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 Final ER-PD: December 18, 2017

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 million ha (89%)
Duration:	The program has a long-term perspective of 20 years with an ER-PA period of six years (2018 – 2023)
CO_2e Reductions:	10,011,393 tCO_2e through 2023
Budget:	US$ 93 million in up-front investment finance and a potential of results-based payments for 10,011,393 tCO_2e over six years

Context and Ambition

The Republic of Congo is home to 22.5 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 final Emission Reductions Program Document (ER-PD) after 2 years' 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 validated its final National REDD+ Strategy in October 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 million hectares of which are forests. With the ER-Program area representing 52% 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 10,011,393 million tCO_2e over six years by 2023, 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 (DFID), 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 (MEF) 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

The 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 will support continuous improvement processes.

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) introducing sustainable subsistence agriculture (cassava, maize via agroforestry systems) to increase agricultural productivity and crop diversification, iii) promoting smallholder outgrower schemes for palm oil on deforested areas within oil palm concessions, and (iv) providing PES for both individuals and communities that protect forests.

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 will be:

- 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 Emission Level (REL) is calculated based on average historical annual emissions for the period 2005-2014 and includes an upward adjustment (per FCPF eligibility requirement).

The total REL for the ER-Program over a six-year ER-PA period (2018-2023) is estimated at 77,422,783 tCO_2e.

ER-Program Reference Level	Annual Emission ($tCO_2e/yr.$)
Average annual historical emissions from deforestation	4,742,795
Average annual historical emissions from degradation	2,764,933
Adjustment (historical average + 0.1% cap)	5,396,069
Total Reference Level	**12,903,797**

Potential Emission Reductions

The Emission Reduction potential of the ER-Program based on the intervention strategy and funding level presented in the finance plan and considering the set-aside of ERs to address reversal (23%) and uncertainty (8%) risks is estimated at 10 million tCO_2e (net) during the term of the ER-PA.

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	Gross ERs (tCO_2e/yr)	Set-aside of ERs Risks and uncertainty	Net ERs (tCO_2e/yr)
1	1,139,459	59,455	78,106	131,724	1,408,744	410,790	997,954
2	1,433,015	59,455	117,159	145,008	1,754,637	511,652	1,242,985
3	1,567,728	59,455	156,211	286,892	2,070,287	603,696	1,466,591
4	1,701,108	59,455	195,264	775,339	2,731,167	796,408	1,934,759
5	1,728,353	59,455	195,264	1,033,786	3,016,859	879,716	2,137,143
6	1,728,353	59,455	234,317	1,128,583	3,150,709	918,747	2,231,962
6-years total	**9,298,017**	**356,731**	**976,321**	**3,501,332**	**14,132,402**	**4,121,008**	**10,011,394**

Benefit-Sharing

The ER-Program will provide a variety of incentives and benefits for the different stakeholders involved. The ER-PD 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 Prime Ministry will play an important role in policy coordination, while technical leadership of the REDD+ process lays with the MEF.

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 MEF 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 Program Management Entity (PME), which will be in charge of the operational and financial management. The PME 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 MEF / 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 the 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) have been validated in January 2017. The comments made during the validation workshop are currently being incorporated in the documents. The final versions of all safeguard instruments are expected in February 2018 and will be available on the FCPF website. 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 (ESMF and sub-frameworks) and respect the national standards (PCI REDD+).

In line with the institutional arrangements designed for the ER-Program, the PME will be responsible for guiding and ensuring compliance with safeguard requirements. That includes for the PME 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 PME 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) has been designed. Its implementation will be the responsibility of the PME and the implementing agencies. A draft FGRM underwent consultations in the ER-Program area in March 2017, and a validation workshop has taken place late December after the results had been integrated. 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	Emission Reductions
ER-Program	Emission Reductions Program
ER-PA	Emission Reductions Payment Agreement
ER-PD	Emission Reductions Program Document
ER-PIN	Emission Reductions Program Idea Note
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
FMT	Facility Management Team of the FCPF
FSC	Forest Stewardship Council
GCF	Green Climate Fund
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
MEF	Ministry of Forest Economy (*Ministère de l'Economie Forestière*)
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)*
PES	Payment for Environmental Services
PFBC	Partnership for the forests of the Congo Basin
PME	Program Management Entity
PNAT	National Land Use Plan (*Plan national d'aménagement du territoire*)
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
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
SNAT	National Land Use Planning Scheme (*Schéma national d'Aménagement du territoire*)

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	Program Management Entity (PME), under the control and supervision of CONA-REDD
Type and description of organization	The PME will be selected through an international call for tender organized by MEF (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 PME will be selected through an international call for tender organized by MEF (subject to government procurement rules). The PME to be staffed with international and domestic experts. Its mandate will be broad.
Main contact person	Georges Claver Boundzanga
Title	National REDD+ Coordinator
Email	bouzgegeredd@gmail.com

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 (CONA-REDD)	**Macaire NZOMONO,** President Advisor regarding Sustainable Development and Environment E-mail: mackzom@yahoo.fr	CONA-REDD 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: bouzgegeredd@gmail.com	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 (MEF)	**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
Ministry of Land Use Planning	**Jean Jacques BOUYA** Minister gomadegoma@gmail.com	Facilitate and ensure program activities are secured regarding land allocation, land property and land tenure.
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	**Pierre TATY** PRONAR Coordinator,	Coordinates reforestation activities, attracts technical and financial partners to support multi stakeholder activities,

Name of the partner	Name of the contact person telephone number and email address	Core capacities and role within the ER-Program
Reforestation Program (PRONAR)	E-mail: pierretaty@yahoo.fr	supports ER-Program activities related to reforestation and agroforestry.
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	**Jean Nganga** President of RENAPAC, E-mail:renapaccongo@gmail.com	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.

Name of the partner	Name of the contact person telephone number and email address	Core capacities and role within the ER-Program
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)	**Hariri Issam** General DirectorE-mail: haririissam@hotmail.com; saad.groupefadoul@gmail.com	Forest company with 1 concession (Tala Tala) in the ER-Program area. Potential implementer of program activities.
Société d'exploitation 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)	**Laurent Cerbonney** Management Cell laurentcerbonney@yahoo.fr	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**	Forest company with 1 concession (Mokabi) in the ER-Program area. 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
	CSR, Marketing, Communication Director E-mail: HUET@rougier.fr	
Bois et Placages du Congo (BPL)	**Georges Bita** General Director E-mail: gbitarbpl@yahoo.com	Forest company with 1 concession (Lopola) in the ER-Program area. Potential implementer of program activities.
PALM OIL COMPANIES		
ECOOIL	**Jean-Christophe MATOUALA,** Responsible for Village Oil palm E-mail: matoujc2017@gmail.com	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.
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.

Name of the partner	Name of the contact person telephone number and email address	Core capacities and role within the ER-Program
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 E-mail: c.ngomba@afdb.org	Financial support to CNIAF to design and implement the National Forest Inventory and 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)	**Christophe Van Orshoven** E-mail: christophe.vanorshoven@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 E-mail: 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 22.5 million hectares of the country's forests represent 69% of the national territory, out of which 80% are exploitable. According to CNIAF, 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.

FSC certified concessions represent a real strength for the Republic of Congo as their effectiveness and impact in comparison to non-FSC concessions are considerable. This can be summed up in 4 main points:

1. **Support to Governance:**

- Certification influences all stages of the policy process: agenda setting and negotiation; implementation, and monitoring and enforcement.
- Certification introduces positive changes in management practices and improves social and environmental performance.
- Certification can provide complementarity filling policy gaps or generating rewards for those actors who comply to extra-legal standards, while public regulation can sanction those actors who violate the law.

2. Economic advantages:

FSC is a performance-based, outcome-oriented standard.

On average, the companies earned an extra US$1.80 for every cubic metre of FSC-certified roundwood or equivalent, over and above any new costs, due to price premiums, increased efficiency, and other financial incentives.

Regarding access to markets, many major companies have policies that state a preference for FSC-certified products. Many governments require the use of FSC-certified products. For instance, FSC certification enables access to "environmentally sensitive" markets, such as the Scandinavian countries, Germany, the Netherlands and Switzerland, which almost systematically ask for FSC certification and and buy on a higher prices basis. Companies that produce FSC-certified products gain access to these markets, and many others.

3. Social advantages:

Regarding community engagement, FSC requires forest managers - on both public and private lands - to engage local community members and to protect customary rights of indigenous people, ensuring their voices are part of the certification process and impacts of forest operations are addressed. In addition, FSC requires the results of certification audits to be released to the public, even on private lands, which makes FSC unique among forest certifications.

4. Environmental advantages:

Regarding environmental protection, FSC's forest management standards expand protection of water quality, prohibit harvest of rare old-growth forest, prevent loss of natural forest cover and prohibit highly hazardous chemicals, which are all unique aspects of the system.

Box 1. FSC's effectiveness and impact in comparison to non-FSC concessions

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 five pillars of the validated National REDD+ Strategy, namely building governance capacities, sustainable forest management, improvement of agricultural systems, rationalization of the production and utilization of fuelwood, and reduced-impact mining. 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 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 million tCO_2e from REDD+ activities over six years (2018-2023), 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). 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.

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) introducing sustainable agriculture (cassava, maize through agroforestry systems) to increase agricultural productivity and crop diversification, (iii) promoting smallholder outgrower schemes for palm oil on deforested areas within oil palm concessions,and (iv) providing PES for both individuals and communities that protect forests.

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 MEF 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 2. 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. This INDC will be updated with French Development Agency support starting in January 2018 to more comprehensively include the LULUCF sector. 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. The country is currently preparing its second NDP, which will integrate the National REDD+ Strategy. The 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. It will shortly be adopted by the Council of Ministers.

In November 2015, the Republic of Congo signed the CAFI Joint Declaration, confirming its commitment to a zero-deforestation development pathway. With joint CAFI and Forest Investment Plan (FIP) financing, it is developing its Investment Plan of the National REDD+ Strategy, which includes national reforms and multi-sectoral programs aimed at transformational change to address the drivers of deforestation and forest degradation. The Investment Plan was submitted to the FIP on October 31, 2017, and approved by the FIP Sub-Committee on December 13, 2017. The Government also submitted the Investment Plan to CAFI on October 2, 2017. Exchanges with CAFI on the Investment Plan are expected to continue through February 2018.

Activities in the Investment Plan will improve the enabling conditions for the ER-Program. In particular, the Investment Plan will include the development of a National Land Use Plan (NLUP) under the leadership of the Ministry of Land Use Planning, the development of which is expected to be submitted for CAFI funding, with co-financing sought from the Green Climate Fund. The work would build on the government's demonstrated desire to implement land use planning, as evidenced through: a) the development of a roadmap for land use planning[3], b) first steps in developing a land use map with support from the African Development Bank, c) the adoption of Law No. 43-2014 of 10 October 2014 on land use planning and territorial development, which

[3] Strengthening Land Use Planning in the Republic of Congo: Assessment, Proposed Roadmap, and Draft Implementation Plan. The World Bank. 2016.

provides the legal framework and guidelines for territorial planning under a sustainable development paradigm, d) the adoption of decrees putting in place four levels of land use planning committees to adjudicate overlapping land use cases in natural ecosystems, the highest of which is chaired by the head of state, and which reach down to departmental level, and e) the first decisions from one of these committees, the national land use planning committee, in June 2017 and published in September 2018, canceling previously issued mining permits that overlapped with Odzala-Kokoua National Park (also see the section on mining on page 33).

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. It is chaired by the Sustainable Development and Environment advisor to the President of the Republic, and includes representatives from the prime minister's office, various ministries[4], 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 strategic orientation for all REDD+ efforts in Republic of Congo, including the ER-Program. To further strengthen its coordination and decision-making power, the government is planning to restructure the body into two chambers: one at ministerial level for high-level ownership and policy coordination, and one at technical level. This will be integrated into the application texts of the new forest code, which, together with the code itself, are expected to be adopted in the first quarter of 2018. While the Ministry of Forest Economy transmitted the Forest Code to the General Secretariat of the government on September 11, 2017, in preparation for its consideration by parliament, due to legislative elections that took place in the summer of 2017, the first parliamentary session (October-December 2017) is a budgetary session that does not take non-budgetary items into account, impeding an earlier adoption of the Forest Code.

As regards the cocoa sector, the Government of the Republic of Congo's initial strategy consisted of allocating a domestic budget of FCFA 33 billion (USD 54 million) for the implementation of the National Development Plan (NDP) 2014-2018 in the cocoa sector, which targeted to plant 23,000 hectares of cocoa in six departments. However, due to the economic crisis, only one departmental site covering 2,700 hectares was implemented, involving 500 farmers. Today, the government is revising its tragets and developing a Second Cocoa NDP 2018-2022 (based on the experiences and lessons learned from the first one) with the support of several partners (CIB-OLAM, AFD, WB). A feasibility study has been completed by the Ministry of Agriculture with support from France. Results of this study have been discussed between Government and its partners.

A new law on agriculture – Congo's first - is currently under development. It is intended to take into account the National REDD+ Strategy and, thus improve policy coherence for forest-smart development. The Ministry of Agriculture is origanizing consultations on a draft submitted to the General Secretariate of the government in preparation for its introduction to parliament. Due to the nature of the ongoing parliamentary session, the adoption of the law on agriculture has suffered from the same delays as the Forest Code.

[4] 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

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

The country's strategy is to regenerate old cocoa plantations, including almost 5,000 hectares in the ER-Program area on degraded forests only. 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 CDZs as part of the Forest and Economic Diversification 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.

As regards the palm oil sector, the Government is pursuing a two-pronged approach: First, it will orient new palm oil plantations toward savannah areas. To prepare that decision, the Government has already stepped up action by joining the Tropical Forest Alliance (TFA) on 2 July 2016 and by signing the TFA 2020 Marrakech Declaration for Sustainable Development of the Oil Palm Sector in Africa on November 16, 2016. Subsequently, it signed TFA's Memorandum on Sustainable Palm Oil Production on March 21, 2017. It organized a first national workshopin August 2017 to develop national principles and two action plans for (i) a responsible palm oil sector and (ii) the implementation of the Marrakech Declaration. A follow-up workshop took place December 14 and 15, 2017, and an action plan to implement national principles was adopted. Representatives from the Government (Ministry of Agriculture, National REDD+ Coordination), the private sector (Eco-Oil) and civil society (WRI and WWF) 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.

Second, the Agriculture Development Plan (PDSA) of 2011 already identified 232,000 hectares for oil plam plantations in Sangha and Likouala. Results-based payments for REDD+, and subsequently the submission of the ER-PIN in 2014, opened the opportunity for prioritizing forest-smart development and a rethinking of the oil palm sector. Beyond the ongoing policy shifts outlined above for new oil palm concessions, the ER-PD sets forth a strategy for limiting the impact of existing plans.

In the forest sector, the Republic of Congo is 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 FLEGT Facility and an independent observer. In 2017, 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 early 2018, will support progress in the VPA FLEGT process to address illegal logging. This is an important synergy with the ER-Program's objectives.

The government also recognizes the challenges the mining sector poses to its REDD+ agenda. The REDD+ process is gradually improving inter-ministerial coordination in this domain. For example, seven prospecting and operation permits issued by the Ministry of Mines in 2016 were suspended[5] after the potential conflict with the ER-Program became apparent. To more systemically address this issue, the government conducted a legal review of Decree 2009-304[6] on the Interministerial Committee on Overlapping Land Uses, finding it to still be compatible with the current legal regime. On this basis, the government activated the Committee under the authority of the Prime Minister in June 2017 to review eight mining titles in the ER-Program accounting area, and decided to cancel them.[7] Exploration permits overlapping with conservation concessions of forest management units in the ER-Program area are also currently being evaluated.

The government is monitoring the actions agreed at CF-16 in June 2017 through a governance matrix agreed with the World Bank. Technical updates of this matrix took place in September and November 2017. The results are reflected in this document.

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 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, the President's sustainable development and environment advisor at that time but now Minister of Forest Economy;
- January 2017: National validation of SESA instruments;
-
- April 2017: National Validation of the ER-PD;
- September 2017: Validation of the Final National REDD+ Strategy
- September 2017: National validation of the Investment Plan of the National REDD+ Strategy

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 communications training session in August 2016.

[5] Note 245/MMG/DGG of July 18, 2016. Ministry of Mines.

[6] Decree 2009-304 of August 31, 2009 *instituant un comité interministériel de concertation en cas d'usage superposé dans les écosystèmes naturels*.

[7] Journal Officiel de la République du Congo. Nr. 39-2017. pp. 1291.

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.

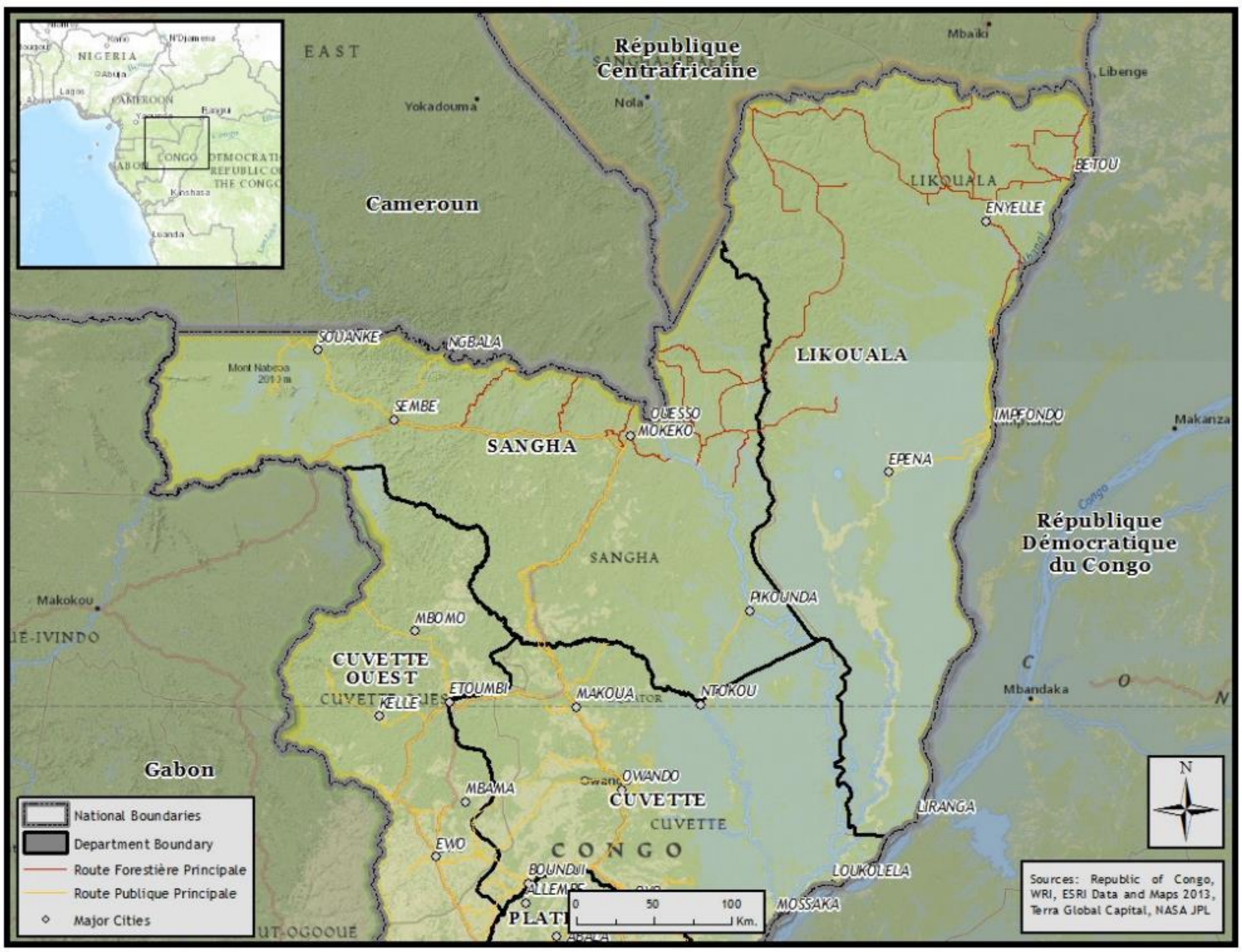


Figure 1. Political Map of the ER-Program Area

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.

