wood density in each of land cover classes.

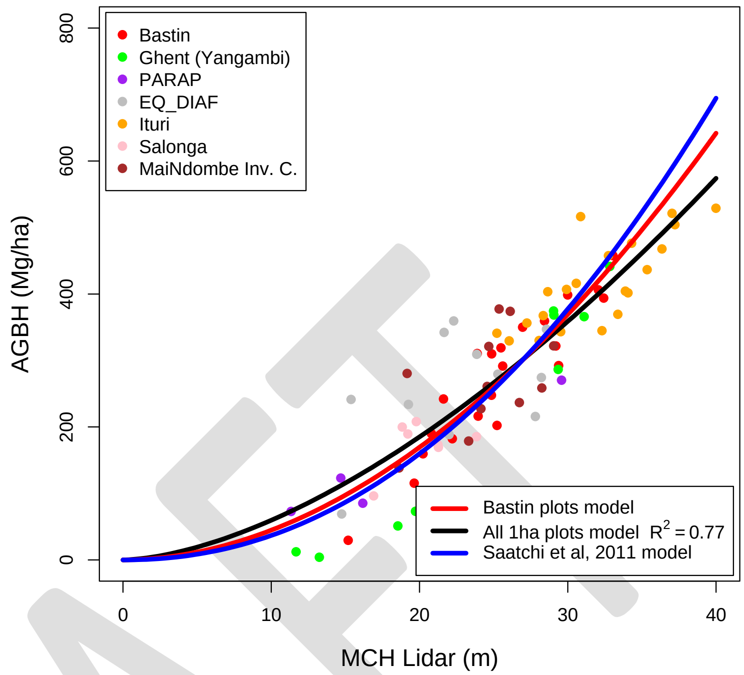


Fig. 5. Comparison of GLAS lidar biomass model (saatchi et al. 2011) and similar models derived from 1-ha research plots and airborne lidar data in DRC.

3. The uncertainty associated with the GLAS LIDAR biomass model is approximately 16% that is derived from the uncertainty of the above LIDAR model through a cross-validation approach.

Table 2. Average wood density of trees within each class of land cover. The wood density values are used to adjust the GLAS derived LIDAR estimates of AGB.

Class ID	Land Cover Class	Hectares	Average WD
1	Primary Forest	4,772,723	0.596
2	Degraded/Secondary Forest	292,605	0.593
3	Forested Wetlands	6,493,433	0.601
4	Marantaceae Forest	171,218	0.625
5	Bare/Grasslands	416,007	N/A
6	Other Wetlands	65,054	N/A
7	Agriculture/Plantation	116,769	0.594

6. SPATIAL MODELING

6.1 Satellite Imagery

We used satellite imagery along with GLAS LIDAR and IFN derived AGB samples in a spatial modeling machine learning algorithm to predict forest biomass for each 1-ha area of the ER program region. The satellite imagery used in our study area includes:

ALOS PALSAR imagery from the L-band radar sensor collected from January 2007 to March 2010. The two polarization channels (HH: Horizontal-Horizontal measurement; HV: Horizontal-Vertical measurement) long-wavelength radar data provides information on vegetation structure that can be used to directly estimate vegetation biomass < 100-150 Mg/ha), separate high biomass forests, and differentiate intact from fragmented or deforested land. Radar data have the additional advantage that it is unaffected by cloud cover and can improve mapping forest types over areas covered by cloud in Landsat data. We have acquired and processed image mosaics across the entire project area at a 25 m resolution for the year 2010 and aggregated to 30 m for stratification to 100 m for biomass mapping. In developing the 100 m mosaic images, we also included the texture measures to allow us to separate variations of the forest biomass over the nominal sensitivity range of forest biomass.

Landsat Thematic Mapper data acquired by Landsat 5, 7, and 8 satellites at about 30 m resolution over the study area. Landsat imagery provides information on the vegetation cover and canopy structure allowing easy discrimination of forest and non-forest classes, and to large extent secondary and degraded forests. We compiled Landsat data from 2012 to 2015 and developed cloud free Landsat image mosaic for the study area. The images included the relatively cloud-free images provided by the University of Maryland forest cover change website (Hansen et al. 2013).

1) SRTM elevation data, at 30 m resolution were used to provide landscape topographical variations at 100 m resolution and help with predicting forest height for the entire region.

Minimum Mapping Unit: The minimum mapping unit for biomass estimate was 1-ha. All satellite imagery used for the study are at < 30 m resolution. All imagery and land cover maps were aggregated to 100 m by averaging or using majority filters in the case of land cover map before developing the biomass map.

6.2 Spatial Estimator

From the LIDAR forest height data and the derived biomass, we develop a map of the forest biomass over the entire Northern Congo region at high spatial resolution (100 m). The map is developed using a non-parametric machine learning approach based on maximum entropy estimator (Saatchi et al., 2011). The Maximum Entropy (MaxEnt) estimator has been used for national and continental scale biomass mapping (Saatchi et al., 2011) and provides relatively similar results as other machine learning approaches with some additional advantages such as development of an uncertainty map based on an embedded Bayesian algorithm, providing a relatively unbiased estimation.

To implement the approach, we first divide about 61000 GLAS estimates of biomass into ranges of biomass (i.e. 0-25 Mg/ha, 25-50, 50-75, 75-100, 100-150, 150-200, 200-250, 250-300, 300-350, 350-400, 400-500, and > 500 Mg/ha) and then we ran the MaxEnt model for each given range to create the probability of predicting the biomass range for each pixel. Within the MaxEnt model, the spatial probability density functions (pdf) for each biomass range is optimally estimated using the Bayesian algorithm. We also adopt a similar Bayesian statistical approach to combine the biomass pdf values over the entire domain of the study. Following Bayesian statistics, we can interpret the output from the MaxEnt model for a range A for a specific pixel (i,j) over the study domain (i.e. entire Project area) as $Pr\left(AGBmin < AGB_{i,j} < AGBmax \middle| A\right)$: the probability of the $AGB_{i,j}$ at pixel (i,j) being inside range A (where $AGBmin$ is the lower bound of range A, and $AGBmax$ is the upper bound of range A) given condition A (here meaning that we are in the domain of the estimation of each pixel of the studying area being either inside or outside of range A, i.e. the Maximum Entropy model run for range A).

For an area of study where we divide the AGB into n ranges, we obtain a set of probability distributions $Pr(AGBmin_k < AGB_{i,j} < AGBmax_k|A_k)$ for k=1 to n. If $Pr(A_k)$ is the prior probability of having condition A_k, then the expectation value of a pixel can be calculated as

$$\boldsymbol{AGB_{i,j}} = \frac{\sum_{k=1}^{n} \mathrm{Pr}\left(\boldsymbol{AGBmin_k < AGB_{i,j} < AGBmax_k \middle| A_k}\right)^{\boldsymbol{m}} \mathrm{Pr}(A_k)\boldsymbol{AGBmean_k}}{\sum_{k=1}^{n} \mathrm{Pr}\left(\boldsymbol{AGBmin_k < AGB_{i,j} < AGBmax_k \middle| A_k}\right)^{\boldsymbol{m}} \mathrm{Pr}(A_k)} \quad (8)$$

where $AGBmean_k$ is the mean AGB for range A_k , and m=3 similar to the optimum value used in Saatchi et al (2011). This creates the correct AGB distribution in the final product while keeping the prior distribution from being over-powering.

The prior probabilities $\mathrm{Pr}(A_k)$ are calculated from the number of LIDAR derived AGB values that fall into each range A_k. Ideally, a random sample of lidar AGB would give a good estimation of $\mathrm{Pr}(A_k)$. However, no truly random sample exists at the global scale. The lidar based AGB distribution approaches the true distribution as the area of interest increases and the number of orbits increase and become more random. We use the LIDAR derived AGB at the Northern Congo region or strata to find the prior probabilities $\mathrm{Pr}(A_k)$.

Implementation of MaxEnt model includes several steps:

1. Training Data: All GLAS LIDAR estimates of biomass were combined over the study region and approximately 70% of the data were used randomly to train the MaxEnt model and the rest were kept for validation. The IFN data were used for final validation and the bias correction of the map.
2. Land cover: The land cover map was used to separate land and water pixels and create a mask for water and all areas outside the boundary of the project area in order to reduce the programming run time.
3. Satellite data preparation 1: average the ALOS PALSAR 25-m products (HH/HV) over 4 years (2007, 2008, 2009, 2010), and aggregate them into 100-m resolution using spatial mean, which makes the first 2 layers of SATDATA inputs.

4. Satellite data preparation 2: aggregate SRTM v3 30-m product into 100-m resolution using both spatial mean and standard deviation, so that we have 3rd and 4th layers of SATDATA input.
5. Satellite data preparation 3: aggregate GFC TM 2012-2015 30-m products were averaged into 100-m resolution using spatial mean, and abandon the Red band, so that we have NIR, SWIR1, SWIR2 as the last 3 layers of SATDATA input.
6. Texture data generation: multi-scale textures for each SATDATA layer were generated. It includes (1) Gaussian filters of 5x5, 9x9, 17x17, and 33x33, and (2) standard deviation filters for discs with radius of 2, 4, 8, and 16 pixels, which calculates the standard deviation of the pixel values within defined disc for each layer. Therefore, for each SATDATA layer, we have generated 8 additional layers, and that makes the total layers be 7+7*8 = 63 layers.
7. Data rearrangement: For machine learning, we rearranged the training data (dependent variable, y) into a single column y vector where each row represents one observation. SATDATA inputs were rearranged into 7 (original layers) or 63 (including texture layers) columns matrix (independent variables, X) observations for training and validation.
8. ME model training: For Maximum Entropy (ME) model, we first categorized y values into classes using intervals described above. The mean value from the training set for each range was designated as the class mean [agb(c)].
9. ME model prediction: With the established ME model derived from training, we can apply them to the rest 12 million observations of X, retrieve probability value p(y,c) for each class for each pixel. And we get the AGB (which is a simpler form of the equation (5):

$$AGB(y) = \frac{\sum p(y,c)^3 AGB(c) p(c)}{\sum p(y,c)^3 p(c)} \tag{9}$$

where p(c) is the prior probability derived from training data.

Independent test: For the independent GLAS LIDAR data for validation , we compared the observations of y with $\hat{y}$ or $AGB(y)$, by making one-to-one scatter plots, and quantitatively calculate RMSE and R^2.

10. Map generation: Once we have $\hat{y}$ or $AGB(y)$ for all rows of observations, we can fill the values into the tree height map by indexing the geographic locations. All empty values would be water or outside of project area, as we have previously defined.

The result of the spatial modeling is provided in Figure 6, showing detailed information about the variations of forest biomass density over Northern Congo at 100 m (1 ha) spatial resolution. The map shows the concentration of high forest biomass density comparable with the field inventory and LIDAR data in the western part of the study area covering a range of forest types from mature old growth to secondary forests to open Maranthasae forests, wetlands. The map shows the distinct differences of forest biomass in terra firme and inundated forests and significant difference associated with the logging and degraded areas, swamp forests and savanna and forest types along the rivers.

7. UNCERTAINTY ANALYSIS

In estimating forest above ground biomass distribution everywhere in the Northern Congo region and map the biomass at 100 m grid cells everywhere, we evaluated each step of the process for possible sources of error, quantified the errors to the best of our ability, and developed uncertainty estimates at three levels:

1. Spatially over the map by using a set of the LIDAR data as an independent test and evaluate the biomass accordingly.
2. Develop the biomass estimate uncertainty at the map grid cell by using spatial statistical models from a Bayesian probability based approach embedded in our MaxEnt model.
3. Evaluate the map at the average level for each stratified class by comparing the map estimated biomass with original LIDAR samples.
4. Evaluate the accuracy of the map by using the available 1-ha plots distributed in the Northern Congo region.

The processing approach to perform the uncertainty analysis included:

1. Ground biomass error (ϵ_{ground}): The main source of error in estimating biomass from ground measurements of DBH, height, wood density, are the errors in all measurements plus the geolocation error of the plot. Using the methodology developed in Chave et al. (2014), it is possible to estimate the error in ground-estimated biomass. At 1-ha, this error stays about 10% of the biomass in most ideal cases. However, the allometry error

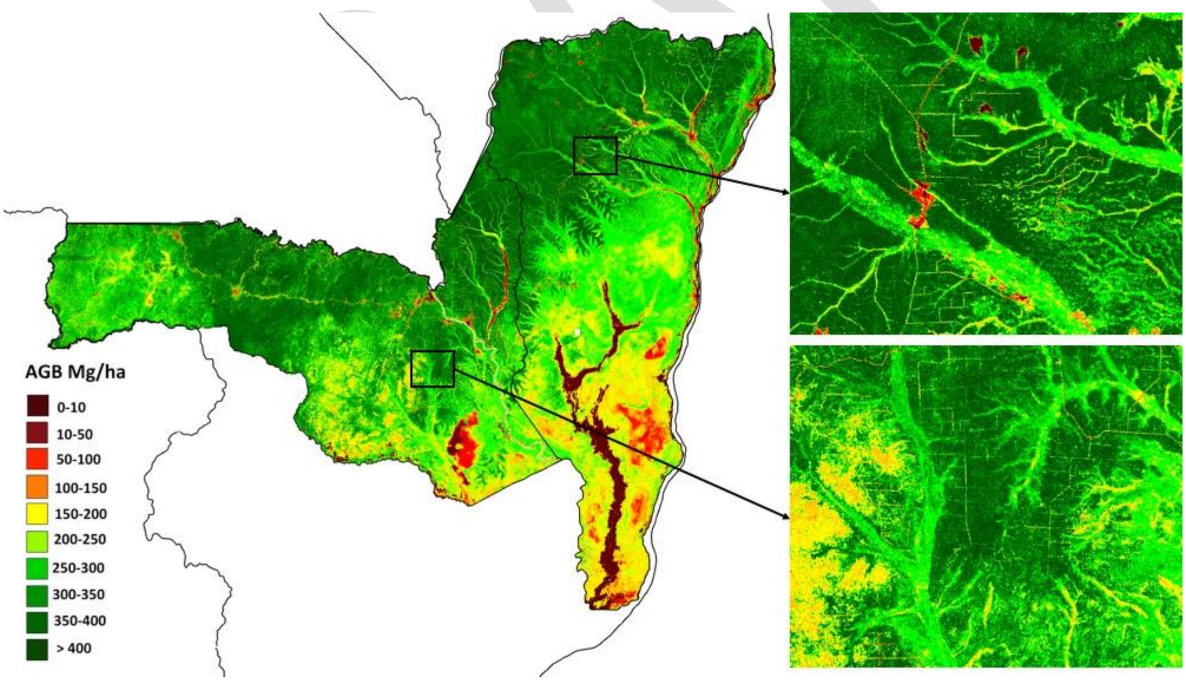


Fig. 6. Map of aboveground biomass distribution in Mg/ha at 1-ha resolution over the northern Congo covering two departments of Sangha and Likouala.

may be larger at smaller plots. We assumed the error from ground allometry to be approximately 10%. In general, we think the error in estimating biomass from ground measurements is much larger. This is primarily due to the errors in measurements of the tree diameter (We found several examples of potential errors in diameter measurements). The tree heights were not measured in the field for the total height and therefore could not be used in developing the model. The pan-tropical diameter-height model used in the Chave et al. (2014) model represented as the E-factor is a gross generalization and may not match with the actual height-diameter measurements on the ground.

2. Lidar height measurement error: The LIDAR height measurement error is associated with the estimation of Lorey's height from GLAS Lidar data. For broadleaf forests, the RMSE has been estimated to be 3.3 m (Lefsky, 2010) or a relative error of about ~13.7% over the entire height range.
3. Lidar height to biomass model or allometry is a power law function derived from the relating LIDAR height metric to ground estimated biomass. The fit of the power law has some errors associated with it that we include as allometric error ($\varepsilon_{allometry}$).
4. Sampling error: Sampling error is associated with representativeness of LIDAR height samples for the forest types, and is assumed to be zero. We collected more 61000 samples of LIDAR and NFI at 0.25-0.5 ha that are much larger than required sample density according to the VT0005 tool. It is assumed that $\varepsilon_{sampling}$ is equal to zero.

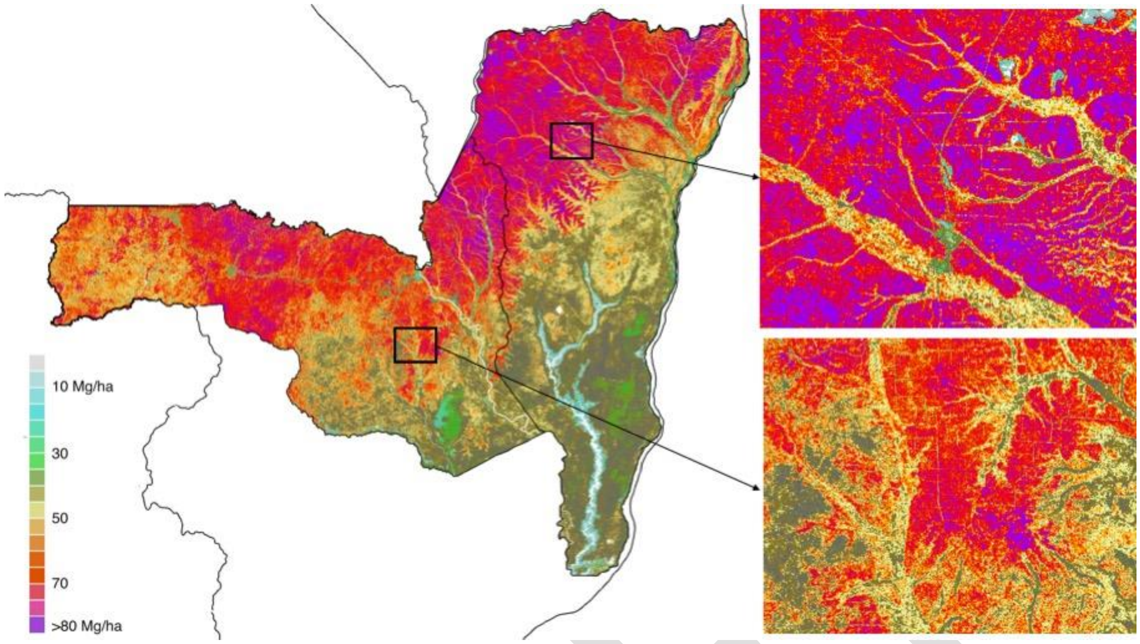


Fig. 7. Spatial distribution of biomass estimation error at the pixel level in terms of Mg/ha at 95% confidence interval and including all sources of errors.