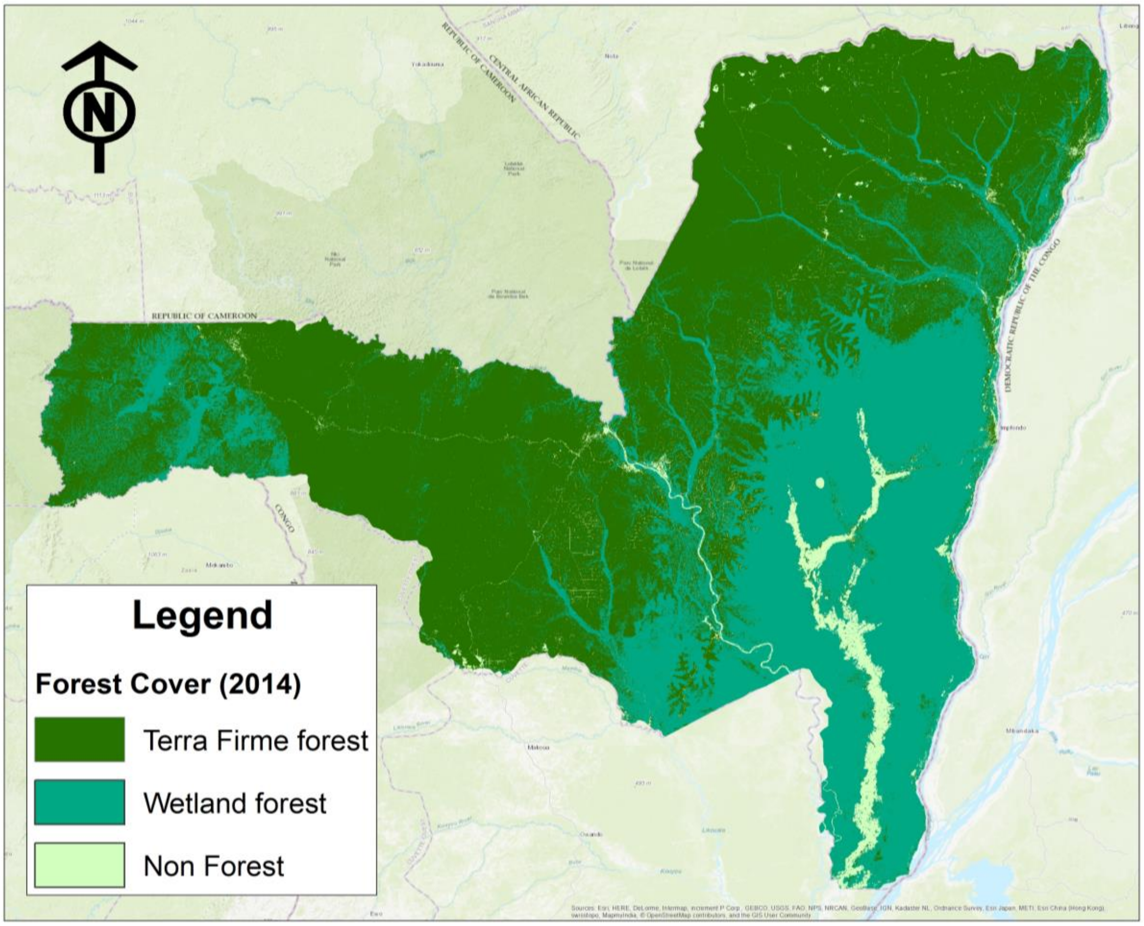


Figure 2. Land Cover in Likouala and Sangha

Table 2. Areas of Different Land-use/Land Cover Classes in ER-Program Area based on a 2014 wall-to-wall map produced by CNIAF with the support of the University of Maryland

LULC Types	Total Program [ha]
	Area (ha)
Forest terra firma	7,384,386
Wetland Forest	4,550,890
Non-Forest	175,548
Wetland and water	246,117
Total	**12,356,941**

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 0 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 2,964,881 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	232,159	201,455	87%	2%
Forest Concession - Production Areas	2	4,651,181	4,479,568	96%	38%
Protected Areas	3	1,947,506	1,821,343	94%	16%
Forest Concessions - Non-Production Areas	4	2,576,016	2,477,731	96%	21%
Unattributed Areas *Not* in oil Palm & Forest Concessions	5	2,964,881	2,707,063	91%	24%
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.

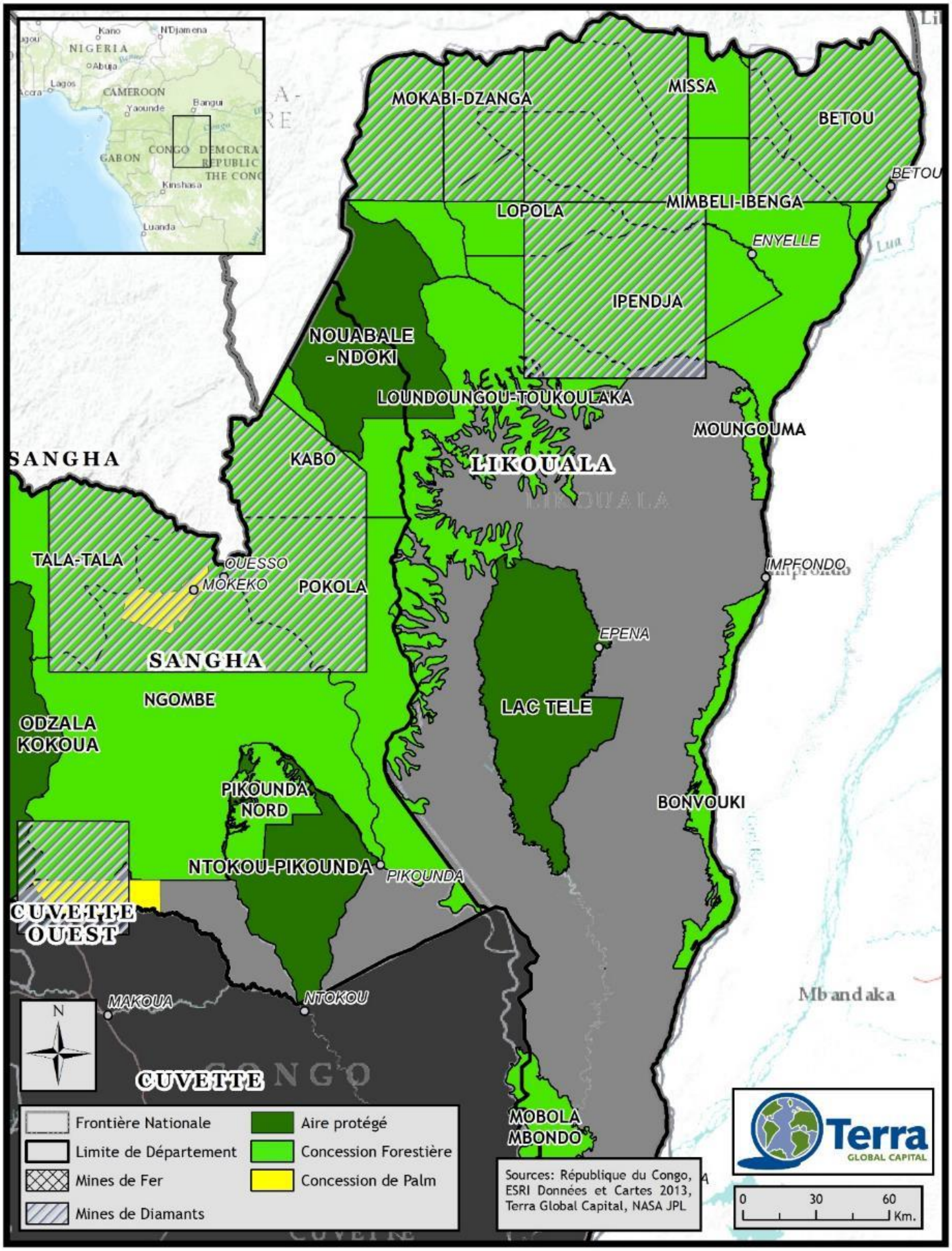


Figure 3. Land tenure and Land-Use in Likouala District

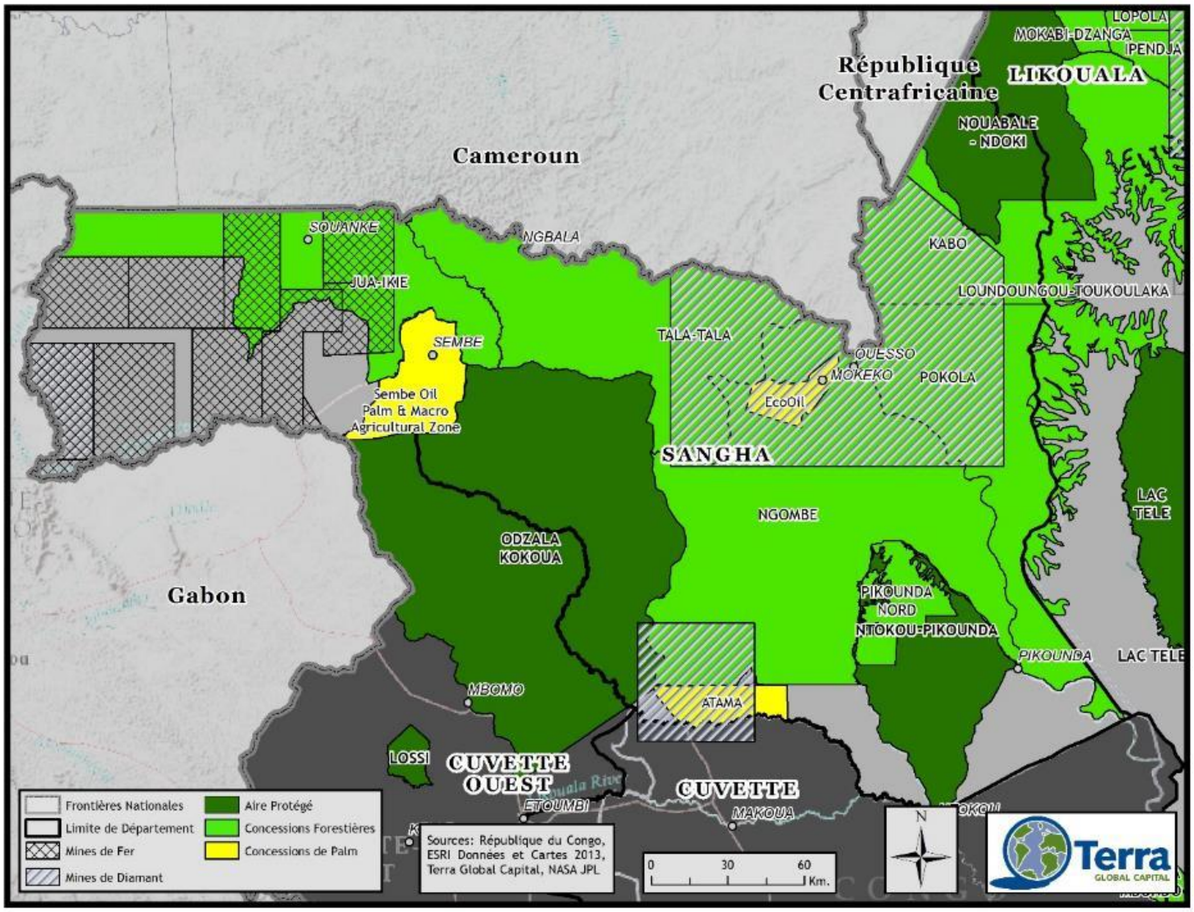


Figure 4. Land Tenure and Land-Use in Sangha District

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 annexed to the ER-PIN, 2) “Spatial Distribution and Causes of Deforestation and Degradation and Analysis of Strategic Options, proposed by the R-PP for the Republic of Congo,” [8] 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.[9]

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.[10] 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.[11] Indirect drivers or underlying causes identified include weak governance, lack of policy coordination and land use planning, poverty and insufficient enabling conditions for sustainable

[8] 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.”
[9] 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.
[10] Ibid., CN-REDD/BRL Ingenerie/C4-EcoSolutions (2014).
[11] R-PP, 2011 (p. 49).

economic activities, population growth and infrastructure. Furthermore, urban expansion and new businesses bring job opportunities in the area[12].

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.

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

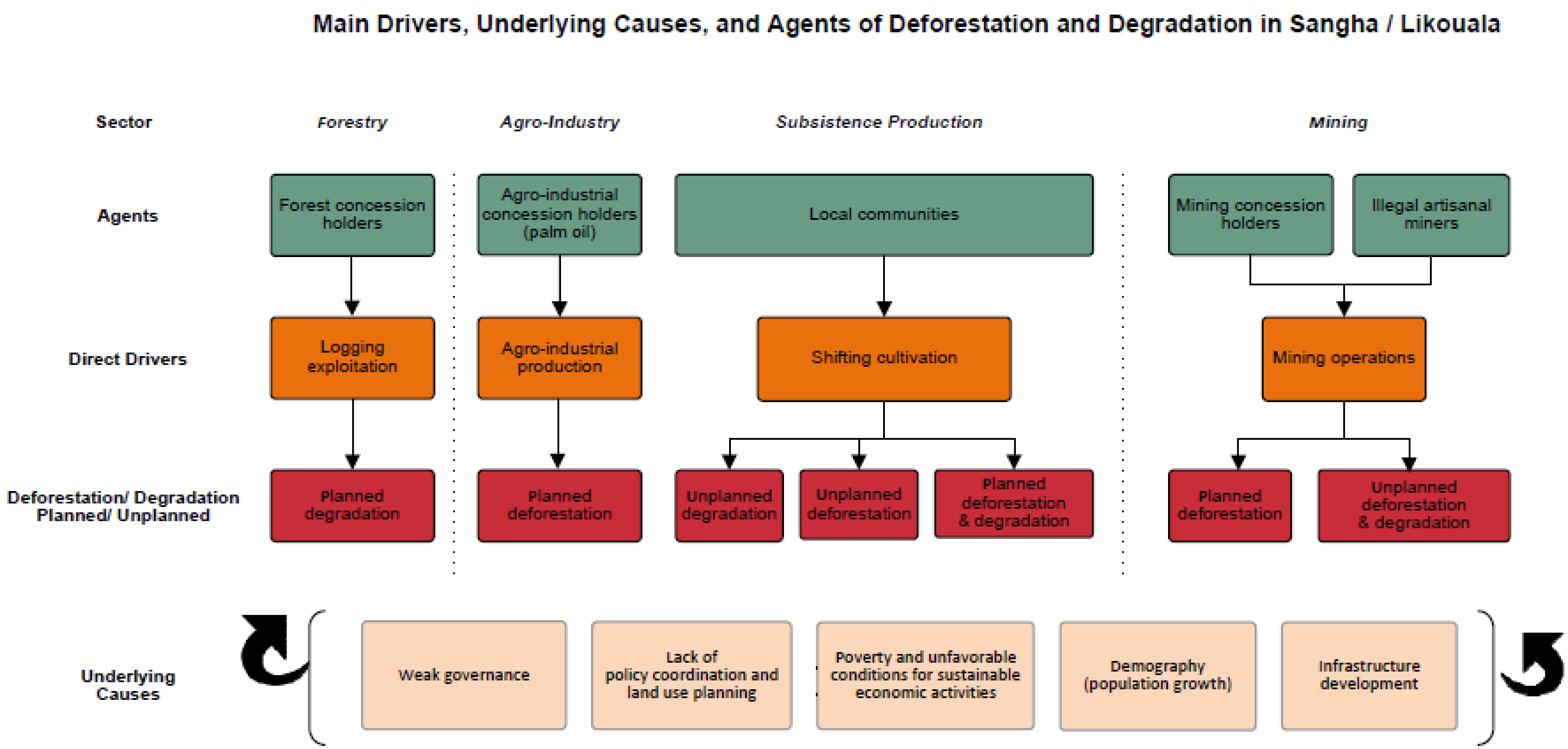


Figure 5. Main Drivers, Underlying Causes, and Agents of Deforestation and Degradation in Sangha / Likouala

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, 11 have approved forest management plans and 2 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.[13]

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.[14]

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.[15]

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.[16]

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.[17] Three industrial plantation areas have been delineated thus far in Sangha, and two of them have been allocated. The palm oil sector has its historical roots dating back to the colonial period in Sangha. Field visits conducted in

[13] Following Article 24 of decree 2002-437 and Arrêté n° 5053/MEF/CAB of the 19 Jun 2007.
[14] Brandt, J. S., et al. (2014). "Foreign capital, forest change and regulatory compliance in Congo Basin forests." Environmental Research Letters **9**(4) : 044007.
[15] 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.
[16] Projet OI-APV FLEGT, Rapport N°01/CAGDF
[17] PDSA, 2012, p. 79.

October 2015 identified other areas where smaller oil palm plantations are currently being cultivated outside of these formal concessions.

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.

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 notably palm oil producers are currently unregulated. The TFA efforts are expected to change that.

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.[18] 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.

[18] 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)

Mining

The last five years have seen Republic of Congo move into the development of its mineral resources. By the end of 2010, the Ministry of Mines had allocated 48 prospecting licenses across the country to 28 companies and 49 research permits.[19] 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 region with three major iron ore mining projects (Avima, Nabeba, and Badondo) planned for the Djoua Ivindo forest area.[20] There are two operations permits in the ER-Program Area, however, the actual impact of mining on forests in the area is 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 operations. However, this could change in the future. Congo has very competitive production costs for iron ore, allowing it to compete in global markets.

Mining operations have direct and indirect impacts on deforestation and degradation. While direct impacts from mining are relatively modest in terms of land clearing, mining does cause deforestation and habituate fragmentation in primarily dense tropical forests.[21] 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 railway does however cause deforestation and habitat fragmentation in primarily dense tropical forests on elevated hills on Mount Nabeba.[22]

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.[23] 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).

---

[19] 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).

[20] 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.

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

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

[23] Hund, et al., p. 45.

Western Sangha is also considered as an emerging gold region, especially in the area around Souanké, where artisinal mining has increased lately. In Likouala, diamonds deposits - whose exploitation does not cause deforestation or forest degradation as diamonds can be found mainly in the riverbed - are 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.

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	Sangha	Souanke	Ibenga
Exploitation	Core mining Congo ltd	Iron	Sangha	Souanke	Mont Avima
Research	Congo Mining	Iron	Sangha	Souanke	Badondo
Research	Sai-Congo	Rough Diamond	Likouala	Enyelle	Mokabi-lola
Research	Distribution internationale	Diamond	Likouala	Betu	Lokoume
					Betu Koumba
Research	Distribution internationale	Gold	Sangha	Souanke	Pandama
Research	Maud Cong	Titanium	Sangha	Souanke	Gola
		Iorn			Minguelakum
Research	Sanu Resources	Manganses	Sangha	N/A	Seka
Research	Avina Gold SARL	Gold	Sangha	Souanke	Mclamankoue (Avina-or)
Research	Golden Lion	Iorn	Sangha	Souanke	Avima Est
Research	Sai-Congo	Rough Diamond	Sangha	N/A	Ketta
Research	Mac- Congo Mines Auriferes et carrieres du Congo	Gold and related substances	Sangha	Souanke	Elogo-Alangog
					Elogo- Jub
Research	Yuan Congo Wang	Gold	Sangha	Souanke	Elen I
Research	Yuan-Dong	Gold	Sangha	Souanke	Yangadou II
Research	EMC	Coltan	Sangha	Souanke	Bellevue
		Diamant		Souanke	Matongo-Kounda

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

Stage	Land-use Change Impacts[24]
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.

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.

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

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. While Congo made some efforts to adopt decrees putting in place four levels of land use planning committees to adjudicate overlapping land use cases in natural ecosystems, policy coordination is yet to be effective and these committees to be 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.[25] 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.

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

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

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.[26] 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.

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.[27] 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, road construction has started 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.

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,[28] 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.

---

[26] World Bank Indicators, Congo.

[27] 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.

[28] 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.

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 .
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 sustainable forest management (as shown in Figure 6 below).

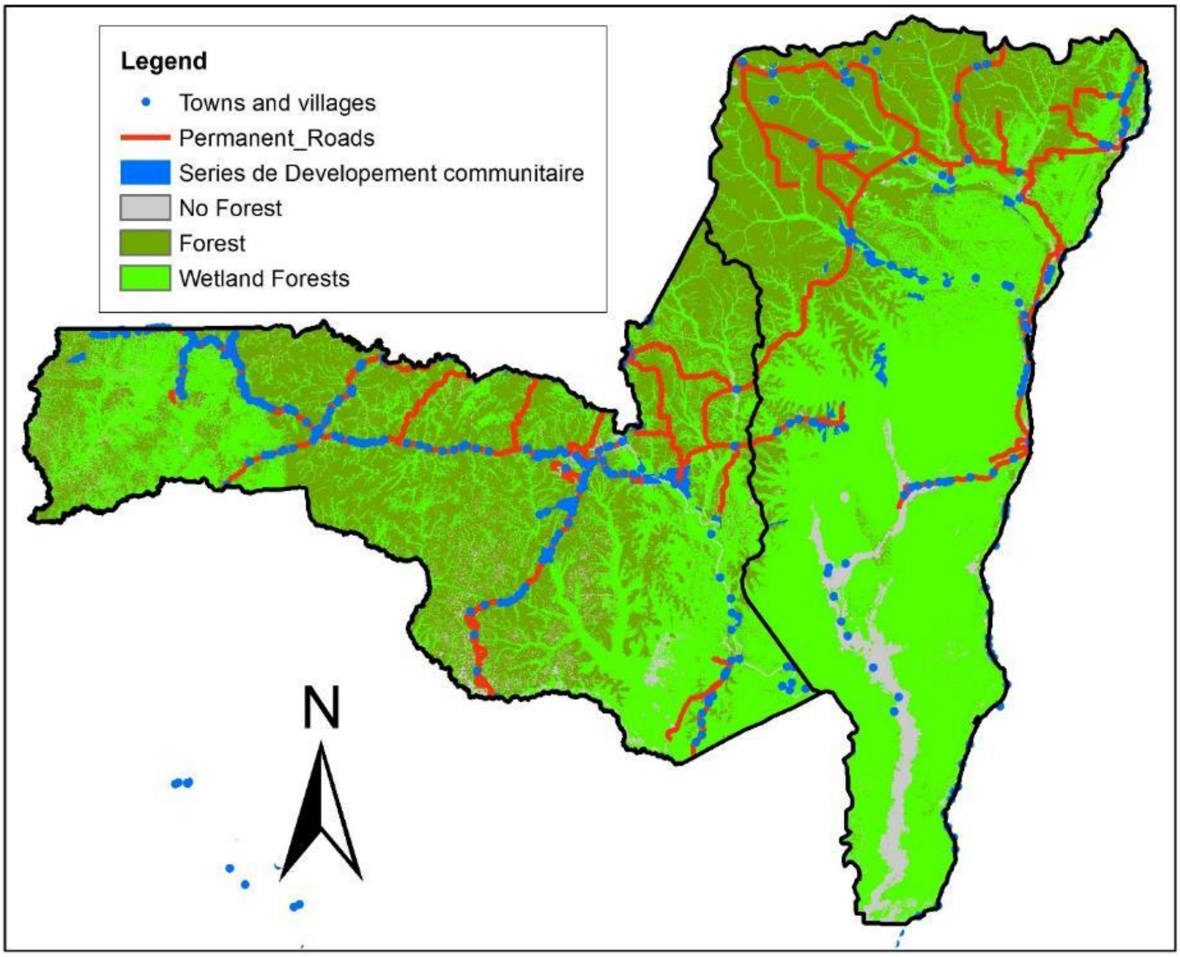


Figure 6. Population repartition in the Program Area

In order to achieve the program objectives and attain the transformational effects needed, the program will adopt a 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-Program 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. Payments for Environmental Services (PES) for Smallholders	• 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.** 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
	SA5. Sustainable subsistence farming and others livelihoods activities	• Promoting improved agricultural productivity and crop diversification	• Reduced unplanned DF and DG	• 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. 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
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	**EA6.** Support for developing	• Inclusion of RSPO as priorities in national agricultural/oil palm strategy	• Will help reduce unplanned and planned DF and DG	• Western Sangha

OS3 Improvement of agricultural systems	sustainable palm oil production			
	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 investments (roads and port storage)	• Will help reduce unplanned and planned DF and DG	• Entire ER-P Area
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.[29] 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.