1. ME prediction errors from the Maximum Entropy model ($\varepsilon_{prediction}$), we calculate $\varepsilon_{prediction}$ using 30% of the samples that were set aside and not used in the MaxEnt model. We estimate spatial uncertainty at the pixel-level by using the predicted probabilities of the MaxEnt model in

$$\boldsymbol{\sigma}_{\hat{B}} = \sqrt{\frac{\sum_{k=1}^{N}\left(\boldsymbol{B_k}-\hat{\boldsymbol{B}}\right)^2 \boldsymbol{P_k}\boldsymbol{P}(\boldsymbol{A_k})}{\sum_{k=1}^{N}\boldsymbol{P_k}\boldsymbol{P}(\boldsymbol{A_k})}} \tag{9}$$

where B_k is the mean biomass of the k^{th} range, $\hat{B}$ is the predicted biomass value, P_k is the MaxEnt generated probability for biomass range k, and $P(A_k)$ is the prior probability of any pixel being in biomass range k. The relative uncertain for each pixel is then $\varepsilon_{prediction} = \frac{\sigma_{\hat{B}}}{\hat{B}} \times 100$.

We can then calculate the total uncertainty in estimating AGB, assuming all errors were independent and random, by using

$$\boldsymbol{\varepsilon_{AGB}} = \sqrt{\boldsymbol{\varepsilon_{ground}^2} + \boldsymbol{\varepsilon_{measure}^2} + \boldsymbol{\varepsilon_{allometry}^2} + \boldsymbol{\varepsilon_{sampling}^2} + \boldsymbol{\varepsilon_{prediction}^2}} \tag{10}$$

where each of the terms are the relative errors at that pixel. Using the above equation (10), we will propagate the errors at the pixel level and create a map of the uncertainty at the pixel level (Fig. 7).

To demonstrate the errors of the spatial prediction over areas outside the training data used in the model, we plot the map prediction over the 30% of independent test samples to show how the error stayed bounded or distributes along the AGB variation. Note that the original samples are much smaller than the map pixel and part of the variations seen in figure 8 are due to differences in pixel size and location of samples. However, the results show that the biomass estimation over areas outside of the training data remain bounded and with low uncertainty. Although the GLAS LIDAR independent test samples (30%) were selected randomly and set-aside for validation, the spatial correction of GLAS footprints along the orbital passes may contribute to reducing the uncertainty (Fig. 8).

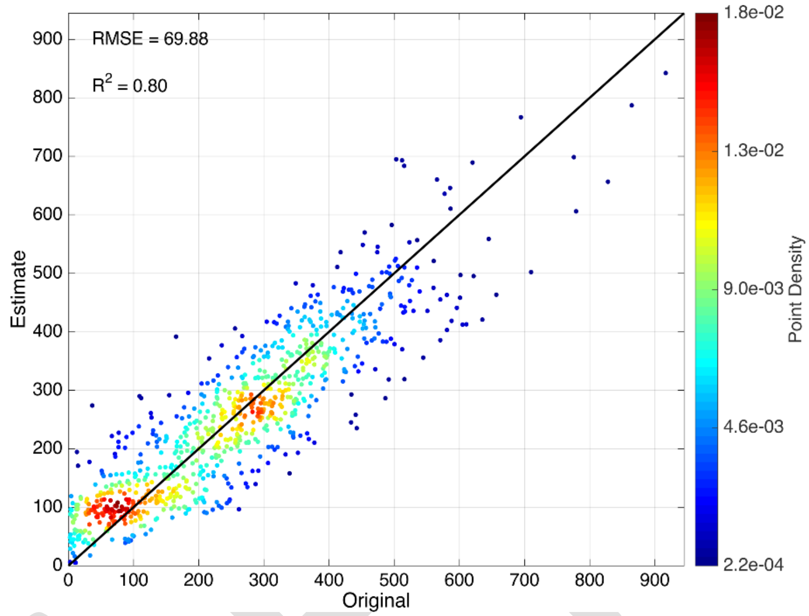


Fig. 8. Validation of the ME biomass map with independent samples (30% of the original samples).

8. BIAS CORRECTION

To further examine the results of the spatial modeling, we compare the biomass estimates from the map with the estimates of the IFN sub-plots at the their approximate locations. We could also compare the average biomass of the map with the average biomass of the plots at 1 km^2. However, we preferred to perform the analysis at the sub-plot basis because of the interest to further improve the map for any potential bias. In theory, both approaches must provide the same mean values and bias. Nevertheless, the bias correction must be applied at 1-ha resolution to preserve the spatial fidelity of the map. The result of comparison of the map with IFN subplots are shown in figure 9.

To evaluate the performance of the spatial modeling algorithms and correct for the bias, we used 3 statistical measures to evaluate the test results: the coefficient of determination (R^2), the root-mean-square error (RMSE), and the mean signed deviation (MSD). We applied all these measures to the independent test results, where the original biomass is obtained from IFN subplots, while the predicted biomass is derived using the satellite derived biomass from the GLAS LIDAR calibrated with the ground plots. Besides the overall MSD over all test samples, we assessed two additional MSD measures for both low AGB (MSD1) and large AGB values (MSD2) to take into account the effect of dilution bias in the data. We define MSD1 as the MSD calculated for test samples with the sum of predicted biomass and measured AGB to be less than 200 Mg/ha of AGB. Similarly, MSD2 is defined as MSD for samples with the sum of predicted AGB and measured AGB to be less than 600 meters. In addition, we calculated the semi-variograms (Fortin et al., 2006) for original AGB as well as the model residuals to quantify the spatial autocorrelation in the data.

The results suggest that the map has very small bias on the average for the entire IFN plots. However, there is a systematic dilution bias as observed in most maps with over-estimation of low biomass values and under-estimation of high biomass values. In general, the methodology for machine learning tend to push the results towards the mean of the distribution and ignore the tails. The dilution bias is due to two factors in our analysis: 1. The remote sensing data used in mapping the biomass is not sensitivity to the entire range of biomass and both ALOS, Landsat data will saturate in low biomass values. Therefore, there is a strong tendency in under-estimating high biomass values. 2. In addition, because of large spatial variability of the biomass range and the fact that both remote sensing and training data are noisy, the non-parametric models often estimate towards the mean of the distribution where the data are abundant and the signal to noise ratio is high. Along the tails of the distribution, the noise in the data and the signal may be of the same order in number and in magnitude.

Based on this evidence that the mapping process, regardless of the methodology, inevitably creates results biased towards the sample mean, and large/small values of AGB are often underestimated/overestimated, we perform a bias correction to improve the results and calibrate the map much better with the distribution of the plots. Various bias correction methods have been proposed for machine-learning algorithms including the Random Forest approach. (Hooker and Mentch, 2015; Mendez and Lohr, 2011; Nguyen et al., 2014). In our study, we modified the bootstrap bias correction method (Hooker and Mentch, 2015), and implemented a new approach run to correct the biases. The new response variable for the second RF is defined as

$$MCH_{new} = \widehat{MCH}_{oob}(\boldsymbol{X}) - \left(MCH - \widehat{MCH}_{oob}(\boldsymbol{X})\right) = 2\widehat{MCH}_{oob}(\boldsymbol{X}) - MCH \tag{11}$$

where $\widehat{MCH}_{oob}(\boldsymbol{X})$ is the out-of-bag estimation of MCH for the training data, and the difference between $\widehat{MCH}_{oob}(\boldsymbol{X})$ and original MCH is the regression residual from the original RF. Our second RF run tries to capture the systematic regression bias due to the original RF by estimating the new metric (MCH_{new}) that is further biased toward the opposite direction of the original MCH. Thus when we obtain the new RF model ($\widehat{MCH}_{new}(X) = \frac{1}{J}\sum_{j=1}^{J} f'_j(x)$), the bias-corrected RF prediction ($\widehat{MCH}_{BC}(X)$) can be written as

$$\begin{aligned} \widehat{MCH}_{BC}(X) &= \widehat{MCH}(\boldsymbol{X}) - \left(\widehat{MCH}_{new}(\boldsymbol{X}) - \widehat{MCH}(\boldsymbol{X})\right) \\ &= 2\widehat{MCH}(\boldsymbol{X}) - \widehat{MCH}_{new}(X) \end{aligned} \tag{12}$$

We denote the bias-corrected RF as RFBC model in our study.

9. FOREST CARBON STOCKS

To estimate the emission factors for deforestation and degradation, we calculate the average carbon stocks in each land cover and land use category. Here, we are only concerned with the live vegetation carbon pools in the above and below ground. We include emission factors for deforestation as the conversion of the forest (intact, degraded, secondary) to nonforest land use (grasslands, croplands, settlements, other) and degradation as the conversion of intact forest to degraded forests. Emission factors are related to the carbon stock in the selected pools for each type of land use and land cover change. In this report, the details for estimating the values of the selected pools that are used for calculating the emission factors are given.

Here, we define the carbon stocks in the forest as the combined aboveground and belowground live biomass carbon pools. To estimate the forest carbon stock, we first need to develop the belowground biomass. The below organic matter pool is estimated from the aboveground organic matter using a relationship between aboveground and belowground organic matter, such as a root-to-shoot ratio.

The mean carbon stock in belowground tree biomass per unit area is estimated based on field measurements of aboveground parameters in sample plots. Root to shoot ratios are coupled with the Allometric Equations method to calculate belowground from aboveground biomass. It is not practical to measure below ground biomass in most tropical forests on a routine basis. It is also very difficult to develop an appropriate, country-specific allometric equation for root biomass. Instead below-ground biomass is estimated from a well-accepted ratio for moist tropical forests, developed by Mokany et al. (2006; also reported in the IPCC 2006 GL), which reliably predicts root biomass based on shoot biomass:

$$BGB = 0.235 * AGB \text{ if } AGB > 125 \text{ Mg ha-1}$$
$$BGB = 0.205 * AGB \text{ if } AGB \leq 125 \text{ Mg ha-1} \qquad (13)$$

Where:

BGB = below ground biomass

AGB = aboveground biomass

Most of our plots in terra firme forests had aboveground AGB > 125 Mg ha^{-1}. However, there were many degraded and secondary forests randomly selected in our plot systems with slightly different biomass and probably different root-to-shoot ratios. We decided to use the data from Mokany et al. (2006) to develop a model that can be used on all forest types not included in the above relations. This model was also used for estimating belowground biomass of tropical forests over three continents by Saatchi et al., (2011). A synthesis of data from available literature, along with elimination of data collected using unclear or incorrect methods, provided an allometric model for estimating forest belowground biomass. We used this equation to estimate belowground biomass from aboveground biomass:

(14)

where BGB is the belowground and AGB is the aboveground biomass in units of Mg ha^{-1} of dry weight. To develop an uncertainty in the above relationship, we used the measurements from Mokany et al. (2006) and examined the variations in the ratio of below: aboveground biomass or root: shoot biomass ratios with respect to vegetation types used in the study. By including sites in forest plantations and grasslands, the RMSE in predicting the belowground biomass was 9.46 Mg ha^{-1} and relative error of approximately 23.2% (Saatchi et al. 2011). The application of the above model to estimate BGB had standard error of 0.659 Mg ha^{-1}. For converting the belowground biomass to carbon (BG), we used the carbon fraction value similar to aboveground carbon pool (~0.5).

Our methodology for estimating belowground biomass will use equation (13) for all mature forest and degraded forests and will switch to equation (14) for secondary forests, swamp forests, and savanna. For savanna shrublands, often the belowground carbon pool is larger than the aboveground. However, since shrublands are not of great use for the carbon reduction efforts in the project area and there was no data for the region to provide us the belowground pool for the shrublands, we decided to keep the estimates from equation (14) unchanged for the savanna class. The same approach has applied to the open forests in the Sangha region. Using the models, we calculate the belowground biomass for all 1-ha pixels and developed a map of belowground biomass.

The uncertainty for the total carbon includes the uncertainty for the below ground carbon using the error propagation methodology discussed above.

$$\boldsymbol{\varepsilon_{total}} = \sqrt{\boldsymbol{\varepsilon^2_{AGB}} + \boldsymbol{\varepsilon^2_{BGB}}} \qquad (15)$$

10. DATA PROCESSING AND UNCERTAINTY ASSESSMENT

We estimated the carbon stocks and uncertainty in for each LULC category using the following approach.

We developed a map of the total carbon by adding the above and below ground carbon density at 100 m pixels.

For the total map, we also developed an uncertainty map that included the uncertainty of the above and below ground for each pixel using the error propagation models in equation (10) and equation (15). We used the values in table 3 to account for the uncertainty values used in the above equations.

Once the uncertainty of the total carbon at each pixel is calculated, we use the carbon map in conjunction with the LULC map to calculate the average and the standard error of the carbon for each land cover category. To perform the calculation, the LULC map was first resampled to 1-ha resolution to match the carbon map using a majority filter. Then, the uncertainty for all pixels for each category of LULC was calculated using the spatial correlation of the uncertainty as developed in VT0005 and Weisbin et al. (2014).

Uncertainty	Source/Definition	Value
$\boldsymbol{\varepsilon_{ground}}$	From ground measurements and allometry ~ 10% (Chave et al. 2003)	0.1 (10%)
$\boldsymbol{\varepsilon_{measurement}}$	GLAS Lidar height measurement error	0.137 (13.7%)
$\boldsymbol{\varepsilon_{allometry}}$	Lidar biomass allometry	0.16 (16%)
$\boldsymbol{\varepsilon_{sampling}}$	Difference between LIDAR footprint and 1-ha pixel of the map. Estimate derived from ground plots	0.1 (10%)
$\boldsymbol{\varepsilon_{prediction}}$	Derived from the MaxEnt Spatial Modeling	Variable at the pixel level
$\boldsymbol{\varepsilon_{BGB}}$	Derived either from equation 13 or equation 14.	$0.235\boldsymbol{\varepsilon_{AGB}}$ for AGB > 125 Mg/ha $0.205\boldsymbol{\varepsilon_{AGB}}$ for AGB < 125 Mg/ha $[(23.2)^2 + (0.89\boldsymbol{\varepsilon_{AGB}})^2]^{1/2}$

The following equations demonstrates how to calculate the effect of the spatial variability in estimating the uncertainty of mean carbon stocks for each LULC class.

$$n = \left(\frac{t\infty_{val}}{E}\right)^2 \sigma_L^2 \tag{16}$$

$$\sigma_L^2 = P^{-1}\frac{1}{m(m-1)}\left(\sum_{i=1}^{m}\sigma_{ui}^2 + 2\sum_{i=1}^{m}\sum_{j<i}^{m}\rho(d)\sigma_{ui}\,\sigma_{uj}\right) \quad (17)$$

$$\rho(d) = \exp(-\frac{d}{cr}) \quad (18)$$

Where:

i, j = Generic indices representing pixels in the map (unitless)

E = Accepted margin of error (i.e. one-half of the confidence interval) in estimation of carbon density at each land cover class. The default value of E is 10% of the mean (MgC ha-1)

n = Effective number of pixels within each land cover class (unitless)

P = Size of pixels (ha)

$t\infty_{val}$ = Two-sided Student's t-value at infinite degrees of freedom for the required confidence level. (unitless)

r = Range from semivariogram estimating the spatial correlation of errors associated within the LULC class.

c = Parameter of fit for exponential spatial correlation function derived from semivariogram analysis. c=1/3 is the default value (Chilès & Delfiner 2012) (unitless)

d = Distance between pixels i and j within m (pixels).

$\rho(d)$ = Spatial correlation function in terms of distance d based on exponential semivariogram model. (unitless)

σ_L^2 = Variance derived from the uncertainty at each pixel and the covariance of the pixels

m = The number of pixels within each land cover type.

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ANNEX 11. PROJECTION OF LAND USE TRANSITIONS

Forest Concession Production Areas (FCProdA)

Table 86: Projected Deforestation and Degradation Transitions for the Forest Concession Production Areas

From Class	PRI	DGS	FWL	DEC	PRI	DGS	FWL	DEC	PRI	FWL	DEC
YEAR	BAR	BAR	BAR	BAR	AGR	AGR	AGR	AGR	DGS	DGS	DGS
2017	3,523	1,078	523	343	1,036	413	231	19	14,565	889	175
2018	3,517	1,077	521	343	1,030	412	229	19	14,528	877	174
2019	3,511	1,077	519	343	1,024	412	227	18	14,492	865	173
2020	3,505	1,077	518	342	1,018	412	225	18	14,456	853	172
2021	3,499	1,077	516	342	1,012	411	224	18	14,421	842	171
2022	3,493	1,076	514	342	1,006	411	222	18	14,386	831	170
2023	3,487	1,076	512	342	1,000	411	220	18	14,352	820	169
2024	3,481	1,076	510	342	995	411	218	17	14,318	809	168
2025	3,476	1,075	508	342	989	410	216	17	14,285	799	166
2026	3,470	1,075	506	341	983	410	214	17	14,253	788	165
SUM	3,523	1,078	523	343	1,036	413	231	19	14,565	889	175

Forest Concessions – Non Production

Table 87. Projected Deforestation and Degradation Transitions for Forest Concessions – Non Production

From Class	PRI	DGS	FWL	DEC	PRI	DGS	FWL	DEC	PRI	FWL	DEC
YEAR	BAR	BAR	BAR	BAR	AGR	AGR	AGR	AGR	DGS	DGS	DGS
2017	2,233	841	1,451	85	1,048	533	1,016	18	5,216	1,389	141
2018	2,535	894	2,101	99	1,316	577	1,654	30	5,354	1,400	145
2019	2,090	856	840	76	836	530	380	5	5,496	1,412	148
2020	2,395	911	1,491	90	1,106	576	1,018	18	5,642	1,423	152
2021	2,203	905	868	80	877	560	381	5	5,793	1,436	156
2022	2,512	961	1,520	94	1,148	606	1,020	17	5,947	1,448	159
2023	2,323	957	898	84	920	592	383	5	6,106	1,461	163
2024	2,635	1,014	1,552	99	1,192	639	1,022	17	6,270	1,474	168
2025	2,450	1,011	931	88	966	625	386	5	6,438	1,488	172
2026	2,766	1,070	1,586	103	1,239	673	1,025	17	6,611	1,502	176
SUM	29,383	11,590	15,188	1,087	12,702	7,251	9,065	147	72,634	17,480	1,945

Protected Areas

Table 88. Projected Deforestation and Degradation Transitions for Protected Areas [ha yr-1]

From Class	PRI	DGS	FWL	DEC	PRI	DGS	FWL	DEC	PRI	FWL	DEC
YEAR	BAR	BAR	BAR	BAR	AGR	AGR	AGR	AGR	DGS	DGS	DGS
2017	509	111	100	328	75	64	25	1	2,516	197	105
2018	523	114	102	337	76	66	25	1	2,581	195	108
2019	537	117	104	347	78	68	24	1	2,648	194	111
2020	552	120	106	357	79	70	24	1	2,717	193	114
2021	567	124	109	367	81	72	24	1	2,789	192	117
2022	582	127	111	378	82	74	24	1	2,862	191	120
2023	598	131	114	388	84	76	24	1	2,938	190	123
2024	615	134	116	399	86	78	24	1	3,016	189	126
2025	631	138	119	411	87	80	24	1	3,096	188	129
2026	649	142	121	422	89	82	24	1	3,179	188	132
SUM	5763	1258	1102	3735	817	730	242	10	28340	1917	1184

Unattributed Areas

Table 89. Projected Deforestation and Degradation Transitions for Unattributed Areas