Medium-term vision and sustainability:

- 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 hectares 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 potential lablel or RIL 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.

[29] 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 protecting permanently 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[30]. 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	• Either Cost-based approach or Carbon-linked payment per hectare of RIL/LtPF (TBD during benefit sharing plan's design)
Program targets after 5 years	• All concessions with certified RIL • 4,169,250 hectares RIL certification
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 • RIL manual • Improved governance of timber operations • FLEGT and VPA
Links to national strategy	• Policy Option 2: Sustainable management of forest resources.

SA3. Payments for Environmental Services (PES) for Smallholders

Smallholder PES 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 and FIP (see EA2).

The PES 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 PES will help smallholders shift away from 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.

[30] The project existed already (since 2012) when the ER-Program was developed and is referenced in the ER-PIN based on which the ER-Program was selected into the Carbon Fund pipeline.

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. Payments for conservation will also guaranty the success of smallholders' agricultural activities described in the Agriculture Pillar section.

Smallholder PES	
Incentives	• Collective to address illegal logging, artisanal mining. • Individual to help smallholders shift away from slash and burn agriculture
Program targets after 5 years	• 457,413 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

One of the main drivers in the ER-Program area is slash-and-burn agriculture, with a focus on cassava production. Under this system, the typical household occupies an area of about 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 rising and may continue if no sustainable solutions are found. In addition, palm oil production is expected to remain a driver of deforestation in already attributed concessions.

To address these two drivers, the strategy relies on a multidimential approach that takes into account local specificities including suitability of sites for agriculture activities, historical production practices, and value chain development potential.

Indeed, the strategy focuses on two main objectives:

(i) Reduce the impact of smallholders' agriculture on forest by adopting agroforestry systems[31] that will reduce the surface area of cultivation, increase substantially crop production and build resilience (both economic and climate change-related). A technical guide to implement these systems is currently under development and will be adopted jointly by the Government and implementation partners.
(ii) Reduce the impact of attributed industrial agriculture (palm oil).

These objectives will be met through: (i) training 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.

With a view to ensuring the environmental and economic sustainability of the activities, it is expected that smallholders would in almost all cases participate in a package of ER-Program activities, rather than just in a single one.

Mid-term vision and sustainability:

- 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 shade cocoa in degraded forests, (ii) sustainable subsistence farming and other livelihood activities, and (iii) outgrower oil palm in existing non-forest areas 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.
- 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.

Key activities

SA4. Smallholder shade cocoa in Community Development Zones

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.

[31] Complex agroforestry systems that consist of a resource management system, controlled by local populations where trees are associated with agricultural (or livestock) activity on the same plot so that the resulting ecosystem resembles that of a natural forest in terms of species richness, plant structure and aerial and root biomass.

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 presence of companies interested in reinvigorating the sector, such as CIB-OLAM, the development of the second national plan for the development of the cocoa sector of the Ministry of Agriculture for 2018-2022, 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, associated to other crops and in degraded forests. 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 aim of the program is to encourage rural communities to revive their interest in cocoa through climate-smart agroforestry systems as an alternative to slash-and-burn agriculture.

This climate-smart approach that applies both to cocoa and sustainable subsistence farming would include the following package of conditions and incentives to reduce the impact on the forest stock:

(i) **Limit interventions to degraded forest areas in community development zones.** A classification of different levels of degradation has been defined as follows:

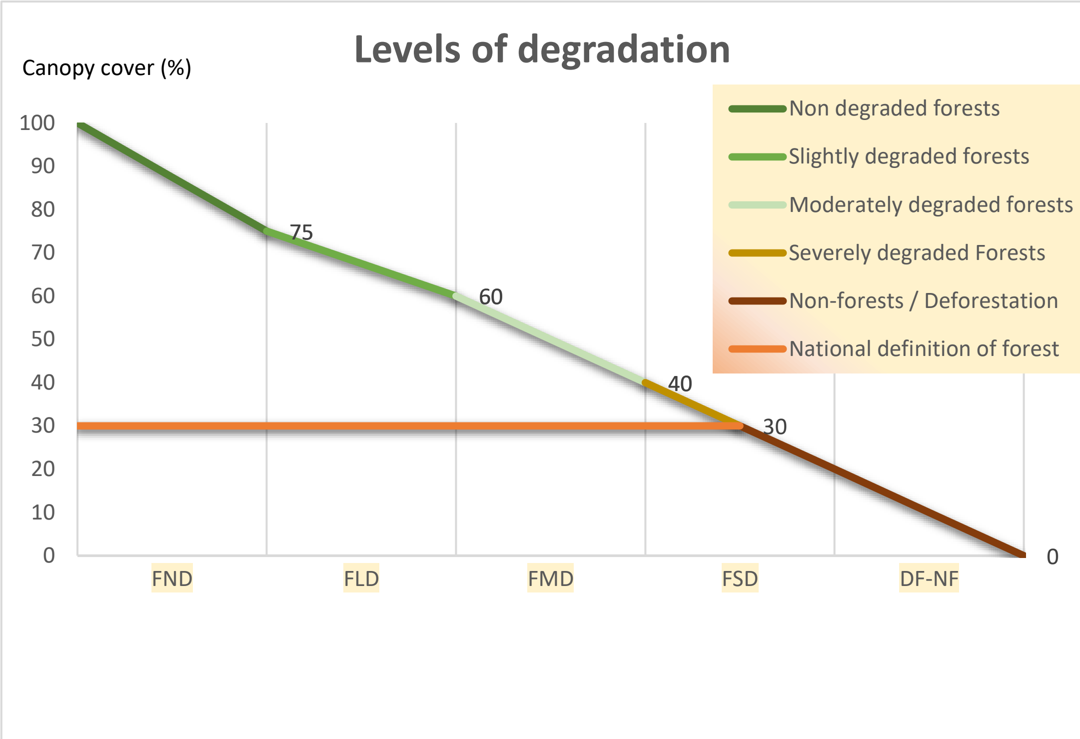


Figure 7 Levels of forest degradation

Agroforestry activities will only be implemented in the 0-60% canopy cover zones. Climate-smart cocoa agroforestry systems will be prioritized in the Moderately Degraded Forest category (40-60% degradation).

(ii) **Local land use planning**: Supported agroforestry activities would take place only in areas that have previously been designated as agricultural areas in the simlplified management plans are being / will be developed in a participatory manner in the CDZs (see EA2 below).

(iii) **Appropriate farm sizes.** The idea of the model is to reduce the 7-ha average surface area for shifting cultivation systems per household to a maximum of 5 ha in return for a package of incentives. On those 5 ha, farmers will choose the ratio between cocoa agroforestry system and sustainable cultivation of subsistence crops (see SA5 below). The adoption of perennial crops such as shade-grown cocoa is expected to boost and diversify household revenues, while support for subsistence crop cultivation is expected to improve food security. As an additional incentive for conservation of forest land, farmers and communities would enter into contracts for payments for environmental services (see SA3 above).

(iv) **Use of appropriate cultivation techniques**. A technical guide is being developed with a view to proposing cultivation techniques that seek to maximize both farmer incomes and carbon storage. The guide defines, among others, appropriate tree densities, types of plantation sites, plantation sites location classified by degree of degradation, etc. Farmers would receive technical support for implementing the promoted techniques.

Cocoa will be intercropped with other marketable crops, including banana, safoutier, 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 of the CDZs was conducted. The methods are described in the Box 3.

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 3. Preliminary Cacao Suitability Analysis

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 study has been funded by AFD.

Further study is also ongoing to analyse and map each type of levels of degradation categories (as shown in Figure 7) and confirm assumptions regarding related forest trees densities. This will help map and further define areas of degraded forest to implement the different agroforestry systems and readjust targets and technical arrangements if needed.

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 following the program's technical guidelines. These incentives will require monitoring of production practices to ensure that they have not caused deforestation.

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. Careful attention will be paid to the development and implementation of the appropriate technical support, field-based activities and monitoring to ensure that 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 fields.

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	• 3952 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, PDAC, AFD, FIP, GEF, FEDP, GCF)
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.

SA5. Sustainable subsistence farming and other livelihood activities

The ER-Program will implement sustainable subsistence agriculture activities through agroforestry systems that will bring both diversification and resilience and will boost LCIPs' revenues. This activity aims to ensure that, in addition to the cash crop of cocoa (and in non-forest areas, of oil palm), local communities can intensify and augment household food production while reducing the need to clear more land and harvest wood. This activity will primarily take place in the CDZs, on previously deforested or heavily degraded land.

Moreover, by increasing LCIPs' revenues, sustainable subsistence 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.

As a foundation for the implementation of sustainable agriculture and other livelihood activities, the ER-Program will build 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 to production. It will promote crop rotations within integrated agroforestry approaches, 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 hybrid germplasm, 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, peanuts, eggplant, fruits, honey and caterpillar, etc.) for both food, sale and fodder.

In addition to increasing the biomass in plantations sites through agroforestry models, both cocoa-based and food crop-based agroforestry systems are 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 production areas.

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	• 5156 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, FEDP)
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

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 industrial palm CDZs 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.[32]

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

[32] 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).

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	• 4070 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. 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. The Sembe agricultural macrozone has been identified in the Sangha Agriculture Sector Development Plan, but without a concessionaire to date. For these existing areas, the ER-Program promotes (i) commitments to minimize the conversion of forest area beyond what is required by law and identifying High Conservation Value (HCV) area, and/or (ii) adoption and certification under Roundtable for Sustainable Palm Oil (RSPO) standards. In parallel, options are under investigation in both the private and public sectors to avoid deforestation for new palm oil concessions (see Section 2.3).

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)[33] and Whitehead et al (2014)[34].

The ATAMA concession in Sangha (which entered the palm oil business in 2009) includes 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.

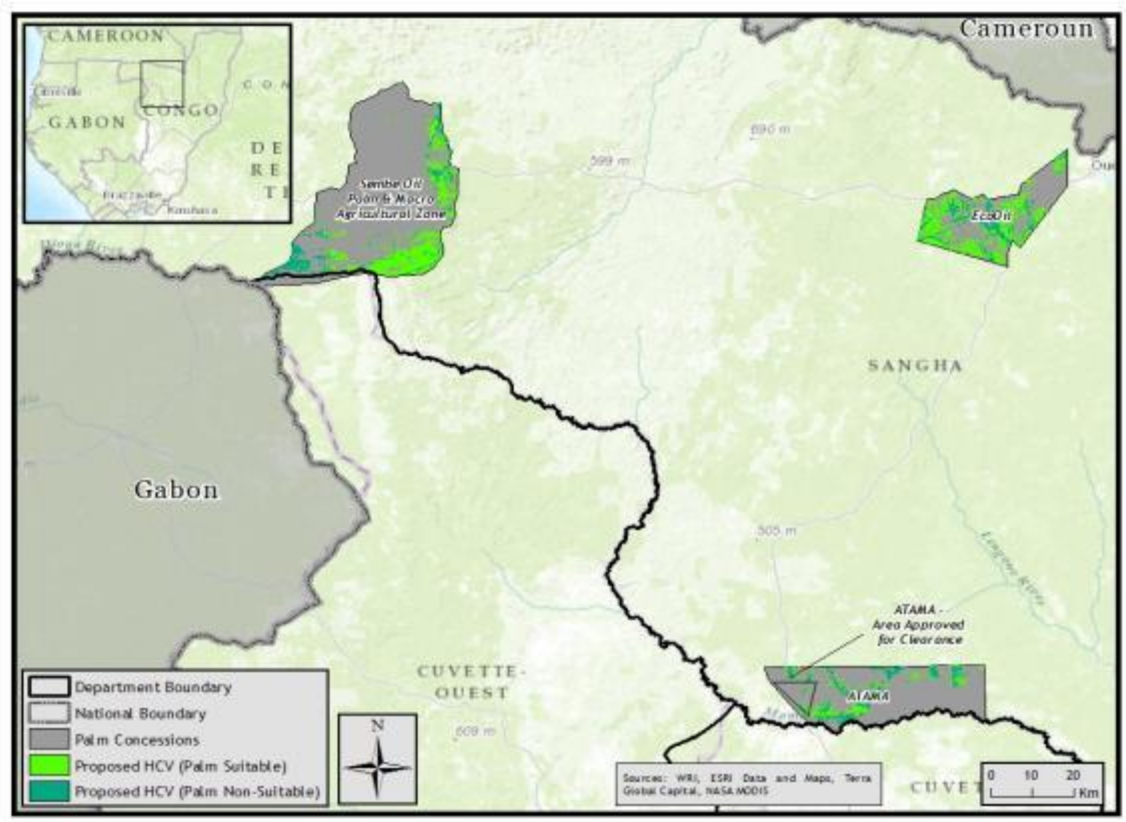


Figure 8. Map of Preliminary HCV Areas in Industrial Plantations

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.

[33] 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.

[34] 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.

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	• 101,706 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

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.

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

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 Land Use Planning intends to implement a national land use plan (PNAT), based on principles set out in the National Land Use Planning Scheme (*Schéma national d'Aménagement du territoire,* SNAT). The ER-Program would support the development of these through CAFI funding (to be mobilized) to allow for the optimization of land allocation decisions. The ongoing investment planning process for the National REDD+ Strategy, conducted with support from FIP and CAFI, is outlining the necessary activities to roll out land use planning at a national scale, with the potential to focus on the ER-Program accounting area at the outset.

Law 43-2014 for the "orientation and development of the territory" lays the basis for this activity. Based on a roadmap developped with support from the World Bank and the World Resources Institute[35], the government is planning to implement multi-sector land use planning by strengthening institutions, spatial data and analytical maps, improving the legal framework, and completing the SNAT. The latter process will receive strategic direction and policy guidance from a National Council on Land Use Planning and Development, placed under the authority of the president. This body is the supreme decision-making authority on land use planning. Land use conflicts will be mediated by the Interministerial Committee on Land Use Planning and Development, which makes recommendations to the Council. It will be placed under the leadership of the Prime Minister. Departmental and/or municipal commissions will ensure local coordination. Law 43-2014 prescribes a mandatory consultative process at all levels of this planning process, thus aiding transparency and public participation in decision-making.

National Land-use planning	
Key results in 5 years	• Draft PNAT/SNAT available • Multi-sectoral coordination functional
Potential Implementing Partners	• Ministry of Planning (MINAT) • WRI

[35] Strengthening Land Use Planning in the Republic of Congo: Assessment, Proposed Roadmap, and Draft Implementation Plan. The World Bank. June 2016.

	• CAFI
Direct Beneficiaries	• Communities • Private Sector • Government
Links to national strategy	• Policy Option 1: Governance strengthening

EA2. Local Land-use Planning

In parallel, the program will support participatory local land use planning to define how to allocate land (in CDZs or elsewhere), optimize resource allocation, reduce the potential for conflict, and identify options for minimizing damage to the forest stock at the local level.

Through the FEDP and AFD, local sustainable management development plans are currently being developed in several CDZs. 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 LCIPs 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 • FIP • AFD
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[36]. To strengthen the ability of local communities to implement their Simple Management Plans, enable them to better promote the socio-economic interests of the populations they serve, and to support the priority investments the program will carry out, the program, through GEF funding, will reinforce local governance, and enhance local capacity

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

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 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[37]. The FEDP is supporting the development of application texts and the new code should be validated in early 2018. In addition, in preparation for the ER-Program, CN-REDD is currently developing a manual of standard operating procedures for RIL to serve as a standard. An advanced draft is available. This will draw on many of the certification requirements, but will capture local circumstances.

The IDA "Integrated Public Sector Reform Project" will provide capacity building of the CODEPA-REDD in Sangha and Likouala to better allow them to coordinate policy at the local level, and supervise the execution of the ER-Program. To improve the ability of the Departmental Forest Economy Directorates of Sangha and Likouala and their forest brigades to oversee artisanal and commercial logging operations, the project will also support capacity building and provision of equipment, training, and communications for these dezentralized governmental agencies.

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+. 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 MEF 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.

[37] 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 • OI-FLEGT • EU, AFD (DFID), FAO • WB Integrated Public Sector Reform Project
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[38] 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 MEF 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

[38] Through upfront GEF-6 funding

Links to national strategy	• Policy Option 2: Sustainable management of forest resources

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.).

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

- 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 National 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 • TFA
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 the final document is available. Discussions between the Government and implementation partners is currently underway to help the Governement formulate 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 as 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 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[39]. 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.

Mid-term vision and sustainability:

- 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.

[39] Ministry of Mines and Geology, 2011.

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.

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+.[40] The report accompanying the Strategic Environmental and Social Evaluation (SESA) describes the land tenure situation as "complex".[41] 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[42] 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*[43]), forestry holdings (*Code forestier*[44]), agriculture, mining, and planning law.

[40] 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;

[41] 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).

[42] Adopted on 25 October 2015.

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

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

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.

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.[45] 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

[45] 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.

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[46] (i.e. ownership of the state) rather than the Forest Code, and they are given out by Presidential Decree (with the 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.[47] This guarantees that at all times customary rights of local communities and indigenous peoples be respected. Note that community development areas are an essential manifestation of customary rights, but not the only one. Customary hunting rights, for instance, extend far beyond the boundaries of community development areas and often cover large areas of production forest areas within a concession.

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 2017 ("FC 2017", 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 2017), 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 2017). 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 2017). Article 71 FC 2017 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 2017) 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

[46]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.

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

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[48], a statute for which the Republic of Congo has been much commended for 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 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 17 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). 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.[49] For community development areas, customary rights are explicitly recognized. Note that with the adoption of the new Forest Code (FC 2017), 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 2017).

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

[48] Loi No 5-2011 du 25 February 2011 portant promotion et protection des droits des populations autochtones.
[49] For now, only 10 UFAs have approved management plans in place (see above, chapter 4.1).

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

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).[50]

Applying general principles of the laws of the Republic of Congo, one needs to distinguish (i) the right to emission reductions (including the right to transfer) as contractual *obligatio*,; (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 and to Their Transfer (obligatio)

The right to define an emission reduction obligation – 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 – and the right to transfer carbon emissions – i.e. to create a claim for the purchaser that these acts be implemented, that the registry units be transferred, and that the purchaser be recognized as the sole legal assignee – have their 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*).[51] 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. It is for the Congolese government, then, to secure implementation of the contractual obligation, including implementation of the exclusivity guarantee, i.e. the

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

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

guarantee that it will not create, sell or transfer carbon units issued for the REDD+ activities in question and that it will not allow others to do so, except where so explicitly permitted under the terms of the ER-PA.

Right to Emission Reductions (ius in rem)

A right *in rem ("droit réel")* 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[52]). A *numerus clausus* of rights, i.e. a limited class of expressly defined property/ servitude ("droits réels) rights, applies, as per the Republic of the Congo's civil law, namely:[53]

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

Carbon-related rights or benefits are not listed, and none of the recognized types seems to fit the conceptual understanding either. It is noted, in this context, that the recognized types of rights discussed in this section 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**. A right to an "emission reduction" or a "carbon right", however, as it is discussed in REDD+ settings around the globe,[54] does not give rise to a certain form of use and it does not represent an inherent claim to an object (land). if anything, such rights are generated through an activity, i.e. they are the *result of an effort* and an achievement that itself is not inherent in a particular piece of land or a tree. The result may be sequestration gains through the reforestation of a particular stretch of land or – further removed from particular lots of land – the emission reduction gains through the introduction of certain policy measures with an impact on country- or jurisdiction-wide deforestation. These gains and achievements themselves can be recognized under law, as they are under Congolese law, but this is once more the law of obligations (see below), not property law.