From Class	PRI	DGS	FWL	DEC	PRI	DGS	FWL	DEC	PRI	FWL	DEC
YEAR	BAR	BAR	BAR	BAR	AGR	AGR	AGR	AGR	DGS	DGS	DGS
2017	284	190	749	31	211	61	15	0	334	265	4
2018	292	196	770	31	217	63	15	0	343	270	4
2019	300	201	791	32	223	65	14	0	353	276	4
2020	309	207	813	33	229	67	14	0	363	281	4
2021	318	213	836	34	236	69	14	0	372	287	4
2022	327	219	860	35	242	71	14	0	383	293	4
2023	336	225	884	36	249	73	14	0	393	299	4
2024	345	232	908	37	256	75	14	0	404	306	4
2025	355	238	934	38	263	77	14	0	415	312	5
2026	365	245	960	39	271	79	14	0	427	319	5
SUM	3,231	2,166	8,506	347	2,397	699	141	0	3,788	2,910	42

Oil Palm Areas

Table 90: Projected Deforestation and Degradation Transitions for Oil Palm Concession Areas (Unplanned)

From Class	PRI	DGS	FWL	DEC	PRI	DGS	FWL	DEC	PRI	FWL	DEC
YEAR	BAR	BAR	BAR	BAR	AGR	AGR	AGR	AGR	DGS	DGS	DGS
2017	217	134	61	68	194	359	39	7	1,878	201	35
2018	217	133	60	68	192	354	39	7	1,872	198	35
2019	216	133	60	68	186	341	39	7	1,867	196	34
2020	215	133	60	68	180	322	38	7	1,862	193	34
2021	214	133	59	68	174	303	38	7	1,856	191	33
2022	213	133	59	68	168	283	37	7	1,851	188	33
2023	212	133	58	68	163	264	37	7	1,846	186	33
2024	212	133	58	67	157	245	37	6	1,841	184	32
2025	211	133	58	67	151	225	36	6	1,836	181	32
2026	210	132	57	67	144	209	36	6	1,831	179	31
SUM	2137	1330	590	676	1708	2905	376	66	18541	1897	332

ANNEX 12. UNCERTAINTY

Uncertainty of Reference Emission Levels				
Uncertainty Land Use Classification				
Year	**2003**	**2012**	**Overall**	**Overall Adjusted**
Primary (PRF)	12%	9%	10.6	7.314
Secondary/Degraded (DSF)	25%	21%	22	15.18
Wetland/Swamp (WLF)	8%	5%	7.33	5.05
Semi-deciduous (SDF)	16%	13%	14.3	9.86
Non-forest (BAR)	9%	11%	10.6	7.31
wetland Non-forest (OWL)	9%	7%	9	6.21
Agriculture (AGR)	18%	13%	16	11.04
Uncertainty in Emission Factors				
Land Use Change	**Before Total carbon**	After total carbon	Emission Factor (MgC/ha)	**Uncertainty at 90% CI MgC/ha**
PRI to BAR	195.75	29.69	166.06	8.56
DGS to BAR	131.45	29.69	101.76	9.04
FWL to BAR	132.55	29.69	102.86	8.8
DEC to BAR	106.57	29.69	76.88	6.11
PRI to AGR	195.75	62.19	133.56	8.85
DGS to AGR	131.45	62.19	69.26	7.86
FWL to AGR	132.55	62.19	70.36	7.59
DEC to AGR	106.57	62.19	44.38	6.69
PRI to DGS	195.75	131.45	64.3	9.76
FWL to DGS	132.55	131.45	1.1	10.1
DEC to DGS	106,57	131.45	0	7.84

Activity	Transitions	Planned Area Annual (ha)	Unplanned Area Annual (ha)	Uncertainty % at 90% confidence Interval	Planned Emission Mean (MgC)	Planned Emission Std (MgC)	Unplanned Emission Mean (MgC)	Unplanned Emission Std (MgC)
Deforestation	PRI to BAR	749	1,554	10	124,384	4,005	258,067	8,085
	DGS to BAR	1,772	1,588	17	180,308	9,673	161,586	8,674
	FWL to BAR	27	117	9	2,780	566	12,032	839
	DEC to BAR	365	240	12	28,089	1,487	18,459	1,067
	PRI to AGR	1,232	2,385	13	164,506	6,820	318,469	13,081
	DGS to AGR	25	25	19	1,736	783	1,738	798

Activity	Transitions	Planned Area Annual (ha)	Unplanned Area Annual (ha)	Uncertainty % at 90% confidence Interval	Planned Emission Mean (MgC)	Planned Emission Std (MgC)	Unplanned Emission Mean (MgC)	Unplanned Emission Std (MgC)
	FWL to AGR	106	273	12	7,455	711	19,213	1,367
	DEC to AGR	0	0	15	168	241	163	234
Degradation	**PRI to DGS**	6,253	7,358	17	402,462	37,449	473,582	44,075
	FWL to DGS	26	52	16	78	113	155	209
	DEC to DGS	103	87	18	192	288	163	246

Please see MS Excel workbook Monte_carlo_simulations for Monte Carlo runs.

ANNEX 13. UNCERTAINTY EVALUATION OF MAPPING PRODUCTS IN THE ER PROGRAM

CNIAF, Brazzaville, Février 2016

Abréviations

CCNUCC	Convention Cadre des Nations Unies sur les changements Climatiques
CNIAF	Centre National d'Inventaire et d'Aménagement des Ressources forestières et Fauniques
ER-P	Emission Reduction Program
FAO	Organisation des Nations Unies pour l'Agriculture et l'Alimentation
MEFDDE	Ministère de l'Economie Forestière et du Développement Durable
NERF	Niveau d'Émission de Reference pour les Forêts
ONU-REDD	Programme des Nations Unies pour la REDD+
REDD+	Réduction des émissions provenant de la déforestation et de la dégradation des forêts
SYNA MNV	Système National Mesure Notification Vérification
TGC	Terra Global Capital
WRI	World Resource Institute

Introduction

Dans le cadre du processus de réduction des émissions provenant de la déforestation et de la dégradation des forêts, et le rôle de la conservation, la gestion durable des forêts et du renforcement des stocks de carbone forestier (REDD+), la République du Congo, qui poursuit sans relâche son engagement à faire valoir ses performances, à mise en place des outils stratégiques pour la mise en œuvre du processus REDD+

Outre la soumission du niveau des émissions de référence pour les forêts (NERF) et le SYNA-MNV, la République du Congo a été retenue dans le pipeline du Fonds Carbone, suite à l'approbation de son ER-PIN élaboré de façon participative, pour soutenir le Programme de Réduction des Emissions (ER-P), dans les départements de la Sangha et de la Likouala.

L'ER-P, en cours de finalisation par la Coordination Nationale REDD+, avec l'appui technique du bureau d'étude Terra Global Capital (TGC), se présente comme le document principal à soumettre à l'approbation des membres du comité des Participants du Fonds Carbone. Il a été consolidé lors d'un atelier tenu à Brazzaville du 1er au 3 Février 2016.

Parmi les recommandations issues de cet atelier, notamment celle du groupe de travail sur le niveau de référence et le MNV, il a été décidé de réaliser le contrôle-qualité et la validation, par le CNIAF, de la cartographie de ER-P, produite par Terra Global Capital (TGC).

C'est dans ce cadre que s'est tenu un atelier du 19 au 26 février 2016 à la BDEAC, qui a regroupé les cadres du CNIAF/MRV (liste jointe en annexe) avec l'appui technique de Remi D'ANNUNZIO, expert de la FAO.

Le présent rapport rend compte des travaux de contrôle-qualité et de la validation de la cartographie de ER-P. L'objectif premier est l'évaluation de la précision de la carte d'occupation des sols (chapitre 2 à 4) ; une analyse succinctes des autres produits cartographiques est présentée en chapitre 5.

1. Présentation de la carte d'occupation des sols

La carte d'occupation des sols pour les années 2003, 2007, 2012 et 2015 avec la légende présentée en **Error! Reference source not found.** a été établie par Terra Global Capital pour les départements de la Likouala et de la Sangha. Elle est basée sur une classification supervisée d'images optiques et radar (Landsat et ALOS PALSAR).

Table 91 Classes d'occupation des sols utilisées dans les cartes

Valeur	Classe	Définition
0	NOD	Pas de données
1	PRF	Forêt Primaire
2	DSF	Forêt Secondaire
3	WLF	Forêt Marécageuse
4	SDF	Forêt Semi Décidue
5	BGN	Sol nu
6	OWL	Autres marécages

Un détail de la carte d'occupation des sols pour les années 2003 et 2012 est disponible en **Error! Reference source not found.**. Les cartes de 2003 et 2012 ont été empilées en un raster unique, pour lequel les pixels correspondants aux valeurs de chaque transition ont été comptabilisés (**Error! Reference source not found.**).

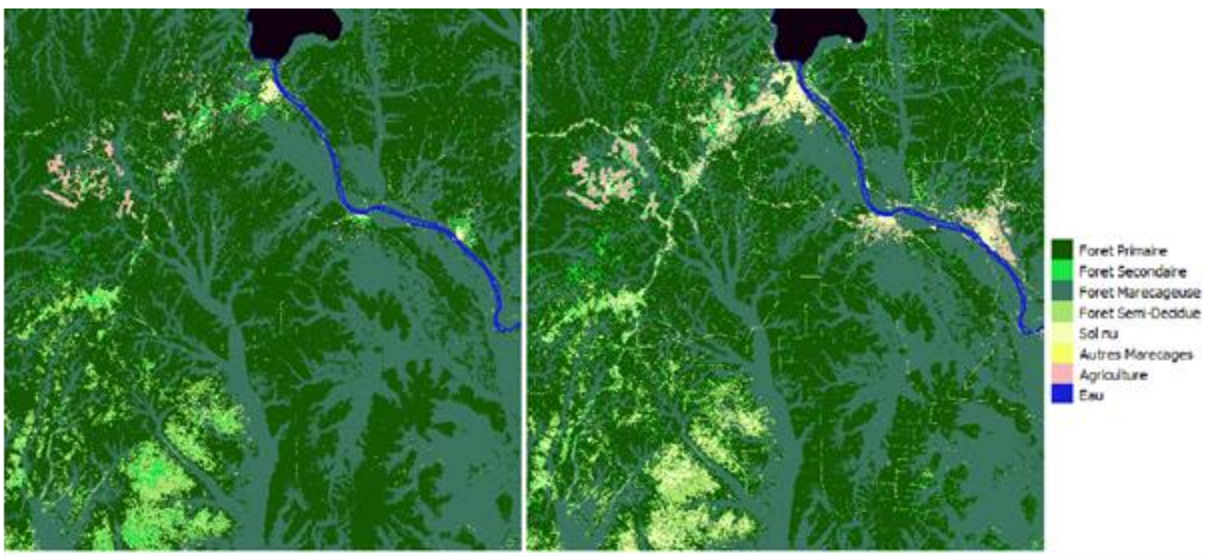

Figure 38 Carte TGC en 2003 (gauche) et en 2012 (droite)

La carte de changement est donc obtenue post-classification (**Error! Reference source not found.** 39).

Table 92 Matrice de transition 2003-2012

		1000 ha							
		2012							
		PRF	DSF	WLF	SDF	BGN	OWL	AGR	WTR
2003	PRF	4878	159	1	0	34	0	57	0
	DSF	4	64	1	2	50	0	0	0
	WLF	1	1	6485	0	2	1	5	0
	SDF	3	2	0	180	8	0	0	0
	BGN	1	0	0	0	268	0	0	0
	OWL	0	0	0	0	0	61	0	0
	AGR	0	3	0	0	0	0	42	0
	WTR	0	0	0	0	0	0	0	43

Pour des raisons de faisabilité, il a été décidé de réaliser l'analyse de la précision sur les classes agrégées suivantes :

- Forêt Stable (tous types de forêt restant forêt sauf vers forêts secondaires)
- Dégradation (toutes forêts vers forêts secondaires)
- Déforestation (toutes forêts vers non forêt)
- Non Forêt Stable (toutes les autres transitions)

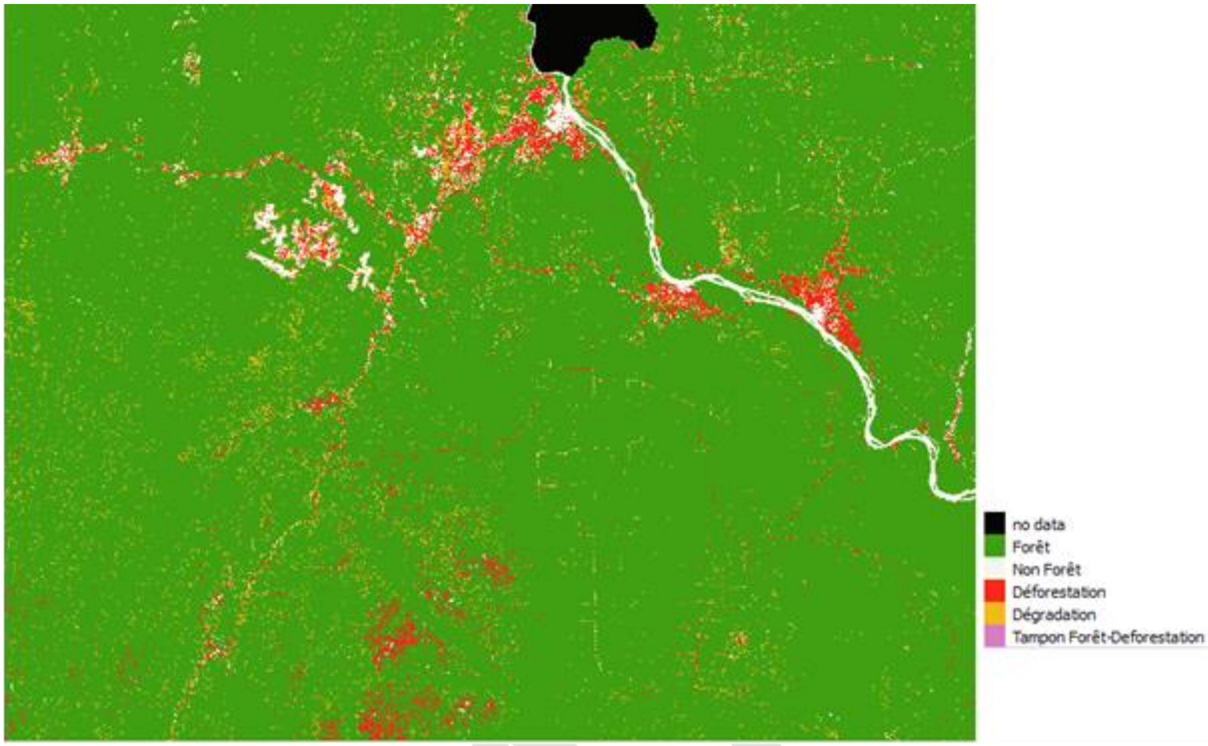

Figure 39 Carte de changement 2003-2012

3. Méthodologie pour l'analyse de la précision

Pour cette production cartographique, l'analyse de la précision s'est faite en suivant les bonnes pratiques décrites par Olofsson *et al.,* (2013) en trois étapes : la définition du système d'échantillonnage, l'adoption d'un système de réponse optimal et l'analyse.

Système d'échantillonnage

Un échantillonnage stratifié a été réalisé avec répartition aléatoire des points dans chaque strate. Avec une précision attendue de 0,9 pour les classes stables et 0,5 pour les classes de changement, 931 points distribués entre les classes conformément au **Error! Reference source not found.**, ont été aléatoirement tirés (Figure 40).

Table 93 Superficies des classes de changement agrégées et points d'échantillonnage

Clusters	Area (1000 ha)	Nb points
Foret	11,475	512
Non Foret	418	119
Pertes	157	100
Degradation	162	100
Tampon	145	100

En plus des strates présentes dans la carte, une zone tampon de 1 pixel autour des pixels de déforestation a été définie et échantillonnée, pour réduire l'effet des erreurs de commission sur les ajustements de superficies de la classe déforestation.

La détermination de la taille de l'échantillon, la répartition au sein de chaque classe et la distribution des points ont été réalisées en utilisant l'interface développée par la FAO avec le paquet *shiny* dans le logiciel R. L'échantillonnage des classes majoritaires a été fait en choisissant aléatoirement des points dans une grille aléatoire (paquet *raster* et *sample* dans R). L'échantillonnage des classes rares a été fait en utilisant la fonction *rasterToPoints* dans R, puis la fonction *sample*. Le détail de la procédure est décrit dans FAO (2016).

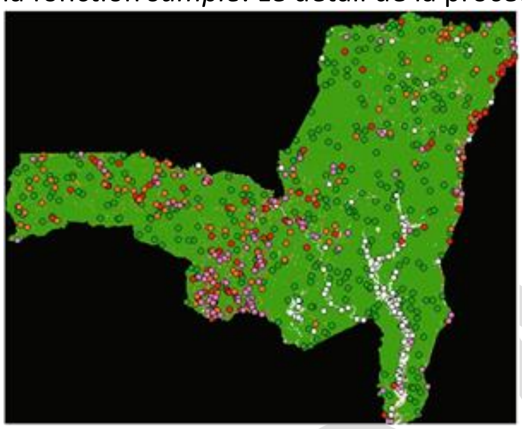

Figure 40 Points d'échantillonnage interprétés

Selon Olofsson *et al.,* (2013) les données qui servent à évaluer la précision d'une carte doivent être de qualité et de résolution au moins supérieures ou égales aux données utilisées pour l'élaboration de la carte.

Le système de réponse choisi a été l'outil Collect Earth (**Error! Reference source not found.**) où les points sont visuellement interprétés en utilisant les images présentes dans Google Earth, Bing map et Here map.