This said, a legislator remains free to define "carbon rights" as a *right sui generis* that may, for instance, give the title holder the right to include or exclude a particular piece of land in a

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

[53] 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).

[54] Cf. Streck, C. / von Unger, M., Creating, Regulating and Allocating Rights to Offset and Pollute: Carbon Rights in Practice, Carbon & Climate Law Review 2016, 1782

REDD+ program and/or that may translate into a security interest in the carbon proceeds) or as a new form of forest product (*fructus industriales*). Yet, these would be fresh categories of property law that require the legislator to become active (for the intentions of the Congolese legislator with respect to FC 2017 see below). In the absence of legislative creation, the law as it is 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 2017). These rights are guaranteed by law – including by the Republic of the Congo's land law[55] and notably by the Law on the Promotion and Protection of Indigenous Populations[56] (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 compensation*.

Also, the laws of the Republic of the Congo recognize 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 2017

Under the revised Forest Code (for formal adoption in 2017), 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 2017). The revised code includes provisions on both "carbon credits" and "carbon rights".

The law is mostly concerned with the former. Any person, whether a natural person or a legal

---

[55] 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."
[56] Loi No 5-2011 du 25 February 2011 portant promotion et protection des droits des populations autochtones.

entity, may "generate carbon credits", it being understood that any carbon crediting action requires the authorization of the Ministry of Forestry (Article 179.2 FC 2017). A delegated instrument will set out the process for the recognition as project proponent (*ibidem*). In principle, any natural person or legal entity, including local communities and indigenous peoples (Art. 180.4 FC 2017), may operate a REDD+ project, when specifically authorized. The State generates carbon credits by default – under the authority of the Ministry of Forestry – for both the Permanent Forest Estate and the Non-Permanent Forest Estate (Art. 179.2 FC 2017).

The new law recognizes three[57] distinct carbon credit allocations: *First*, where the State undertakes the crediting action in its own right and on State forest land, then the State holds all carbon credits (Art. 180.1 FC 2017). The same applies, in theory, to the forests which are transferred to the local government level ("*forêts des collectivités locales*"). Carbon credits generated within these forests are allocated to the respective communities. However, as under the Forest Code of 2000, the transfer of forest land into local government control requires a formal act, namely an independent decree of the Council of Ministers (Article 24 FC 2017). To date, no such decree has been adopted and none is immediately planned.

Second, where the Ministry of Forestry authorizes a third party (an individual or a private entity) to undertake a carbon project as its proponent, then this proponent assumes the right to the carbon credits as co-owner (Article 180.2 FC 2017).

Third, a specific carbon credit allocation is made in the case that the Ministry authorizes a REDD+ project in an area that includes "communal forests" ("*forêts communautaires*"). As explained above, communal forests are different from the forests transferred to the local government ("*forêts des collectivités locales*"). They are to be established as part of the community development series under a concession (Article 28 FC 2017), and they will be immediately eligible for the status as "communal forests". The new Article 180.4 FC 2017 states that, in the case a project includes a communal forest, the carbon credits generated will be owned either exclusively by the communities, including indigenous populations, in question – this is the case when the communities are the proponents of the REDD+ project – or jointly by the communities, including indigenous populations, and a third-party proponent.

For all practical purposes, at present only the first allocation – carbon credits are owned by the State, if the State operates the REDD+ program – is of consequence. It is currently not intended by the government to authorize REDD+ projects outside the program (see further chapter 18).

However, the new Forestry Code does not just make an allocation of "carbon credits", it also establishes the concept of "carbon rights", and it allocates them to the holders of customary rights:

> *"[180.3 FC 2017] … Nonethess, the holders of customary rights and of rights of usage are considered beneficiaries of carbon rights."*[58]

The revised code does not provide a definition of either "carbon credits" or "carbon rights".

[57] If plantations and REDD+ activities in private forests were included, one would distinguish five different allocations, see Article 182 and Article 183 FC 2017. Since both categories play no role for the program, they are excluded from the analysis.

[58] "Toutefois, les titulaires des droits coutumiers et des droits d'usage sont bénéficiares des droits carbone."

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 an a priori claim to the commodified product (the carbon credits). Rather, a priori, direct and primary access to credits is restricted to the following persons and entities: (i) public actors (the State and other public owners); (ii) communities and indigenous peoples, subject to their formal allocation of communal or community forests; private forest owners; and specifically, authorized REDDD+ project proponents.

The concept of "carbon rights", in this context, serves more as legal guarantee: The beneficiaries hold a secure claim to REDD+ participation and revenue sharing, independent of whether they have been formally allocated communal or community forests in accordance with the respective rules and independent of the status and the specific details of an UFA management plan or the concession terms.

Administrative carbon generation permits and other agreements (public law)

Once an executive regulation under Article 179.2 FC 2017 (project authorization) is adopted, an individual carbon title (the title to the carbon credits) 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 11 out of 17 UFAs present in the Accounting Area have management plans. This means that for seven (7) UFAs the clear allocation of agroforestry usage zones is outstanding, to the effect that certain tenure holdings of local communities (*Séries de Développement Communautaires*) are not secured (others remain unaffected however, in particular hunting rights which extend beyond the community development sites, see also above) and protection areas (*Séries de Protection*) not recognized.

Response by the ER-Program: For all the UFAs, the development and adoption of concise land management plans is under way. While the completion of this work may still take time, the Program will guide the way and anticipate a number of core planning elements, including concerning the designation of protection and regeneration zones, sustainable cocoa plantations, and other usage zones. The local communities and indigenous peoples, spread across roughly 2,000 villages (total of the Accounting Area), will be specifically engaged and be given the opportunity to shape their role in, and contribution to, the ER-Program. While participation is voluntary, it is estimated that all stakeholders will join the effort, to be integrated in the ER-Program. It is targeted, in particular, that for all 17 UFAs the ER-Program will establish core communal usage zones, which are expected to serve as blueprint areas for management plans that are yet to be written. In this sense, the ER-Program will ascertain and further the land tenure positions in all UFAs.

The adoption of FC 2017 will render additional support to the recognition of customary rights independent from the formal adoption of management plans and, consequently, to the implementation of the ER-Program. The new forestry code includes considerations of process by, e.g., subjecting the elaboration of UFA management plans to participatory management principles (Art. 91 FC 2017) and by including local communities and indigenous peoples in all decisions on demarcations of community development areas (art. 93 FC 2017). The local communities and indigenous peoples are also involved in the negotiation of the specific concession side terms ("cahier de charges particulier"), which addresses obligations from the management plan and foresees specific contributions of the concessionary including with respect to a local development fund, and they must give their approval (art. 135 FC 2017).

- 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.[59] 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 2017, 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[60] 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 ER-Program will clearly define rules of usage and exploitation for all areas included. 'Zones banales' will not be recognized within the ER-Program and by its stakeholders. The ER-Program also aims at creating a level-playing field for different land-users including concessionaries, local communities, and indigenous peoples. This anticipates the participatory approach FC 2017 is to establish (see response before).

[59] 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.

[60] 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).

- 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.[61] A detailed and concrete PNAT/SNAT – with clear strategic orientation for the different economic sectors, comprehensive zoning and the 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 four interministerial consultation committee[62] in 2017 to address instances of overlapping usages of ecosystems and – even before, in 2006 – the adoption of a process to settle customary law conflicts[63] 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.

---

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

[62] Décret n° 2017-226 fi xant la composition, l'organisation et le fonctionnement du conseil national d'aménagement et de développement du territoire.
Décret n° 2017-227 fi xant la composition, l'organisation et le fonctionnement du comité interministériel d'aménagement et de développement du territoire
Décret n° 2017-228 fi xant la composition, l'organisation et le fonctionnement de la commission départementale d'aménagement du territoire.
Décret n° 2017-229 fi xant la composition, l'organisation et le fonctionnement de la commission municipale d'aménagement du territoire.

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

CONA-REDD will guide the design of the ER-Program and facilitate its implementation. It is vital, in any case, that the ER-Program will respond directly to comprehensive and inclusive planning needs and that it foresees 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 originally by the ER-Program should follow meticulously all agreed safeguards.

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 will 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 2017). 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 3. List of environment-related conventions and agreements.

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 Indigenous People of 2011		• Guarantees the right of Indigenous Peoples to be consulted before consideration 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);	• Indigenous Peoples present in the Accounting Area need to be fully 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

Statutory basis	Relevant Implementing Acts	Land Tenure Relevance	Relevance for the ER-Program / the Accounting Area
			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.; • 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;	• 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 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;	• Main legislative framework to define land tenure within the Accounting Area;
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[64]	• 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;

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

Statutory basis	Relevant Implementing Acts	Land Tenure Relevance	Relevance for the ER-Program / the Accounting Area
Regulation REDD+ Institutional Design 2015[65]	• 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 Protection 1991[66], the Elephant Protection Act 1991[67], and the Law on Wildlife and Protected Areas 2008[68]		• Lays down the need for an environmental impact assessment for all development projects; • Provides specific protection status for species and designated protection areas;	• Will facilitate REDD+ implementation;

*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

[65] 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.

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

[67] Act No 114 of 24 June 1991.

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

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.[69]

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 2017), ready for adoption. The FC 2017, in particular, puts in practice real guarantees of customary usage (direct and indirect guarantees) and participation (including in REDD+ benefits.

4.6 Expected lifetime of the proposed ER-Program

The program will start implementation in 2018 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 (2018 – 2023) The financial calculation, presented in ANNEX 1. Summary of financial plan, has been designed for 10 years.

[69] 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”.

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 CONA-REDD 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. A second marketing mission took place in late November 2016 to discuss preliminary business models. Following this mission, companies signed letters of interest to participate to the ER-Program (cf. Annex. 2).

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 community development zones developped 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 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
Consultations on land and resource tenure	Local government, LCIPs	April–June 2016	Confirm findings of preliminary land and resource tenure assessment
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

Stage	Target group	Dates	Objectives and comments
Marketing of the ER-Program	Potential participants	November 2016 – March 2017	Specification of concrete commitments by program partners
Consultations on GRM	LCIPs, Private sector, local authorities	March 2017	Gather comments from stakeholders and confirm GRM's proposal
Consultations on SESA tailored to the ER-Program Area	All stakeholders	May 2017	Confirm safeguards' arrangements
Consultations on RIL manual	Private sector, government, LCIPs	April-December 2017	Confirm RIL requirements are relevant to the context and realistic
Consultation on PCIV-REDD+ tailored to ER-P	LCIPs, Private sector, local authorities	August 2017	Get feedback from stakeholders and confirm PCIV REDD.
PCIV (tailored to ER-P) validation workshop	All stakeholders	August 2017	Validate final modifications of PCIV-REDD
GRM validation workshop	All stakeholders	December 2017	Validate final modifications of GRM

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	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 2018	
	CONA-REDD special session on benefit sharing	CONA-REDD members and experts on Benefit sharing from CN-REDD and technical panel	Spring 2018	
Implement relevant tools	Consultation on SIS and non-carbon benefits monitoring	LCIPs, Private Sector, Local authorities	February-March 2018	Adaptation of SIS to ER-P
	Consultations on benefits sharing plan	All stakeholders	April–December 2018	Refine benefit sharing plan
	Validation of RIL manual	All stakeholders	April 2018	Validate final modifications emerging from field verification mission
Ensure program	Marketing of the ER-Program	Potential participants	Continuous	Specification of concrete

Stage		Target group	Dates	Objectives and comments
success thanks to strong engagement				commitments by program partners
	High-level dialogue	Government, CONA-REDD	Continuous	Affirm political commitment to the success of ER-Program

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 2018). 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.

Annex 4 summarizes the consultations to be held during ER-Program implementation, and Annex 5 summarizes those held during the preparation of the ER-Program.

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.

.

6 OPERATIONAL AND FINANCIAL PLANNING

6.1 Institutional and Implementation Arrangements

Strategy for Capacity Building

The institutional arrangements for the ER-Program are in line with the country's national REDD+ infrastructure established in the REDD+ readiness phase. As the country moves from the readiness to the implementation and results-based payments phase, the country's priority is to maintain a simple and cost-effective, yet robust infrastructure.

Main features of the ER-Program's institutional design are the following:

- The ER-Program is fully embedded into the national REDD+ process and institutional architecture;
- With the support of the World Bank, the ER-Program has been developed in a programmatic approach that coordinates various finance sources to avoid duplication of structures, functions and activities (see Chapter 6.2);
- The ER-Program will involve an external service provider to minimize fiduciary risks and help build robust implementation structures;
- Capacity building of ER-Program stakeholders is integral part of ER-Program implementation, in particular through the investment projects of the World Bank and other partners.

More specifically, the ER-Program's strategy to build capacities over time includes the following elements:

- The IDA "Integrated Public Sector Reform Project" has reserved US$ 1.5 million to:
    - Build the capacity of of the CODEPA-REDDs in the departments of Sangha and Likouala. This support, available as of early 2018, will include the following:
        - Training of CODEPA members on:
            - the ER-Program and their role in its governance;
            - ER-Program monitoring, including on benefit-sharing, safeguards, and strengthening of MRV understanding;
            - Stakeholder relations, consultation and communication techniques;
            - Functioning of and CODEPA role in the Grievance Redress Mechanism.
        - Institutional support and development of an operations manual;
        - Support for the implementation of the consultation plan, including:
            - Monthly working groups on each of the six ER-Program pillars;
            - Field missions for information and consultation;

        - Support for communications;
    - Regular meeting of the CODEPAs, including to collaborate with the program management unit to develop annual implementation plans, budgets, and to facilitate the PMU's logistics;
    - Participation in the implementation of the benefit sharing plan (BSP), including:
        - Participation in the permanent BSP platforms to avoid complaints;
        - Regular liaison with decentralized focal points;
        - Participation in mediation missions, etc.
    - Support for monitoring safeguards, including meetings, field missions, etc.
    - Support for CODEPA participation in the update of departmental sectoral development plans to improve policy coherence and include REDD+ in planning;
    - Office equipement for the CODEPAs;
  - The possibility of supporting an Independent REDD+ Observer is being evaluated. Build the capacity of the Departmental Forest Economy Directorates (DDEFs), of Sangha and Likouala and their forest brigades to boost oversight of artisanal and commercial logging operations, with benefits for both tax revenue generation and REDD+ implementation, and to prevent incursion of outside actors into CDZ:
    - Training on the ER-program and the role of the DDEFs and their brigades in its implementation;
    - Training and support for the application and control of the Reduced Impact Logging Manual;
    - Support for control missions, including with designated civil society and local community observers;
    - Support for communications with the Ministery of Forest Economy.

- The World Bank will further assess opportunities throughout its portfolio to build capacities in support of the ER-Program in the context of the development of the Country Partnership Framework (CPF);
- The French Development Agency is planning a project to support Sustainable Forest Management in the ER-Program area, which will also include support to the capacity development of relevant government institutions;
- Capacity building for REDD+ implementation also is a key part of the National REDD+ Strategy and its Investment Plan, which will be used for further fundraising.
- It will be among the tasks of the PME to support the departmental governments and build capacities over time.

Figure 9 provides an overview of the ER-Program's institutional arrangements, which are described in more detail in the subsequent sections.

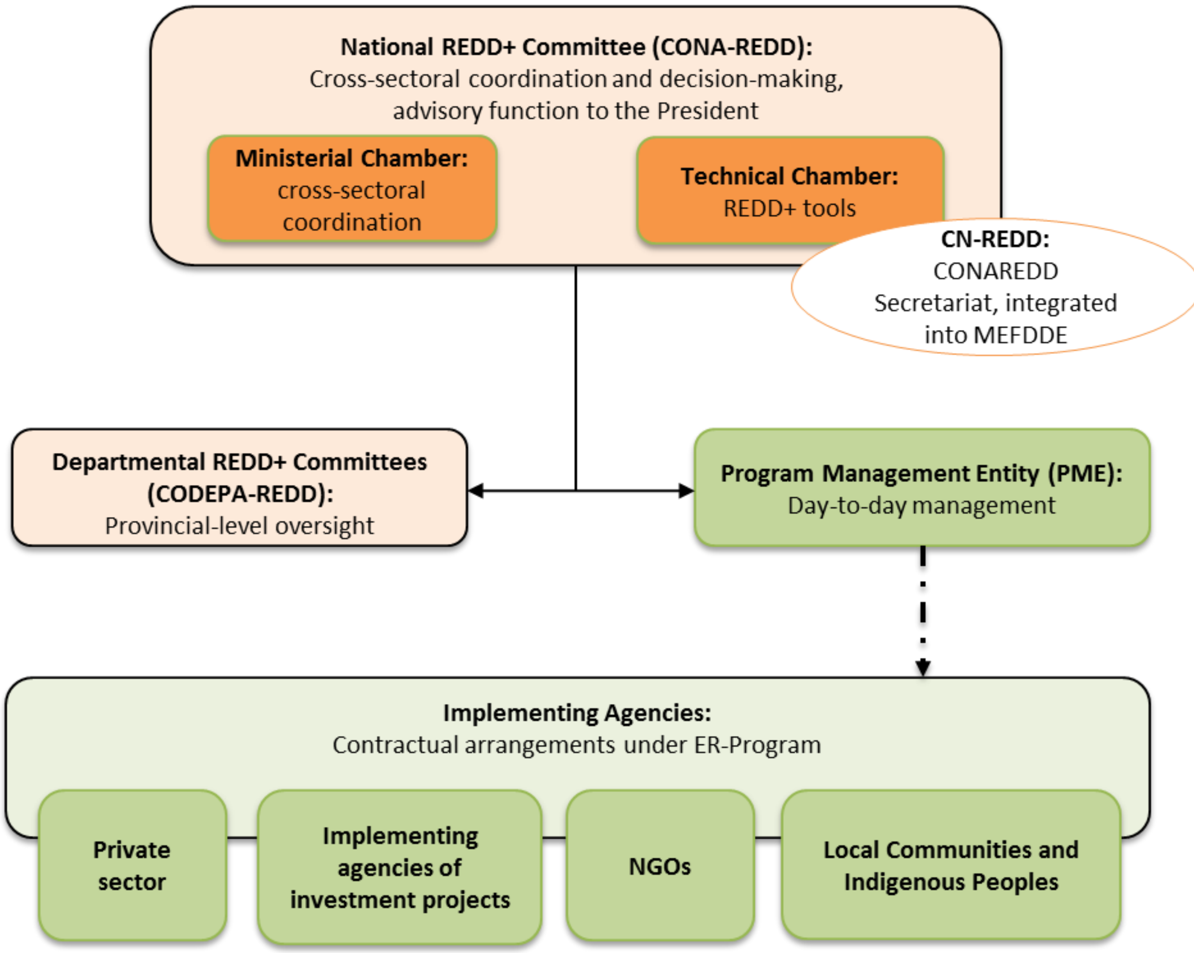


Figure 9: Institutional arrangements of the ER-Program

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 Program Management Entity, to administer and manage the ER-Program. The overall responsibility for REDD+ development in the country falls under MEF (Decree 1155/2012), supported by the Prime Ministry where interministerial coordination requires it. The Ministry of Finance may designate the MEF 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 is in the process of being restructured to ensure high-level inter-sectoral dialogue through a Ministerial Chamber on the other. 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 including agriculture, forestry, mining, planning and finance;
- Mediate potential conflicts if elevated up to national level;
- Assume oversight of the ER-Program.

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

- Approve the annual implementation plans and budgets prepared by the PME;
- Assess and review monitoring reports from PME.

The CN-REDD is an operational unit under MEFresponsible 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:

- Operationalize REDD+ tools, such as REDD registry, FGRM, safeguards monitoring;
- 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 PME (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 a small CN-REDD composed of key technical experts could be maintained as integrated unit of MEF to assist the CONA-REDD technical chamber regarding the operationalization of REDD+ tools.

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 FLEGT. 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

At the departmental level, CONA-REDD is mirrored by **CODEPA-REDD in Sangha and Likouala**. 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 PME 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 PME in the departments;
- Facilitating implementation at departmental level of decisions made by CONA-REDD;
- Support the implementation of the stakeholder engagement plan.

Program management at an operational level will include aspects of *operations* (e.g. purchases of material, training, stakeholder engagement, marketing of the program), *contract management and compliance* (e.g. 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*.

On the day-to-day basis, the ER-Program will be managed and administered by a ProgramManagement Entity (PME). The PME's role 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 one or two decentralized offices (probably in Ouesso and Impfondo). The PME 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, PME governance and oversight issues, including with respect to the annual implementation plans and budgets as well as monitoring plans. While the PME will report to CONA-REDD (ex ante and ex post), it shall be given a broad mandate and a high degree of autonomy when pursuing its activities. The PME's mandate will bundle aspects of operations, contract management and compliance, monitoring, audit and follow-up, as well as fund management.

Where necessary, the ER-Program will use contractual agreements with participating stakeholders to define roles, responsibilities, activities, budget and benefit sharing arrangements. The agreements will be developed, as needed, by the PME in accordance with the ER-PD, implementation plans, budgets and benefit sharing plan. 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.

In summary, the PME will be responsible to:

- Manage 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;
- 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.

CNIAF will be responsible for the following tasks:

- Provide technical support to the ER-Program on MRV;
- Ensure consistency of methods and techniques for reference level and MRV between national and the ER-Program level;
- Coordinate/leverage acquisition of remote and field based data required for monitoring.