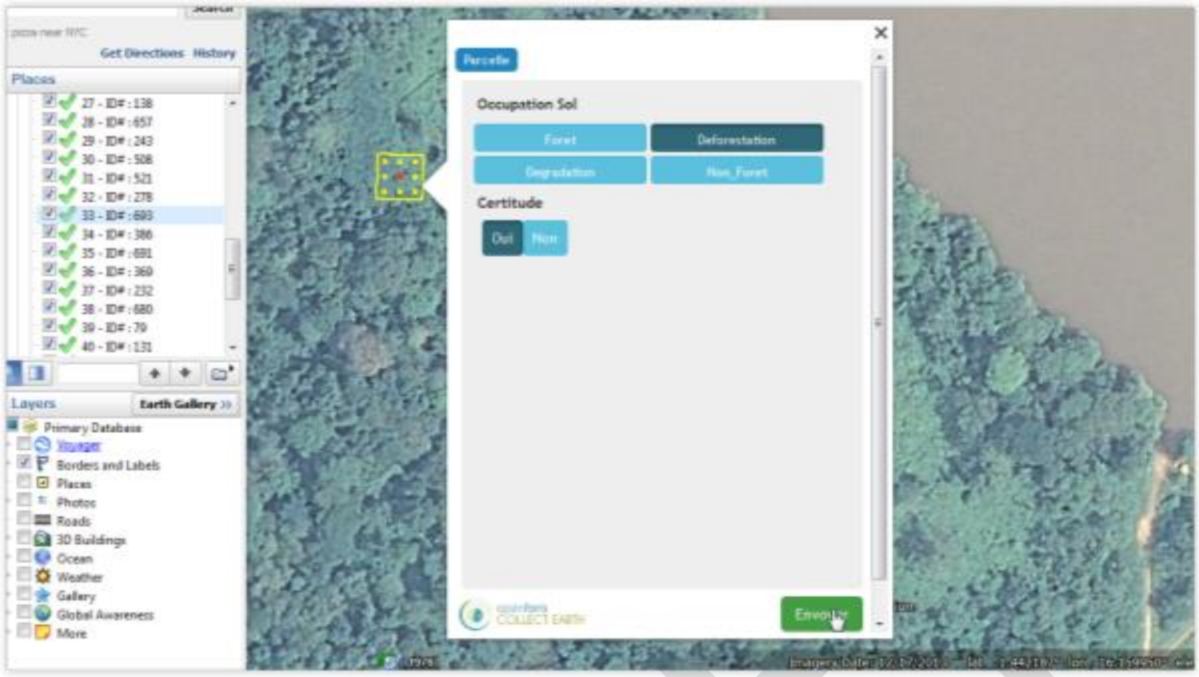

Figure 41 Interface Collect Earth utilisée comme système de réponse

Par ailleurs, le Congo dispose d'images SPOT à 20m de résolution pour le pivot 2010, et d'images SPOT à 10m de résolution pour le pivot 2015 qui ont été utilisées pour chacun des points comme source d'informations supplémentaires.

Pour finir, des composites annuelles d'images Landsat à 30m de résolution avec une couverture nuageuse inférieure à 5% ont été découpées pour une zone de 1km autour des points d'échantillonnage, permettant de visualiser les modifications du couvert végétal (indice NDVI utilisé pour la visualisation) au cours de la période de référence.

Pour certaines années, l'indisponibilité des images avec le seuil choisi n'a pas permis de couvrir tous les points. La Figure 42 présente ainsi un profil temporel avec les images SPOT découpées aux mêmes dimensions.

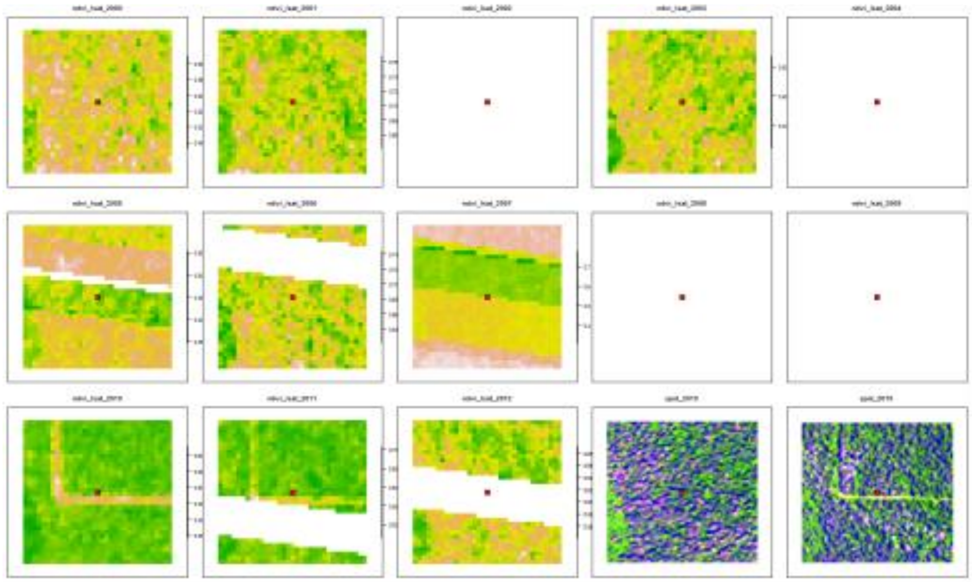

Figure 42 Série temporelle NDVI Landsat 2000-2012 et images Spot 2010 et 2015

Système d'Analyse

Les résultats ont été produits sous forme d'une matrice de confusion et d'une table des surfaces estimées corrigées en utilisant une interface développée par la FAO avec le paquet *shiny* dans le logiciel R. Une version Excel du calcul correspondant est également disponible.

Organisation du travail

La collection des points et l'analyse de la précision ont été réalisées par l'équipe cartographie du CNIAF, avec le support technique de l'équipe ONU-REDD de la FAO. Pour chacun des 14 membres du groupe de travail, environ 49 points par strate ont été attribués : 21 points en forêt, 8 en Non Forêt, 6 points en Déforestation, 7 en Dégradation et 7 points dans la zone tampon sur le front de déforestation.

Les points ont été interprétés individuellement dans un premier temps, puis les résultats ont été examinés par l'ensemble du groupe et, si nécessaire, amendés.

Par ailleurs, pour la zone Forêt, tous les points issus de l'analyse de la précision organisée pour les données d'activité du niveau de référence national soumis à la CCNUCC (Congo, 2016) ont été utilisés dans le cadre de ce calcul (202 points).

4. Résultats

Matrice de confusion

La matrice de confusion indique une précision générale ajustée de 95% (**Error! Reference source not found.**). La précision utilisateur (indique la probabilité d'une classe sur la carte d'être correctement attribuée) présente des différences entre classes : elle est plus élevée pour les classes stables (>85%) et plus basse pour les classes de changement (~40%).
La précision producteur ajustée (probabilité qu'une classe du jeu de données de référence soit représenté sur la carte) est meilleure pour les classes de changement, indiquant de faibles erreurs d'omission.

Table 94 Matrice de confusion de l'analyse de la précision

		REFERENCE								
		FF	NF	Df	Dg	Tampon	total	area	area_prop.	UA
CLASSIFICATION	FF	505	6	1	0	0	512	11,475,015	0.93	98.63%
	NF	13	103	0	3	0	119	417,967	0.03	86.55%
	Df	39	11	36	14	0	100	157,212	0.01	36.00%
	Dg	56	0	2	42	0	100	162,040	0.01	42.00%
	Tampon	82	2	3	13	0	100	144,707	0.01	
	Total	695	122	42	72	0	931	12,356,941		
	PA	72.66%	84.43%	85.71%	58.33%	-			Overall	73.68%
	PA_adj	97.28%	70.05%	65.36%	56.99%	-			Overall_adj	95.53%

De façon générale, ceci indique que les changements réels de couvert forestier sont tous pris en compte (faible erreur d'omission) mais surestimés (erreur de commission importante, exemple en **Error! Reference source not found.**). L'ajustement des superficies grâce aux données de référence permet de corriger ce biais.

Sur les 202 points recyclés de la précédente analyse de la précision, 198 points concordaient (classés comme forêt) et 4 ont été classés comme non forêt, ce qui justifie pleinement l'utilisation de ces points stables pour une période englobante (2000-2012).

Superficies ajustées

Les forêts de la Likouala et de la Sangha couvrent 11.600.000 ha (+/- 120.000 ha) soit 93% de la superficie des deux départements (**Error! Reference source not found.**). Entre 2003 et 2012, 87.000 ha (+/- 48.000 ha) de forêt ont été perdus, soit un taux moyen de perte annuelle de 0,08%. Le taux de dégradation annuelle est du même ordre de grandeur mais plus élevé, avec 0,11% (**Error! Reference source not found.**)

Table 95 Superficies ajustées et intervalles de confiance à 95% (ha)

	Préc. Prod.	Préc. Util.	Superficie carte	Superficie ajustée	CI
Foret	97%	99%	11,619,722	11,634,505	122,371
Non Foret	70%	87%	417,967	516,430	112,802
Deforestation	65%	36%	157,212	86,590	47,540
Degradation	57%	42%	162,040	119,415	22,895
Total	96%		12,356,941	12,356,941	

Ces chiffres pour les deux départements sont dans la fourchette haute des chiffres obtenus pour le Niveau de référence au niveau national soumis à la CCNUCC (Congo, 2016) qui donnait un chiffre moyen de 0,052% de pertes annuelles pour l'ensemble du pays.

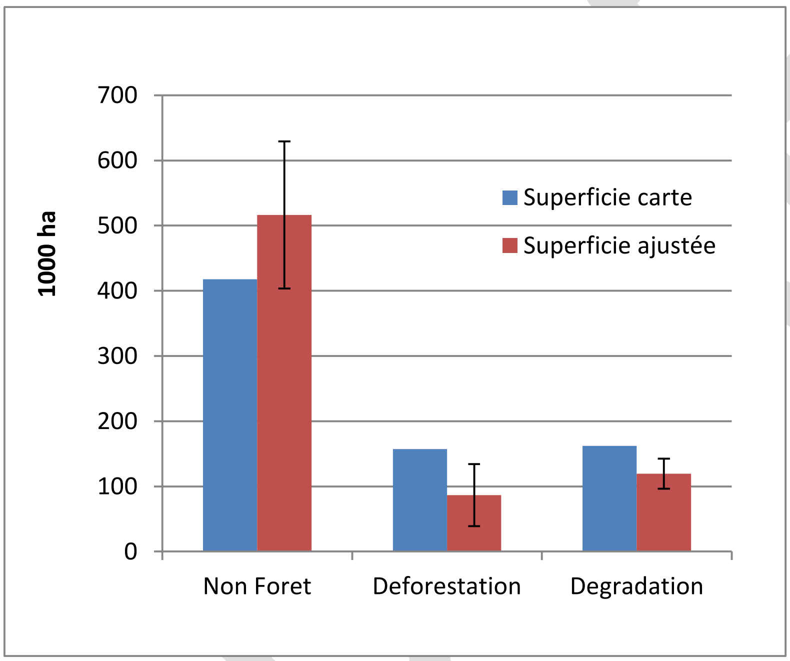

Figure 43 Ajustement des superficies pour la strate non-forêt et les pertes

Discussion et comparaison avec le Niveau de Référence national

Il est à noter que l'unité minimum de cartographie pour le niveau de référence national a adopté un seuil de 0,5 ha, en deçà duquel les pertes n'ont pas été considérées pour être en accord avec la définition nationale.