Implementation Arrangements

Besides the institutions mentioned above, the private sector, NGOs as well as LCIPs play an important role in implementing ER-program activities, be it through investment projects or directly by co-financing activities.

Companies manage over 60% of the total ER-Program Area. Their specific roles are summarized in Table 14.

Table 14. 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, mostly financed through investment projects**. In particular, the management of protected areas in the ER-Program Area is outsourced to international NGOs on a contractual basis with MEF. In addition, NGOs can play a role in promoting other ER-Program activities.

Table 15. 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, mainly with the support of investment projects, related to improved management of the forest concession's non-production areas, protected areas and unattributed in the ER-Program Area. Their specific roles include:

- 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:[70]

(i) Secured or committed investment programs that will target ER-Program activities, including GEF (World Bank / UNDP), IDA, 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 strategically coordinated in a programmatic approach to complement each other, fund different types of activities, or scale up tested practices. More specifically, the programmatic approach supported by the World Bank combines the following forest and climate trust funds as well as IDA projects in support of the ER-Program:

Table 16: World Bank-supported programmatic approach for the ER-Program

Readiness at national level	Investment Package for the ER-Program	Results-based payments for the ER-Program
FCPF Readiness Fund: US$ 8.8 million (at national level but lays groundwork for the program)	Forest Investment Program (FIP): US$ 24 million, approximately US$ 16 million of will directly support ER-Program activities	FCPF Carbon Fund: Letter of Intent signed between World Bank and RoC for purchase of 11.7 million tons CO_2e
	Dedicated Grant Mechanism for Indigenous Peoples (DGM): US$ 4.5 million, a portion of which will go directly to ER-Program area	
	Global Environment Facility (GEF): US$ 6.5 million, US$ 5.08 million of which will directly support ER-Program activities	
	International Development Assiatance (IDA): Commercial Agriculture Project (US$ 100 million), a portion of which will support ER-Program activities, and Integrated Public Sector Reform Project, US$ 1.5 million of which will go to ER-Program activities	

As regards the FIP, the government committed in its expression of interest 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

[70] For details, please refer to ANNEX 6. Complementary programs

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) 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 MEF'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.

A new project financed by the GEF will be administered as additional finance to the FEDP and further support agroforestry on degraded land in the accounting area. It will also establish a management structure for Ntokou-Pikounda National Park.

In addition, the programmatic approach entails the World Bank's integrated approach with investments in other sectors to design its overall portfolio in an environmentally friendly way in general and to promote the successful implementation of the ER-Program in particular. The World Bank's engagement on the REDD+ agenda extends beyond the forest sector to other pillars of the national REDD+ strategy, e.g., agriculture and public administration. The SCD/CPF process will analyze the linkages in more detail and further foster cross-sectoral alignment. The following projects of the World Bank portfolio in RoC are related to sucessful REDD+ implementation:

- ✓ Governance: Integrated Public Sector Reform Project, which supports capacity building at departmental levels in the ER-Program area;
- ✓ Agriculture: Commercial Agriculture Project, which supports the intensification and commercialization of crop production, the development of agro-industrial activities and capacity-building of public, private and NGO actors providing technical assistance to commercial agriculture including the provision of key inputs for the cocoa value chain.

In addition, the French Development Agency (AFD) is preparing a project that will support the cocoa sector and sustainable forest management in the accounting area.

With support from the European Union, RoC 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.

A preliminary summary of the estimated finance sources is provided in Table 17.

Table 17. 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	16.00
	FIP DGM	4.50
	VPA-FLEGT	5.02
	DFID	6.17
	AFD	13.81
	WB IDA (Integrated Public Sector Reform Project)	1.50
To be mobilized	CAFI	8.00
	WB IDA (Commercial Agriculture Project)	tbc
Private investments (expressions of interest)	Companies and investors	29.54
Total		**92.63**

Out of the estimated budget of USD 92.63 million from the finance sources listed in Table 17. Summary of the estimated finance sources of the ER-Program (excluding carbon revenues), the following ER-Program activities will be supported:

Table 18. Financing of ER-Program activities

	ER-Program Activities	Total funding allocation (in million USD)
Sectorial activities	Reduced Impact Logging (RIL)	17.82
	Logged to Protected Forest (LtPF)	0.58
	Reduction of Forest Conversion from Industrial Palm (HCVPalm)	1.14
	Smallholder shade cocoa in Community Development Zones (SH Cocoa)	15.01
	Palm Outgrower Schemes in Community Development Zones (SH Palm)	4.00
	Sustainable agriculture and others livelihoods activities (SH SustainAgr)	15.34
	Smallholder PES	2.00
Enabling activities	Biodiversity and protected area management	6.55
	Community level governance	3.84
	Land-use planning	8.00
	Forest sector governance	15.36
	Support for developing a sustainable cocoa production	2.00
	Support for developing a sustainable palm oil production	1.00
	TOTAL	92.63

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 activity, funding sources and benefit sharing assumptions as discussed in Chapter 15. The finance plan foresees MRV three times (2019, 2021 and 2023) 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.

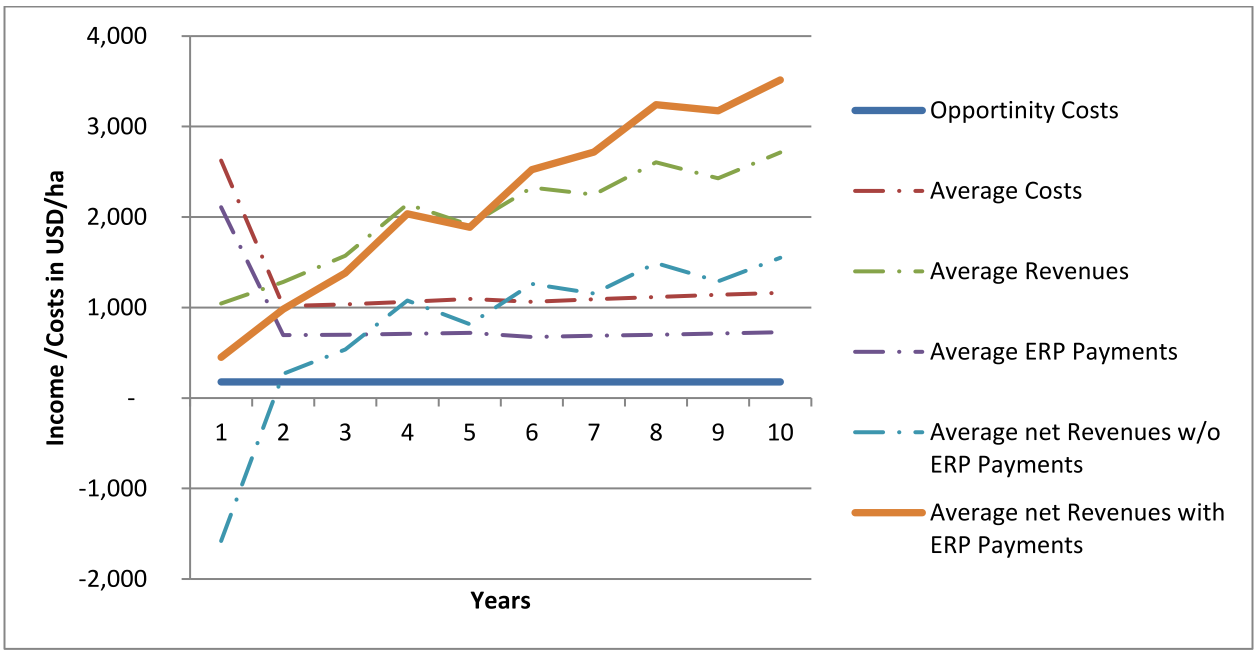


Figure 10. Results demonstrating that the potential revenues including the ER-Program payments/investments result in income which exceeds the revenues from shifting cultivation.

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 19. 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.
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).
Removals from enhancement of carbon stocks	**No**	**In line with the terminology used in the national Reference Emission Level / Forest Reference Level submitted to the UNFCCC**, removals from enhancement of carbon forest 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.
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.

7.2 Description of Carbon Pools and Greenhouse Gases Selected

Table 20. 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**	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 deadwood 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.
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

Table 21. 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 31), 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 31), so GHG emissions from forestland remaining forestland is expected to be very low.

[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

[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 two years before the TAP starts the independent assessment of the draft ER-Program Document and 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 31st December 2014. The start-date for the Reference Period is about 10 years before the end-date. The program reference period is set between 2005-2014.

Since Activity Data is available for the periods 2003-2012 and 2013-2016, the 'Guidance on the use of interpolation of data in relation to the Reference Period of an ER-Program' will be used in this case.

8.2 Forest Definition Used in the Construction of the Reference Level

Forest definition and definition of forest types

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 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, and it excludes palms.

Table 22. 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

Although the national FREL does not distinguish between different forest types, the ER-program distinguishes between two forest types as they present different carbon contents and this will allow to be able to monitor GHG emissions from potential peatland conversion in the future: ‘Terra firma’ forest and Wetland/Swamp forest.

Table 23. Description of LULC Types with the ER-Program Area

LULC Type	Definition
‘Terra Firma’ Forest	This category consists of all forests including old growth terra firma forest, semi-deciduous forests, open natural forests, disturbed, secondary forests in the ER-Program area. These also include agroforestry systems which are classified as degraded forests.
Wetland/Swamp Forests	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 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. This class includes also disturbed wetland/swamp forests.
Non-forests	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. 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

Box: Cocoa plantations

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.

If a forest is converted to a cocoa plantation it will be detected through the monitoring system.

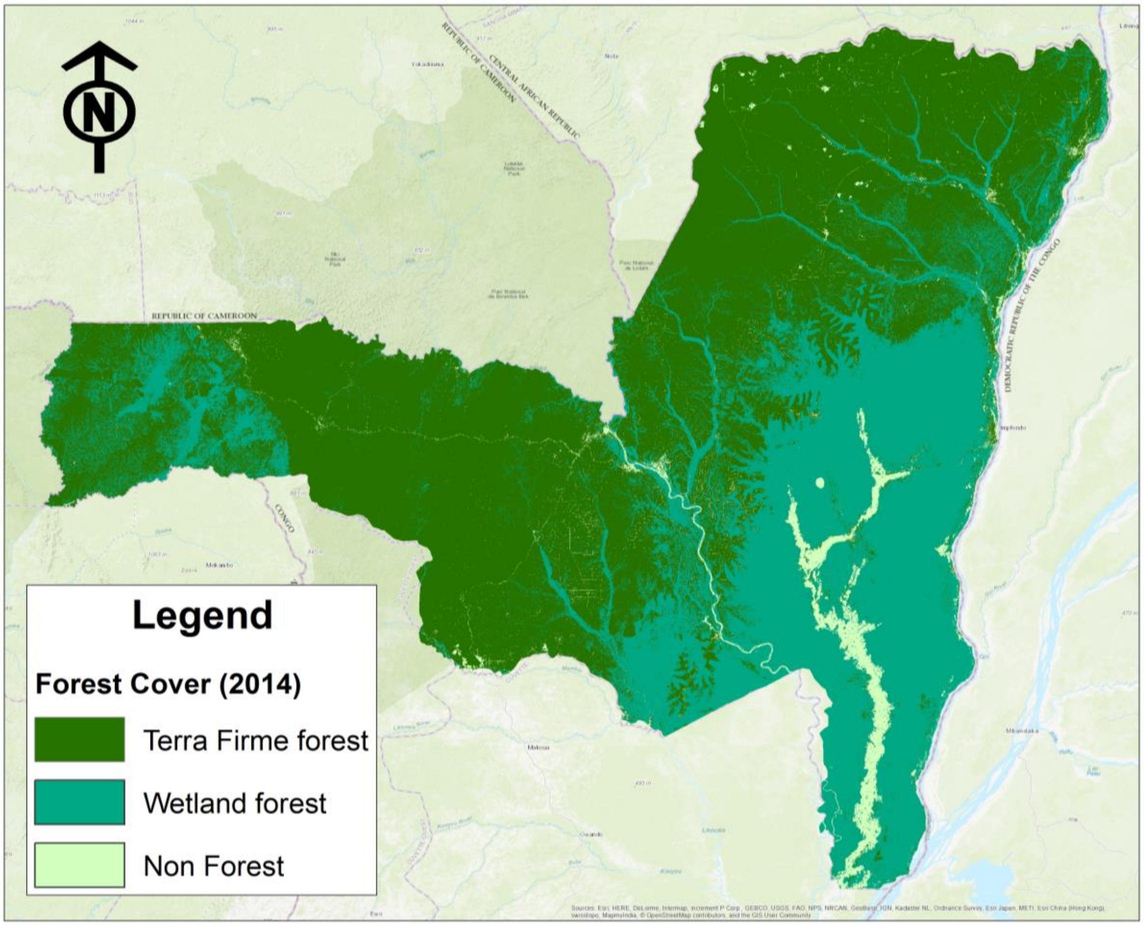


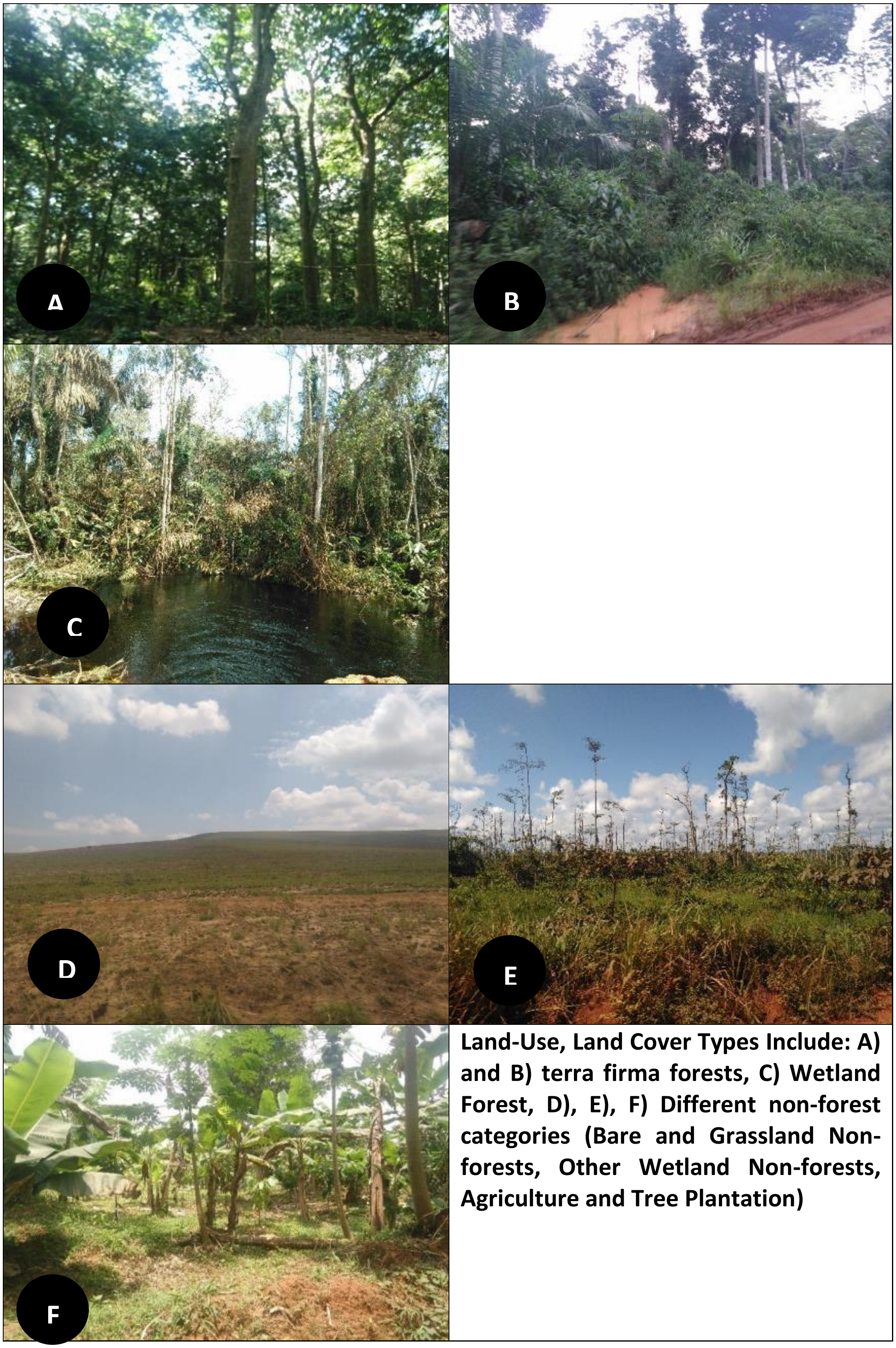
Figure 11. Classification of the ER-Program area into dominant forest types.

Error! Reference source not found. 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.

Table 24. Area of LULC Types in Each Department and in the Entire ER Project Area according to a 2014 map. Note: areas have not been "adjusted"

LULC Types	Total Program [ha]
	Area (ha)
Forest terra firma	7,384,386
Wetland Forest	4,550,890
Non-Forest	175,548
Wetland and water	246,117

LULC Types	Total Program [ha]
	Area (ha)
Total	**12,356,941**



Land-Use, Land Cover Types Include: A) and B) terra firma forests, C) Wetland Forest, D), E), F) Different non-forest categories (Bare and Grassland Non-forests, Other Wetland Non-forests, Agriculture and Tree Plantation)

Figure 12. 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

Definition of Activities

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[78] for estimating changes in carbon stocks in Forestland to Other Land (Deforestation) and Forestland remaining Forestland (Degradation).

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

Table 25. 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. Any conversion to plantations is accounted as deforestation as clearance of vegetation would be required.
Degradation (DG)	Forest degradation is defined as a human-induced loss in forest biomass on forest land remaining forest land. The threshold for carbon loss and minimum area affected as well as long term use needs 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.

[78] 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

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	IPCC Land Use Change Category	IPCC Method
Reducing emissions from deforestation	Forestland to Other Land	Stock-Difference*
Reducing emissions from degradation	Forestland remaining Forestland	Stock-Difference+

*** 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 ($\Delta\boldsymbol{C_{LU_i}}$) would be equal to the annual change in carbon stocks in the aboveground biomass carbon pool ($\Delta\boldsymbol{C_{AB}}$) and the annual change in carbon stocks in belowground biomass carbon pool ($\Delta\boldsymbol{C_{BB}}$) accounted as indicated in volume 4, chapter 2.

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

EQ 2

(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 ($\Delta\boldsymbol{C_{B}}$) would be estimated through the following equation:

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

EQ 3

(Equation 2.15, 2006 IPCC GL)

Where:

$\Delta \boldsymbol{C_B}$ = Annual change in carbon stocks in biomass on land converted to other land-use category, in tons C yr^{-1}

$\Delta \boldsymbol{C_G}$ = Annual increase in carbon stocks in biomass due to growth on land converted to another land-use category, in tons C yr^{-1}

$\Delta \boldsymbol{C_{CONVERSION}}$ = Initial change in carbon stocks in biomass on land converted to other land-use category, in tons C yr^{-1}

$\Delta \boldsymbol{C_L}$ = 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[79] 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

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

(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

[79] 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.

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:

$$\Delta \boldsymbol{C_B} = \boldsymbol{A_j} \times \frac{(\boldsymbol{CD_{t_2}} - \boldsymbol{CD_{t_1}})}{(\boldsymbol{t_2} - \boldsymbol{t_1})} \qquad \textbf{EQ 5}$$

$$\Delta \boldsymbol{C_B} = \sum_{\boldsymbol{j}} \left\{ \left(\boldsymbol{CD_{t_2,j}} - \boldsymbol{CD_{t_1,j}} \right) \times \Delta \boldsymbol{A_j} \right\}$$

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

Where:

$\boldsymbol{B_{AFTER,j}}$	=	Biomass stocks on land use transition $\boldsymbol{j}$ 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
$\boldsymbol{B_{BEFORE,j}}$	=	Biomass stocks on land use transition $\boldsymbol{j}$ 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.
$\Delta \boldsymbol{A_j}$	=	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 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.

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 26. Activity Data considered in the ER-Program

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

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):	$\Delta \boldsymbol{A_j}$ - Area of Land Use subcategory / stratum converted to another Land Use subcategory/ stratum (transition denoted by $\boldsymbol{j}$) in a certain year
Explanation for which sources or sinks the parameter is used	Deforestation and degradation
Data unit (e.g. ha/yr):	ha yr^{-1}
Value for the parameter:	The results based on the methods explained below are provided in the following table:

		2003-2012 (ha/an)	2013-2016 (ha/an)
Deforestation	Forest terre ferme	8,357.1	14,445.4
	Forest Wetland	301.9	0.0
Degradation	Forest terre ferme	11,652.1	21,668.4
	Forest Wetland	289.4	1,766.2

<table>
<tr><td></td><td>The activity data for 2005-2014 was estimated through a weighted average considering as weight the number of years: 8 years of the activity data in 2003-2012 and 2 years in the activity data in 2013-2016. The result is as follows.
<table>
<tr><th></th><th></th><th>2005-2014 (ha/an)</th></tr>
<tr><td>Deforestation</td><td>Forest terre ferme</td><td>9,574.8</td></tr>
<tr><td></td><td>Forest Wetland</td><td>241.5</td></tr>
<tr><td>Degradation</td><td>Forest terre ferme</td><td>13,655.4</td></tr>
<tr><td></td><td>Forest Wetland</td><td>584.8</td></tr>
</table>
For values per management strata see Chapter 8.3.3</td></tr>
<tr><td>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):</td><td>Remote sensing procedures described in this chapter.</td></tr>
<tr><td>Spatial level (local, regional, national or international):</td><td>Regional. IPCC Approach 3.</td></tr>
<tr><td>Discussion of key uncertainties for this parameter:</td><td>Refer to Chapter 12.</td></tr>
<tr><td>Estimation of accuracy, precision, and/or confidence level, as applicable and an explanation of assumptions/methodology in the estimation:</td><td>Further described in Chapter 12.</td></tr>
</table>

Source of data

The method used to estimate activity data is based on the good practices described in the GFOI MGD Version 2, i.e. a stratified estimator where the stratification is based on a forest cover change map and the samples are sample reference data based on the visual interpretation of a combination of medium, high and very high resolution imagery. A forest cover change map for 2003-2012 and another for 2013-2016 were used for stratification, and estimates for both periods were obtained.