Or, la distribution des pertes dans la carte TGC indique que plus de 25% des pertes détectées le sont dans des zones inférieures à ce seuil (**Error! Reference source not found.**). Ceci permet d'expliquer la différence entre les données d'activité reportées.

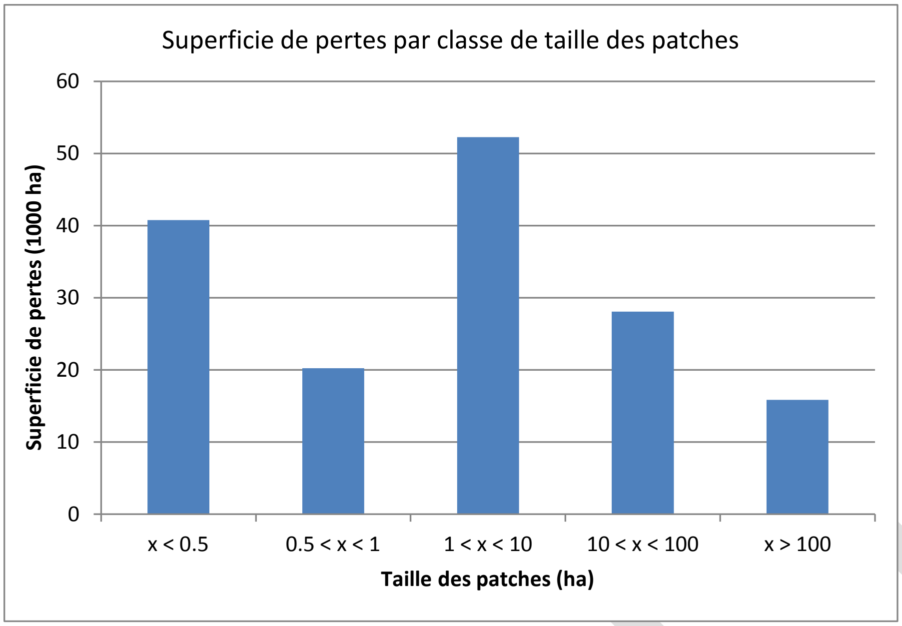

Figure 44 Distribution de la taille des zones de pertes

Par ailleurs, il existe des différences entre les activités par département, les deux départements de la Likouala et de la Sangha regroupant plus de 40% des pertes du pays (Congo, 2016).

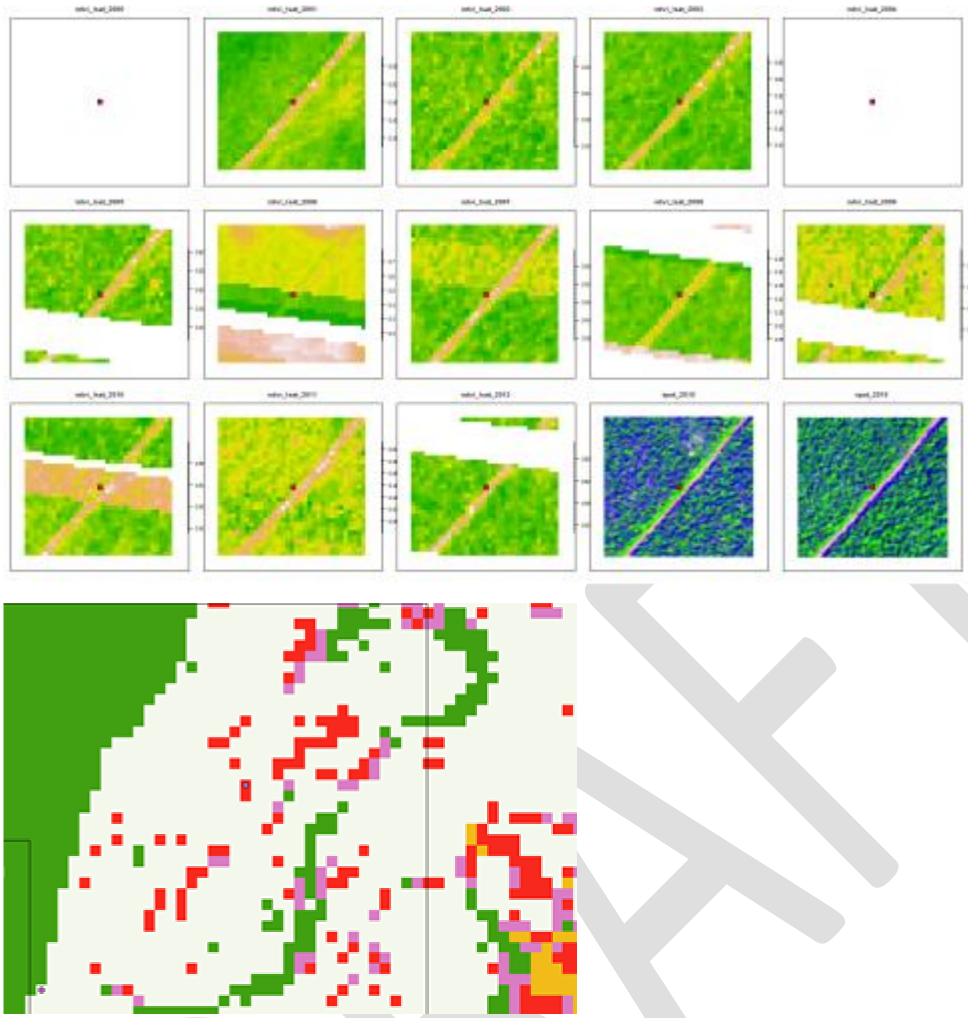

Figure 45. Deux exemples d'erreur de commission de la déforestation :

Point #343 (2.02N -- 16.77E), la route est déjà présente en 2000

Point #570 (2.45N -- 18.15E), tous les pixels de pertes sont compris dans une zone non forêt

5. Evaluation des autres produits cartographiques

Les produits cartographiques suivants, inclus dans l'ER-P, ont été soumis à une analyse d'ensemble :

- Cartes de concessions industrielles de Palmier à Huile (données WRI)
- Cartes des espaces communautaires dans les concessions forestières les plus appropriées pour la production de cacao et de palmier à huile (données TGC).

Concernant la carte des concessions industrielles de palmier à huile il a été constaté que les données proviennent uniquement d'une étude menée par WRI. Les sources de données n'ont pas été vérifiées ni validées. Par ailleurs, un examen rapide montre que les limites des zones agro-industrielles présentent des chevauchements avec les limites officielles des concessions forestières, comme illustré dans la Figure 46.

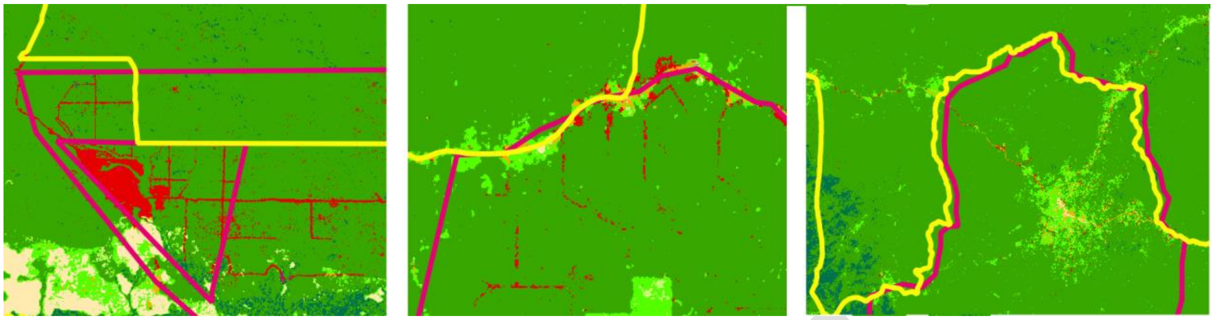

Figure 46 Superposition des limites des concessions agro-industrielles et des concessions forestières (de gauche à droite Atama, EcoOil et SembeOilPalm)

Concernant les espaces communautaires, les séries de développement communautaire (SDC) dans les concessions aménagées sont effectivement prises en compte. Cependant, il manque une concession forestière (Karagoua, Nord-Ouest de la Sangha) dans la figure 18 du ER-P.

De façon générale, il est impératif que les données officielles du pays, disponibles au CNIAF, soient utilisées pour la réalisation des cartes présentées dans l'ER-P, en particulier les limites administratives et les concessions forestières.

Conclusion

L'évaluation de la précision de la carte d'occupation des sols pour 2003-2012 a été mise en œuvre par le CNIAF avec le soutien de la FAO.

La carte d'occupation des sols préparée par TGC présente une précision générale de 95% pour des classes agrégées.

Entre 2003 et 2012, 87.000 ha (+/- 48.000 ha) de forêt ont été perdus, soit un taux moyen de perte annuelle de 0,08%.

Ce chiffre est supérieur au taux de déforestation reporté dans la soumission nationale du Niveau de Reference à la CCNUCC mais s'explique par les différences des définitions utilisées (seuil de 0,5 ha dans un cas, 0,09 ha dans l'autre).

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