Map production

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. 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, 2014, 2015 and 2016 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 2000-2003-2012-2015 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, 2012 and 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 11. Estimation of Carbon Stocks).

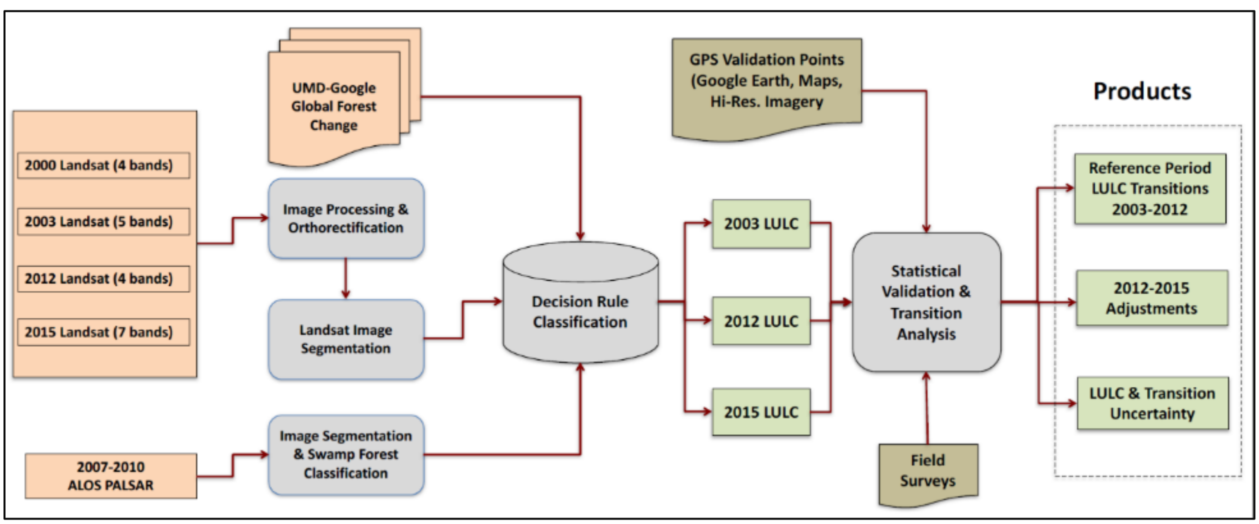


Figure 13. Methodology for Classification of Land Use Activities and Transitions During the Reference Period

Examples of land use and land cover classification for separating degraded and deforested areas are shown in Figure 14.

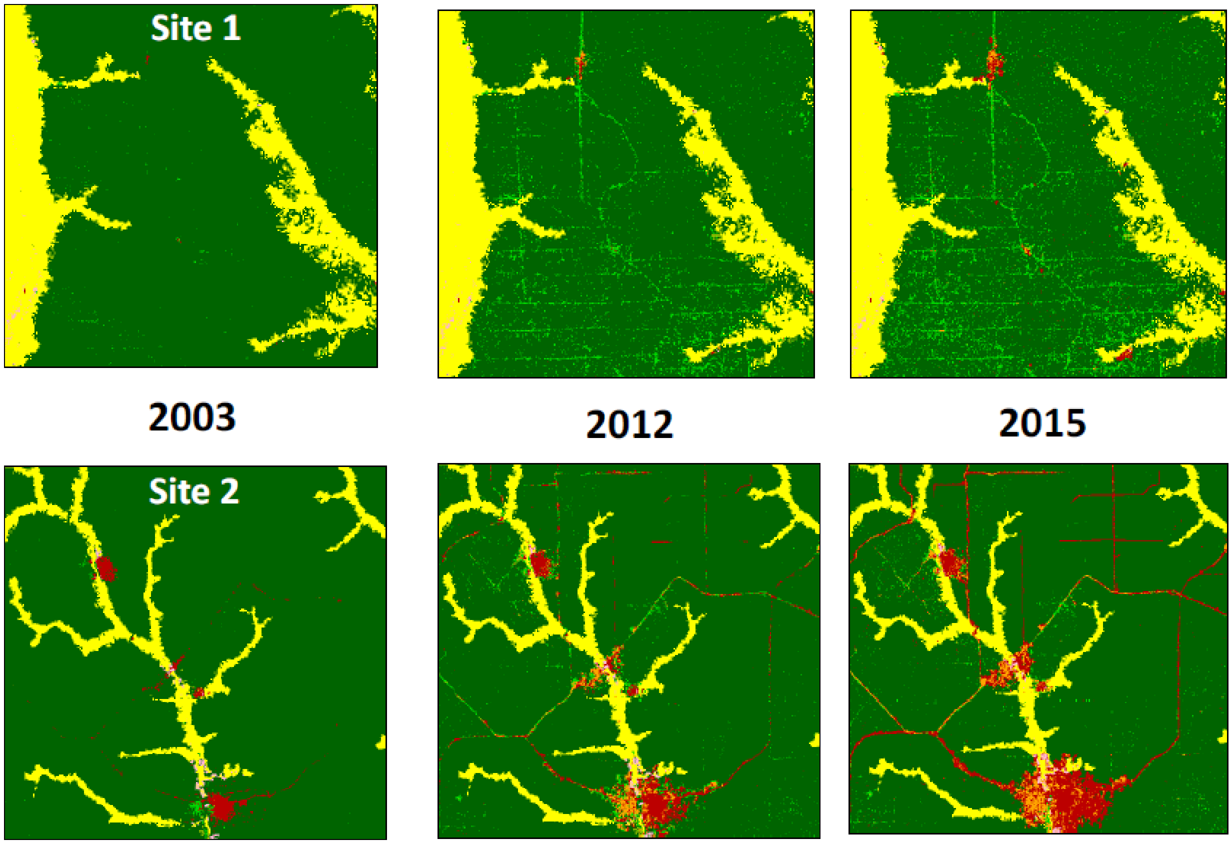


Figure 14. Examples of LULC Transitions during the Reference Period and the Adjustment Before the Start of the Program

The loss maps from the University of Maryland for years 2015 and 2016 were added in order to ensure that any omitted loss from the map of 2015 and losses of 2016 were considered.

The maps for 2003, 2012, 2015 and the forest loss information from UMD for 2015 and 2016 were merged to create two hybrid maps: one forest cover change for 2003-2012 and another forest cover change map for 2013-2016

Sampling design

The above process produced two forest cover change maps, one for 2003-2012 and another for 2013-2016 that provided distribution of forest, non-forest, deforestation and degradation. Two additional changes were made for producing the stratification maps:

1. A buffer stratum was created around the forest stable stratum to improve the estimation. This buffer surrounds the areas of loss and it has a size of one pixel.
2. For 2013-2016 a large forest fire stratum was created based on manual interpretation of Landsat 8 imagery and the 2016 Normalized Burn Ratio Index (NBRI) image from Google

Earth Engine. This was done in order to isolate the large-scale forest fires that are not of anthropogenic origin.

Based on these stratification maps, the following allocation of samples was made following the good practices set in Olofsson et al. (2014).

Table 27. Sampling design for 2003-2012

Class	Pixel_count	Samples
Forest	148158597	512
Non-Forest	5396546	119
Deforestation	2029824	100
Degradation	2092160	100
Buffer	1868369	100

Table 28. Sampling design for 2013-2016

Class	Pixel_count	Samples
Deforestation	915805	100
Deforestation feux (non anhropogenic)	237328	100
Degradation	1295666	100
Forest	140563330	1541
Non-Forest	5731394	100
Buffer	10821563	118

Response design

For all stratum classes the chosen response system was the Collect Earth tool where points are visually interpreted using the images in Google Earth®, Bing map® and Here map®. In some cases SPOT images from 2010 and 2015 were used to support the interpretation. Some ground reference data was also used to help in the interpretation of the spectral signature of Landsat imagery.

Figure 15. 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 assessment time frame was:

- 1 January 2003 to 31 December 2012 for the 2003-2012 period
- 1 January 2013 to 31 December 2016 for the 2013-2016 period

The assessment unit was a pixel of 30m by 30m coregistered to the stratification maps. The classes of interpretation were the following for the two periods:

Table 29. Classes of interpretation of the reference data

Class	2003-2012	2013-2016
Deforestation	x	x
Deforestation wetland forest	x	x
Deforestation feux (non anhropogenic)		x
Degradation	x	x
Degradation wetland forest	x	x
Forest	x	x
Non-Forest	x	x

The classification rule applied was as follows:

- Classify the forest cover at the beginning of the period of analysis. Assign if it is forest, wetland forest or non-forest.
- If more than 50% of the forest is lost within the assessment unit during the period of analysis, classify this as deforestation. Assign if it is in wetland forest or not.
- If less than 50% of the forest is lost within the assessment unit during the period of analysis, classify this as degradation. Assign if it is in wetland forest or not.
- If the loss is non-anthropogenic caused by large scale fires, indicate it.
- If the loss is in a palm concession area, indicate it.

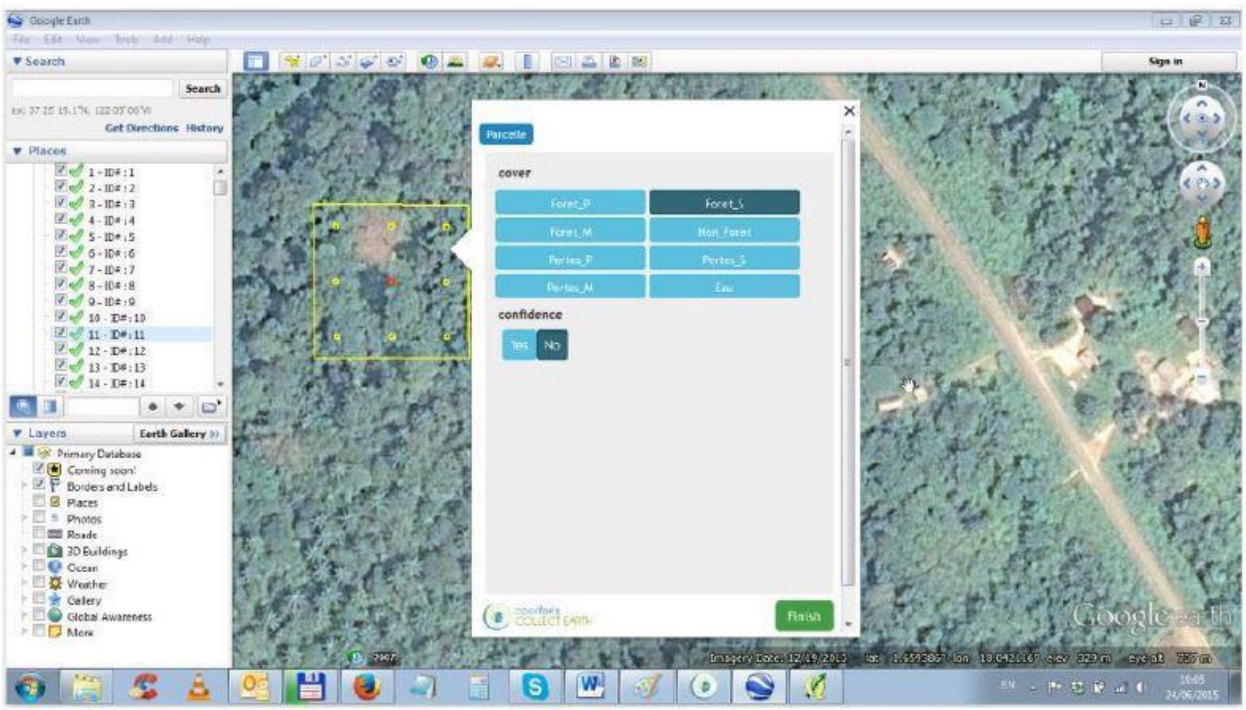


Figure 16. Example of an interpretation form created in Collect Earth.

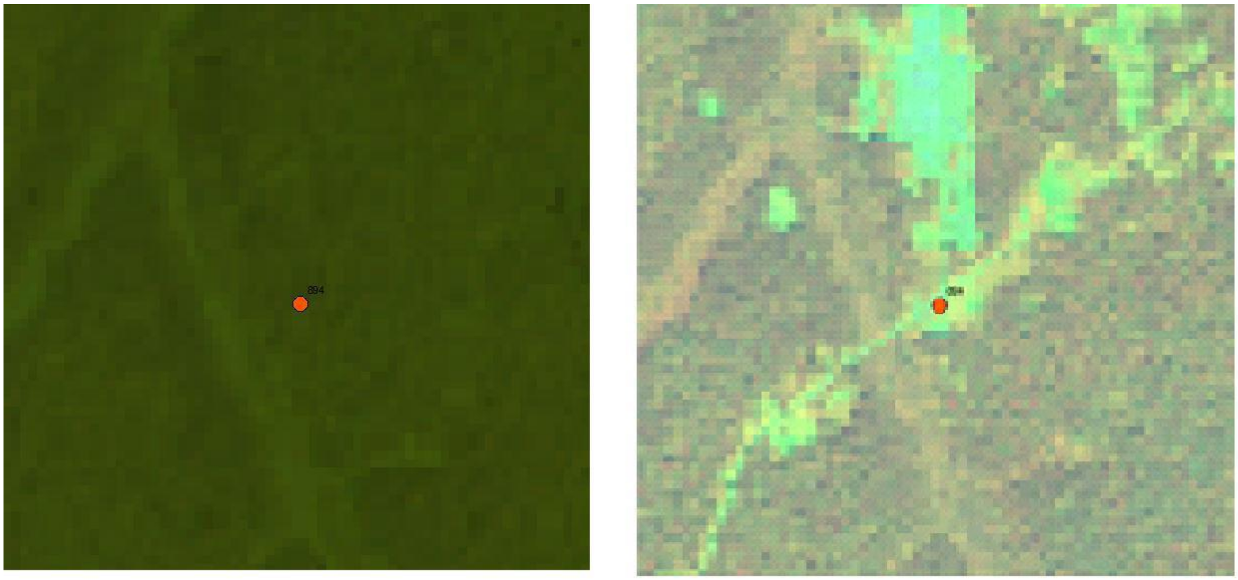


Figure 17. Example of a forest loss point.

Analysis

The analysis was done using the formulae for stratified estimators as described in Olofsson et al. (2014). The results of the interpretation are provided in the following tables, which do not include deforestation and degradation caused by non-anthropogenic fires and by conversion to palm oil plantations.

Table 30. Results of interpretation for 2003-2012

Strata	Deforestation		Degradation		Foret	TOTAL SAMPLES
	Deforestation	Deforestation_Wetland	Degradation	Degradation_Wetland		
Forest	1	0	0	0	505	512
Non-Forest	0	0	3	0	13	119
Deforestation	35	1	14	0	39	100
Degradation	2	0	42	0	56	100
Buffer	2	1	11	2	82	100

Table 31. Results of interpretation for 2013-2016

Strata	Deforestation		Degradation		Foret	TOTAL SAMPLES
	Deforestation	Deforestation_Wetland	Degradation	Degradation_Wetland		
Deforestation	0		1	0	84	100
Degradation	1		1	0	89	100
Forest	6		12	1	1382	1541
Non-forest	0		0	0	86	100

Deforestation fire	1		1	0	76	100
Buffer	2		0	0	105	118

Using the formulae from Olofsson et al. (2014) and not considering the deforestation and degradation events due to non-anthropogenic fires (large scale fires) and conversions to palm oil (, the results are as follows:

Table 32. Statistical results of activity data for the period 2003-2012

Statistic	Deforestation	Deforestation_Wetland	Degradation	Degradation_Wetland	Forest
Stratified estimator	0.007	0.000	0.009	0.000	0.942
Variance	0.000	0.000	0.000	0.000	0.000
Erreur standard	0.002	0.000	0.001	0.000	0.005
Relative margin of error 90%	47%	117%	17%	116%	1%
Estimated area (ha)	83,571	3,019	116,521	2,894	11,634,505
Confidence interval	44315 - 122827	-499 - 6537	96238 - 136804	-458 - 6247	11533344 - 11735666
Activity Data (ha/year)	8,357	302	11,652	289	11,634,505

Table 33. Statistical results of activity data for the period 2013-2016

Statistic	Deforestation	Deforestation_Wetland	Degradation	Degradation_Wetland	Forest
Stratified estimator	0.005	0.000	0.007	0.001	0.894
Variance	0.000	0.000	0.000	0.000	0.000
Erreur standard	0.002	0.000	0.002	0.001	0.007
Relative margin of error 90%	57%	-	46%	165%	1%
Estimated area (ha)	57,781	0	86,673	7,065	11,053,883
Confidence interval	24887 - 90676	0 - 0	46493 - 126854	-4561 - 18690	10912528 - 11195238
Activity Data (ha/year)	14,445	0	21,668	1,766	11,053,883

The presented relative margin of errors is high for deforestation an degradation of ‘terra firma’ forest mainly due to the very low deforestation and degradation observed in the region of interest. Reducing the relative margin of error would require a very significant sample size.

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
$\boldsymbol{B_{AFTER,j}}$ $\boldsymbol{B_{BEFORE,j}}$	Biomass stocks on land use transition j immediately after the conversion, tons d.m. ha^{-1} Biomass stocks on land use transition $\boldsymbol{j}$ before the conversion, tons d.m. ha^{-1}	• Reducing emissions from deforestation • Reducing emissions from degradation

Description of the parameter including the forest class if applicable:	$\boldsymbol{B_{AFTER,j}}$ - Biomass stocks on land use transition $\boldsymbol{j}$ immediately after the conversion $\boldsymbol{B_{BEFORE,j}}$- Biomass stocks on land use transition $\boldsymbol{j}$ before the conversion
Data unit (e.g. t CO_2e/ha):	t d.m. ha^{-1}
Value for the parameter:	see table below
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 12 .

Vegetation Type	Mean AGB (t d.m./ha)	Mean BGB (t d.m./ha)	AGC + BGC (MgC/ha)
'Terra Firma' Forest	280.41	65.90	169.69
Wetland/Swamp Forest	188.73	44.35	114.21
Degraded 'Terra Firma' Forest	197.13	46.32	119.29
Degraded Wetland/Swamp Forest	117.35	24.06	69.29
Non-Forest	61.91	12.69	36.56

Estimation of accuracy, precision, and/or confidence level, as applicable and an explanation of assumptions/methodology in the estimation:	Estimation of uncertainties with remote sensing are described in detail in Chapter 12.

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 the biomass map which was produced following the below methods.

The data and methodology for estimating the carbon stocks are:

1. National Forest Inventory (IFN) data for 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[80]. 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

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

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 ($AGB_{>10cm}$).

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

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 show how the belowground biomass (BGB) can be estimated from AGB.

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

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

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; additional plots from Gabon and DRC were used as proxies to augment the dataset, taken from LULC classes with extremely similar ecological and geographic characteristics, allowing for calibration of the LiDAR dataset across additional LULC classes. 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) to interpolate biomass across all forest and nonforest classes based on the LiDAR data calibrated with the IFN plots (augmented with plots from Gabon and DRC in similar ecological conditions. 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 12 discusses the uncertainty of the map and the process of estimating the standard error of AGB for each LULC classes.

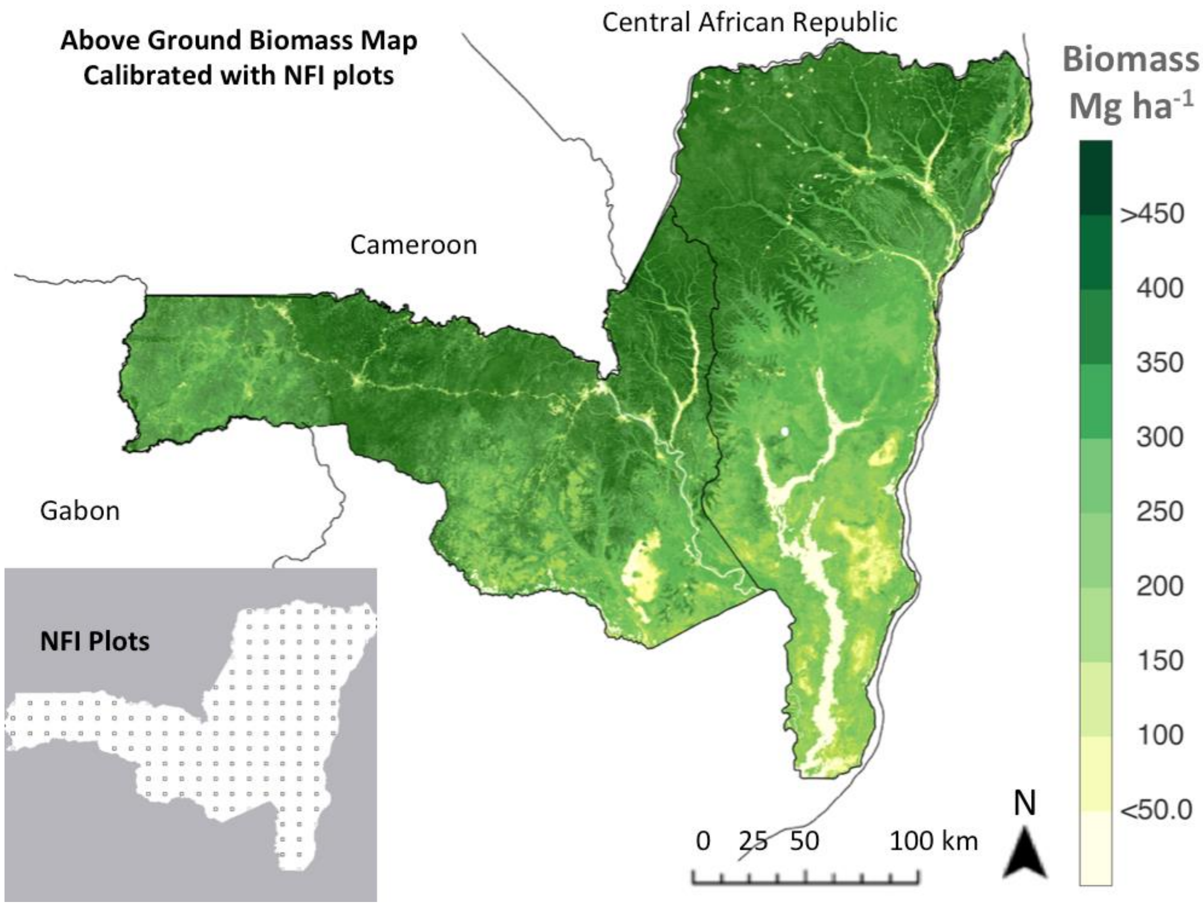


Figure 18. Map of Forest Above Ground Biomass (Mg/ha) Derived from Satellite LiDAR Measurements of Forest Structure and Adjusted for Wood Density and Forest Biomass Variations Derived From the National Inventory plots

To obtain estimates comparable to the classes of interpretation the biomass map was overlapped with the reference samples. The average for each forest type was used as the estimate.

Results and comparison

The results are provided in the following table:

Table 34. Mean Above and Below Ground Biomass and Carbon Stock in Each Stratified Vegetation Type in the Northern Republic of Congo

Vegetation Type	Mean AGB (t d.m./ha)	SE AGB (t d.m./ha)	Mean BGB (t d.m./ha)	SE BGB (t d.m./ha)	AGC + BGC (MgC/ha)	SE AGC + BGC (MgC/ha)
'Terra Firma' Forest	280.41	29.69	65.90	10.40	169.69	15.42
Wetland/Swamp Forest	188.73	21.12	44.35	7.18	114.21	10.93
Degraded 'Terra Firma' Forest	197.13	26.18	46.32	8.20	119.29	13.44
Degraded Wetland/Swamp Forest	117.35	20.03	24.06	6.24	69.29	10.28

Non-Forest	61.91	8.00	12.69	2.97	36.56	4.18

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

Table 35. 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	114.98	Congo National Forest Inventory (CNIAF) 52 plots at 0.5 ha (AGB only)
Wetland/Swamp Forest	113.21	Congo National Forest Inventory (CNIAF) 437 0.5ha Plots (AGB only)
Primary Forest	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	118.60	Zapfak et al. (2013) (AGB only)
Wetland/Swamp Forest	88.49	Zapfak et al. (2013) (AGB only)

Table 36. Emissions Factors

Classe	Changement de stocks de carbone (tC/ha)	Relative margin of error at 95% confidence level
Deforestation 'terra firma'	133.13	29%
Deforestation wetland forest	77.65	30%
Degradation 'terra firma'	50.40	29%
Degradation 'wetland forest	44.92	35%

Table 36 provides the emission factors used for historical and projection emission levels including the carbon pools specified in Table 20. The below ground biomass is assumed to be released at the time of conversion following Tier 1 methods[81].

[81] 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

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

Table 37. Average Annual Emissions and Emissions during the Historical Reference Period based on Land-use Transition

		Activity Data (ha/year)	AGB before (tdm/ha)	AGB after (tdm/ha)	Shoot-Root Biomass Ratio Before	Shoot-Root Biomass ratio After	FC, tonne C (tonne d.m.)-1.	Conversion	tCO2/year	Relative margin of error 95%
Deforestation	Terra firma forest	9,574.8	280.4	61.9	0.24	0.205	0.49	3.7	**4,674,023**	47%
	Wetland Forest	241.5	188.7	61.9	0.24	0.205	0.49	3.7	**68,772**	120%
Degradation	Degraded terra firma forest	13,655.4	280.4	197.1	0.24	0.205	0.49	3.7	**2,668,615**	35%
	Degraded wetland forest	584.8	188.7	117.3	0.24	0.205	0.49	3.7	**96,318**	115%
								TOTAL	**7,507,728**	

*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 38. Calculation of Emission Reductions per REDD+ Activity in the Reference Period

REDD+ Activity	tCO_2e/year in RP	%
Reducing emissions from deforestation	4,742,795	63%
Reducing emissions from degradation	2,764,933	37%

It can be confirmed that GHG emissions from forest degradation are significant, as they constitute about 37% of total GHG emissions in the Reference Period.

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%;
- entry into operation of forest concessions that were not operational during the reference period;
- expansion of the industrial agriculture.

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.[82] The most recent forest cover change map produced at the national level by CNIAF[83] 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 2015, 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 1.1:

1. National development programs which were established since 2012[84,85] 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 was finalized in 2015.[86] New road construction and improvements expandis ing 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 2015;
    - The global timber market was in a recession in the period from 2008-2012, and has since recovered. After this period, within the Accounting Area, four new concessions were granted and are expected to enter into operation in 2018.

The use of historical rates purely from the historical reference period of 2005-2014 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 in the period 2013-2016, confirming that the change in national circumstances is accelerating rates beyond the historical baseline. Hence, it is

[82]De Wasseige et. al, 2012

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

[84] 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.

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

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

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.

For the adjustment justification and its quantification, these will be done separately for each driver of deforestation and degradation

Table 39. Adjustments made

Adjustment Made	Summary of Method for Adjustment quantification	This Adjustment applies to the following drivers
Adjustment considering the rates observed in 2013-2016	This rate adjusts the deforestation/degradation rate forward, calculated through Remote Sensing.	Applied across the whole jurisdiction.
Adjustment considering Population Growth	This rate adjusts the deforestation/degradation rate by adding population growth.	Applied to the historical GHG emissions in areas out of the production areas of the forest concessions already delineated.
Adjustment considering additional Forestry Concessions Pikounda Nord, Karagoua and Mimbelli-Ibenga	This adjusts the deforestation/ degradation rate by adding future deforestation/ degradation cause by inactive concessions becoming active.	Applied to the historical GHG emissions in areas out of the production areas of the forest concessions already delineated.
Adjustment considering oil palm plantations	This adjusts the rate of deforestation by adding deforestation caused by documented oil palm plantations.	***Palm oil concessions***

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

Adjustment for Acceleration of Trends (2013-2016 level) and Population

Deforestation and Degradation were present in the Accounting Area during the historical period (2005-2014), however there is an acceleration of trends over the historical rate. Observed deforestation and degradation rates accelerated between 2003-2012 and 2013-2016. This documentation of acceleration of trends is shown in **Error! Reference source not found.** and Figure 19. Historical rates from 2003-2012 are unreflective of current trends and therefore the deforestation and degradation rates have been adjusted to capture current rates.

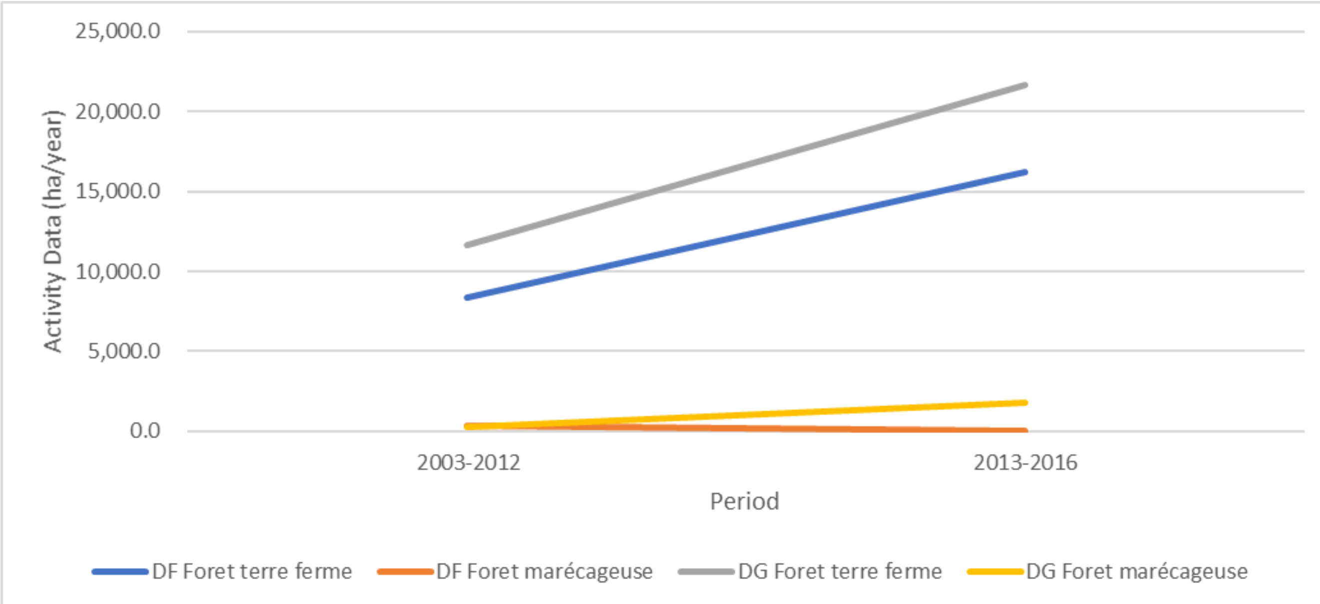


Figure 19. Graphic Display of Acceleration of Trends between 2003-2012 and 2013-2016

The acceleration in emissions in more recent years has mainly been driven by improvements in the road network (in particular the N2 Brazzaville-Ouesso road), a partial recovery of timber markets after a period of major depression and attendant forest production and population influx into concessions.

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).[87] 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).[88] Field visits to the ER-Program Area

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

[88] 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

confirmed that unplanned mosaic deforestation follows a pattern strongly correlated with distance to the roads.

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 20), represents a change over the 'baseline' road network, driving deforestation above that experienced in the reference period (Table 40).

Table 40: 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%

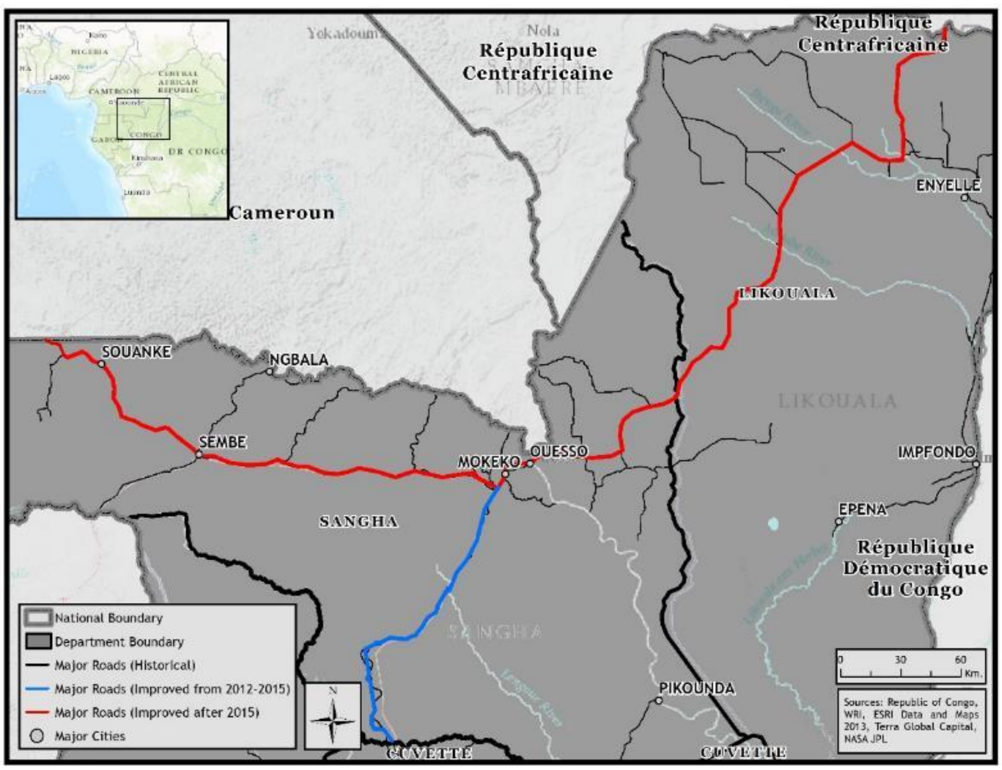


Figure 20: Major Roads and Road Improvements in ER-Program Area

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).

Adjustment for Forest Concession Production Areas

In 2000 forest production in the Congo exceeded 1.5 million cubic meters of wood annually.[89] 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).[90] In 2011 the formal forest sector to employed 0.5% of the Congolese labor force and accounted for USD $149 million contribution to the GDP.[91]

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.[92] 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%.[93] Figure 21 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).[94]

---

[89] FRA 2010 Country Report, Congo

[90] Annual stats 2013

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

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

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

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

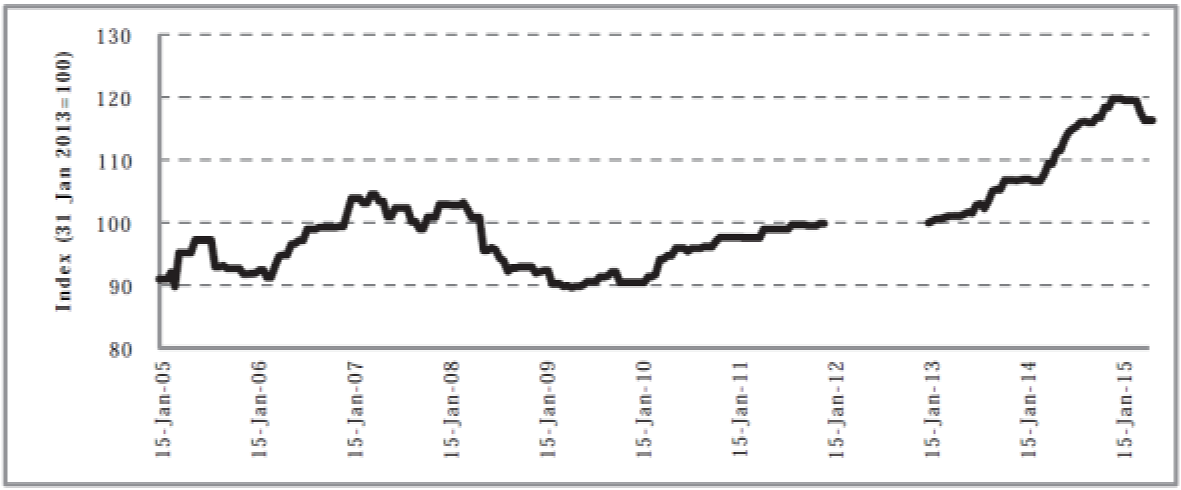


Figure 21. West Africa Roundwood Average Export Prices

There is a significant acceleration of existing trends in the timber industry that is not reflective of the reference period. Tropical Timbert extraction rates are expected to increase at 2%.[95] [96] 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 Mimbeli-Ibenga concession, 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 it has not yet entered yet operation. As described previously, there are significant new roads and infrastructure improvements causing increasesd 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)[97] and PDSA[98] 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, Mimbeli-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

---

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

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

[97] 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.

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

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.

Adjustment for Designated Areas for Oil Palm Plantations

There are three large industrial oil palm concessions areas geographically delineated in the Accounting Area. In Sangha, Eco-Oil and ATAMA have been granted palm concessions in 2013 and December 2010, respectively. The third concession, Sembe Oil Palm and Macro Agricultural zone, has been delineated but not been allocated yet. In Likouala, there are currently no industrial oil palm areas delineated.

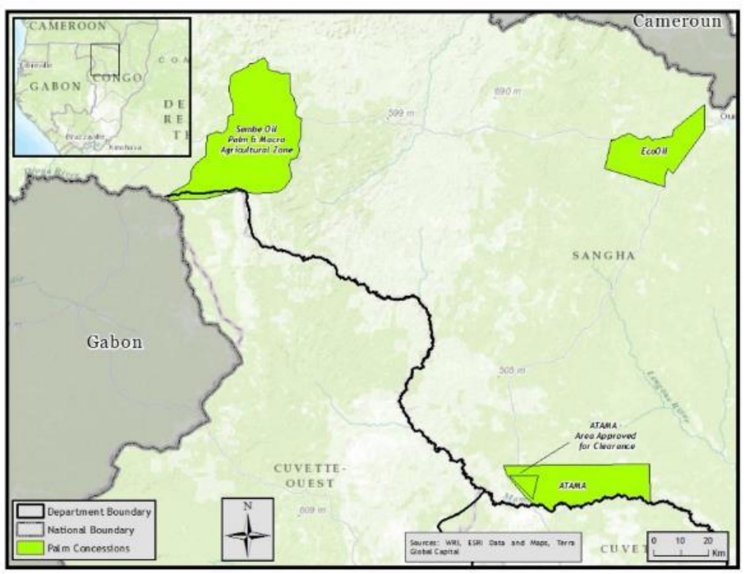


Figure 22. Industrial Oil Palm Plantations with Geographic Delineation in the ER-Program Area

Forest Areas (2015 map)	ATAMA	EcoOil	Sembe	Total
Forest	44,036	35,425	122,067	201,528
Total Forest Area (excluding FWL)	24,545	26,186	94,330	145,060
Non-Forest	12,252	11,896	6,735	30,882

These conversions are not fully reflected in the Reference Period due to the following:

- 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;
- 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.

.

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

Drivers of deforestation and forest degradation

The Accounting Area can be divided in clearly delineated areas where drivers of deforestation and degradation operate almost exclusively. Logging companies operate in the production areas of the forest concessions, while small-scale deforestation and degradation occurs in the areas outside of these production areas. Palm oil plantations occur only in those areas designated for palm oil.

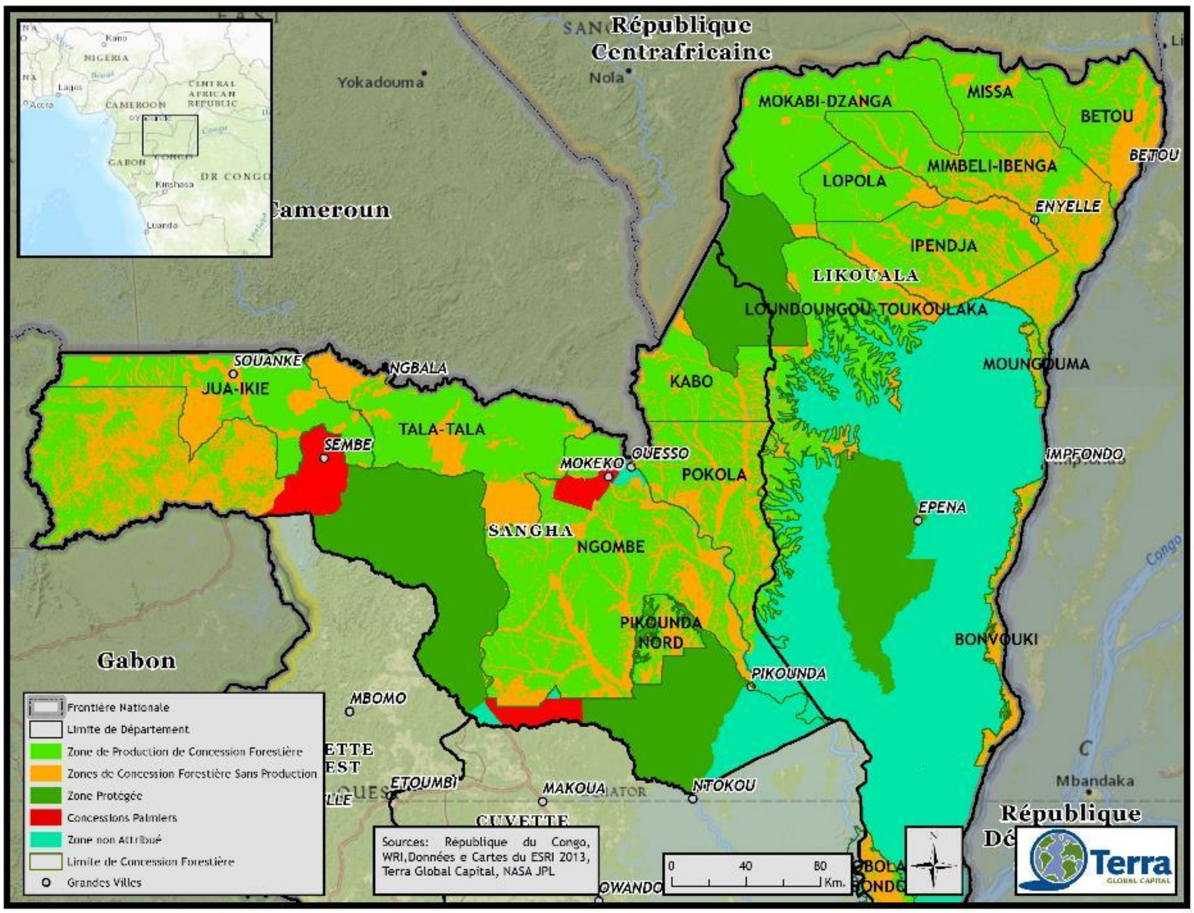


Figure 23. Map with the attribution of lands to the different drivers

Those areas are described in the following table:

Table 41. areas per driver used for Activity Data (excluding WTR and OWL)

Areas per driver	Description	Area (ha)
Small-scale drivers act in the following areas: • Forest Concessions NonProduction Areas • Protected Area • Undesignated Areas	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.	2,576,016 1,821,343 2,964,881
Logging companies act in the forest Concession Production Areas	These are the timber production areas in the forest concessions	4,651,181
Palm plantations occur only in the designated Oil Palm Areas Plantations	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	232,159*
Total		**12,356,941**

In each of these areas a different method for quantification of the adjustment to the historical GHG emissions was done.

Table 42. Summary of Method for quantifying the adjustment

Type of adjustment	Future Deforestation / Degradation Dynamics (in the absence of the ER-Program)	Summary of Method for Adjustment quantification
Adjustment considering the rates observed in 2013-2016	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 is simple as the estimates of GHG emissions in the period 2005-2014 are adjusted to the GHG emission level observed in 2013-2016. GHG emissions are estimated using the IPCC Stock-Change method as used for the annual average GHG emissions.
Adjustment considering Population Growth	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 GHG emissions for 2013-2016 are then disaggregated according to whether they occur in forest production areas or elsewhere. GHG emissions occurring elsewhere are assumed to occur due to small-scale activities and they are adjusted by a population growth rate of 2.86% annually.
Adjustment considering additional Forestry Concessions Pikounda Nord, Karagoua and Mimbelli-Ibenga	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 three concessions (Pikounda Nord, Karagoua and Mimbelli-Ibenga) that were inactive	The GHG emissions for 2013-2016 are then disaggregatd according towhether they occur in forest production areas or elsewhere.

Type of adjustment	Future Deforestation / Degradation Dynamics (in the absence of the ER-Program)	Summary of Method for Adjustment quantification
	during the reference period, but now have newly assigned active concession holders; and access to forests (roads).	GHG emissions occurring in forest production areas are adjusted by adding the new production areas that will be added with the concessions of Pikounda Nord, Karagoua and Mimbelli-Ibenga. This is done through a simple ratio as GHG emissions in 2013-2016 occurred as a result of X ha of concessions, then with X+Y ha of concessions the GHG emissions would be higher.
Adjustment considering oil palm plantations	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 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.	The adjustment is simple. It is based on historical rates observed across these different palm oil concessions, i.e. ATAMA and EcoOil. Sembe is not considered. GHG emissions are estimated using the IPCC Stock-Change method as used for the annual average GHG emissions.

These adjustments are further explained below.

Adjustment Based on Observations from 2013-2016

The first Adjustment is based on historical deforestation and forest degradation GHG emissions observed in the period 2013-2016 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. All the jurisdiction will be affected by this adjustment.

Table 43. Average Annual Emissions and Emissions during the period 2013-2016

		Activity Data (ha/year)	AGB before (tdm/ha)	AGB after (tdm/ha)	Shoot-Root Biomass Ratio Before	Shoot-Root Biomass ratio After	FC, tonne C (tonne d.m.)-1.	Conversion	tCO2/year	Relative margin of error 95%
Deforestation	Terra firma forest	14,445.4	280.4	61.9	0.24	0.205	0.49	3.7	7,051,659	64%
	Wetland forest	0.0	188.7	61.9	0.24	0.205	0.49	3.7	0	30%
Degradation	Degraded terra firma forest	21,668.4	280.4	197.1	0.24	0.205	0.49	3.7	4,234,566	55%
	Degraded wetland forest	1,766.2	188.7	117.3	0.24	0.205	0.49	3.7	290,912	168%
								TOTAL	**11,577,137**	

This means an increase from 7,507,728 tCO2 to 11,577,137 tCO2 from the period 2005-2014 to the period 2013-2016. This increase is due to many factors, but it is considered that this increase is mainly due to the ramp-up of production due to concessions that have been entering in operation in the ER-Program area: In 2003, concessions in the ER-Program area covered a total of 2.9 million ha, while by 2016 they covered a total of 4.6 million ha.

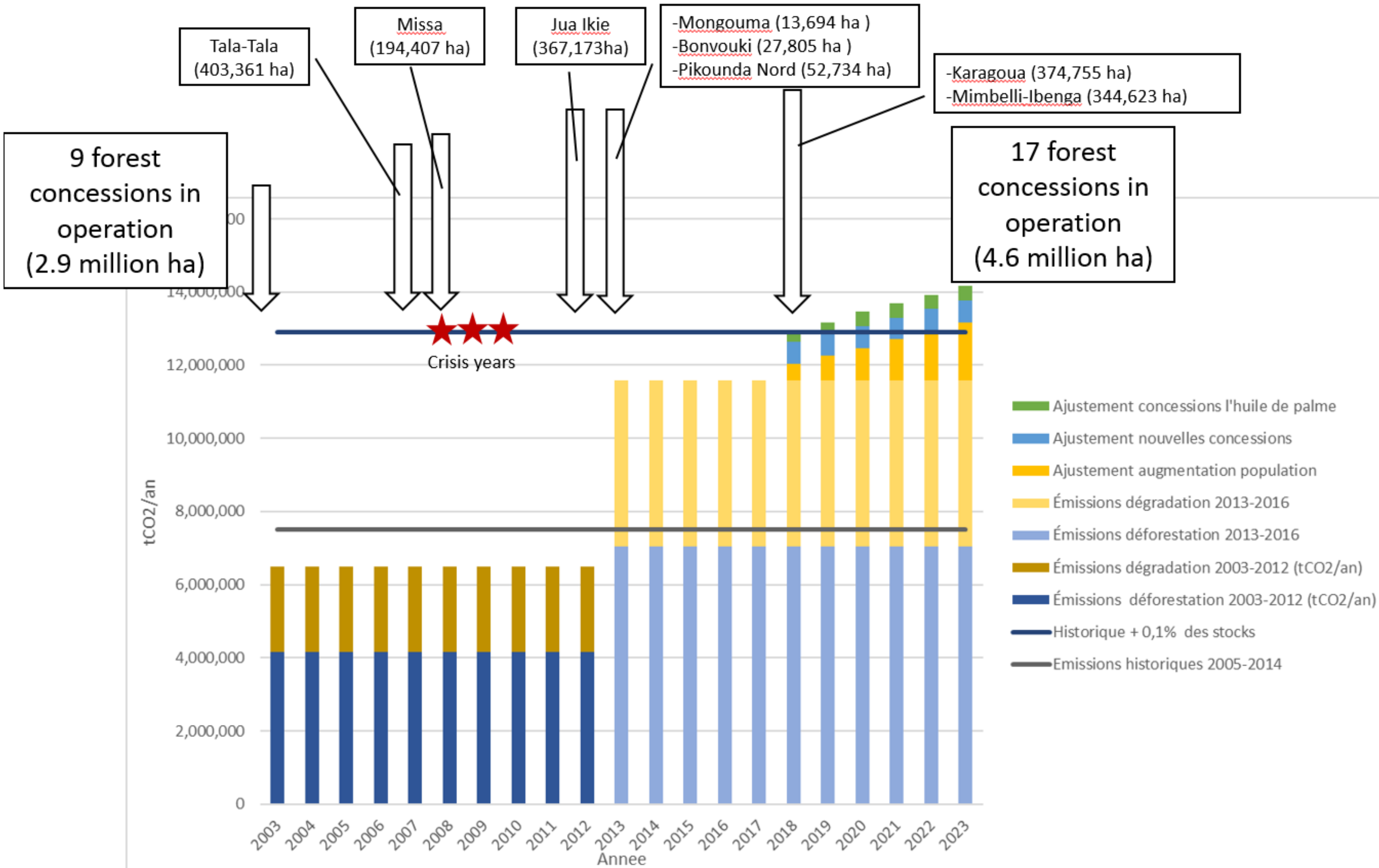


Figure 24. Entry into operation of concessions and the 2008 crisis, and their relation to the GHG historical emissions in the subperiods 2003-2012 and 2013-2016

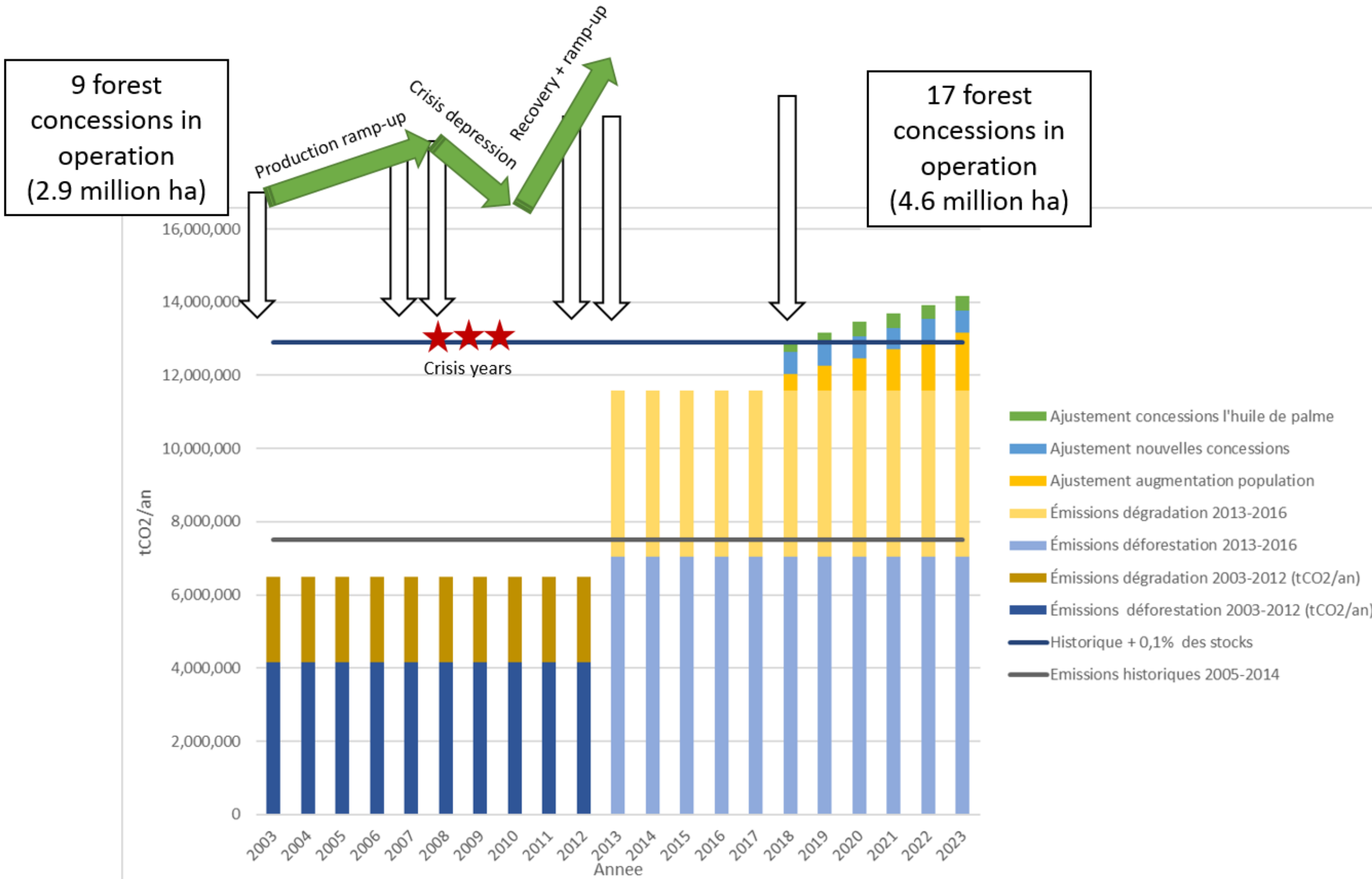


Figure 25. Entry into operation of concessions and the 2008 crisis, and their relation to the GHG historical emissions in the subperiods 2003-2012 and 2013-2016

Adjustment considering Population Growth

The projected GHG emissions in areas that are not forest production areas are calculated using a population increase rate.

The population growth adjustment was applied to the average GHG emissions in the period 2013-2016 in the areas that are not forest production areas so as to get a projected GHG emissions. The adjustment was based on the historical weighted average population growth in the departments of 2.86% per annum (Table 44).

Table 44. Population Growth[99]

	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%

GHG emissions in the forest production areas and out of the forest production areas were estimated based on the relative contribution of deforestation and degradation to each of these areeas.

Table 45. GHG emissions in 2013-2016 within the production areas and out of the production areas.

		tCO2/year	Relative margin of error at 95% confidence level
Deforestation	Community development zones	2,028,361	64%
	Areas outside of production zones	5,023,299	64%
Degradation	Production zones	2,244,615	52%
	Areas outside of production zones	2,280,863	52%
TOTAL		**11,577,137**	

Based on the GHG emissions in 2013-2016 in the areas out of the forest production areas, an annual increase factor of 2.86% was applied annually.

[99] 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

Table 46. GHG emissions in the period 2018 to 2023

Year	Deforestation (tCO2/an)	Degradation (tCO2/an)	Facteur de croissance	Deforestation (tCO2/an)	Degradation (tCO2/an)	Relative margin of error at 95% confidence level
1	5,023,299	2,280,863	1.029	5,166,965	2,346,095	47%
2	5,023,299	2,280,863	1.058	5,314,740	2,413,194	47%
3	5,023,299	2,280,863	1.088	5,466,742	2,482,211	47%
4	5,023,299	2,280,863	1.119	5,623,091	2,553,202	47%
5	5,023,299	2,280,863	1.151	5,783,911	2,626,224	47%
6	5,023,299	2,280,863	1.184	5,949,331	2,701,334	47%

Adjustment considering additional Forestry Concessions Pikounda Nord, Karagoua and Mimbelli-Ibenga

This adjustment considers the GHG emissions of production areas that belong to concessions that have been legally sanctioned and have not yet entered into operation. These are three: a) Pikounda Nord; b) Karagoua; c) Mimbelli-Ibenga. The former has already an approved management plan and is expected to be logged without carbon incentives, while the second and third concessions were given in 2016 and it is expected that their management plans will be approved in 2018 and will enter in operation already in 2019.

The adjustment consists in adjusting the GHG emissions considering the increased forest production areas. The production areas sourced from official data from Congo are provided in the following table, resulting in a ratio of 1.20 between the total areas in operation by 2018 and the areas that were already in operation before 2016.

Table 47. Areas of new forest production areas entering into operation.

	Concession		
	Pikounda Nord	Karagoua	Mimbelli-Ibenga
Production areas that will enter in operation after 2016 (ha)	52,734	374,755	344,623
Area of production areas newly entering into operation (ha)	772,112		
Area of production areas in operation before 2016 (ha)	3,882,782		
Ratio between between total production area after 2016 and before 2016 (ha)	1.199		

The GHG emisisons are provided in the following table.

Table 48. GHG emissions from forest production areas in the period 2018 to 2023

Year	Deforestation (tCO2/an)	Degradation (tCO2/an)	Facteur de croissance	Deforestation (tCO2/an)	Degradation (tCO2/an)	Relative margin of error at 95% confidence level
1	2,028,361	2,244,615	1.199	2,431,711	2,690,969	41%
2	2,028,361	2,244,615	1.199	2,431,711	2,690,969	41%
3	2,028,361	2,244,615	1.199	2,431,711	2,690,969	41%
4	2,028,361	2,244,615	1.199	2,431,711	2,690,969	41%
5	2,028,361	2,244,615	1.199	2,431,711	2,690,969	41%
6	2,028,361	2,244,615	1.199	2,431,711	2,690,969	41%

Adjustment considering oil palm plantations

Areas for Conversion

The Sangha-PDSA shows three oil palm and agro industrial areas (Atama, EcoOil, Sembe), mostly in the western region for future development. These have already been delineated, and two of them (Atama and EcoOil) are already active. Sembe has not yet been allocated. In addition, the PDSA contains plans to develop 350,000 hectares of palm oil plantations by 2035. However, the prospect of ER payments is causing an ongoing national policy shift (See Section 2.3 on political commitment) that makes the pursuit of these plans likely to be revisted.

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. 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). 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 are likely to be insignificant, given that the carbon stock would return to the baseline over a 25-30-year time scale.

To obtain an accurate estimate of the annual conversion of natural forest in the forest concessions, a visual interpretation of satellite imagery was done and polygons of deforestation per year were delineated for the two macrozone areas.

Year	Area (ha) per concessions		
	ATAMA	Eco-Oil	Sembe
2013	631.62	34.66	0
2014	32.07	99.25	0
2015	156.42	69.84	0
2016	649.60	152.35	0
TOTAL	**1469.71**	**356.1**	**0**

GHG emissions

Based on the above information gathered and the transition rates, the following assumptions were made:

Table 49. Inputs to Areas for Conversion for Oil Palm Concessions

	ATAMA	EcoOil	Sembe
Year in which deforesting natural forest will start	1	3	0
Area to be planted(ha)	12,888	15,000	50,000
Area of natural forest to be converted (ha)	12,888	14,500	0
Rate of implementation (ha/year)	650	150	0

Table 50 provides the annual hectares for conversion from forest to oil palm over the next 6 years in the ER-Program Area.

Table 50. Hectares of Forest for Conversion to Palm Oil during ER-Program Life

Annee	Year	ATAMA	EcoOil	Sembe	ha/year
1	2018	650		0	650
2	2019	650		0	650
3	2020	650	150	0	800
4	2021	650	150	0	800
5	2022	650	150	0	800
6	2023	650	150	0	800

To calculate the emissions from the conversion from forest to oil palm plantation, the same GHG emissions factors for the deforestation of 'Terra Firma' forest to non-forest as presented in Table 36 were used.

Table 51. Annual Emissions from Oil Palm Conversion during the ER-Program Life [tCO_2e]

Year	Activity Data (ha/year)	AGB before (tdm/ha)	AGB after (tdm/ha)	Shoot-Root Biomass Ratio Before	Shoot-Root Biomass ratio After	FC, tonne C (tonne d.m.)-1.	Conversion	tCO2/year	Relative margin of error 95%
1	650.0	280.4	61.9	0.24	0.21	0.49	3.7	317,304	29%
2	650.0	280.4	61.9	0.24	0.21	0.49	3.7	317,304	29%
3	800.0	280.4	61.9	0.24	0.21	0.49	3.7	390,528	29%
4	800.0	280.4	61.9	0.24	0.21	0.49	3.7	390,528	29%
5	800.0	280.4	61.9	0.24	0.21	0.49	3.7	390,528	29%
6	800.0	280.4	61.9	0.24	0.21	0.49	3.7	390,528	29%

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 52. Historical GHG emissions and adjusted emissions considering the different components

Year	Emissions deforestation 2003-2012 (tCO2/an)	Emissions degradation 2003-2012 (tCO2/an)	Emissions during reference period 2005-2014	Emissions deforestation 2013-2016	Emissions degradation 2013-2016	Adjustment based on population growth	Adjustment considering addition forestry concessions	Ajustement considering oil palm plantations	Adjusted GHG emissions
2003	4,165,579	2,324,797	7,507,728						
2004	4,165,579	2,324,797	7,507,728						
2005	4,165,579	2,324,797	7,507,728						
2006	4,165,579	2,324,797	7,507,728						
2007	4,165,579	2,324,797	7,507,728						
2008	4,165,579	2,324,797	7,507,728						
2009	4,165,579	2,324,797	7,507,728						
2010	4,165,579	2,324,797	7,507,728						
2011	4,165,579	2,324,797	7,507,728						
2012	4,165,579	2,324,797	7,507,728						
2013			7,507,728	7,051,659	4,525,477				11,577,137
2014			7,507,728	7,051,659	4,525,477				11,577,137
2015			7,507,728	7,051,659	4,525,477				11,577,137
2016			7,507,728	7,051,659	4,525,477				11,577,137
2017			7,507,728	7,051,659	4,525,477				11,577,137
2018			7,507,728	7,051,659	4,525,477	461,401	597,202	317,304	12,953,044
2019			7,507,728	7,051,659	4,525,477	676,274	597,202	317,304	13,167,918
2020			7,507,728	7,051,659	4,525,477	897,293	597,202	390,528	13,462,161
2021			7,507,728	7,051,659	4,525,477	1,124,633	597,202	390,528	13,689,501

2022			7,507,728	7,051,659	4,525,477	1,358,475	597,202	390,528	13,923,343
2023			7,507,728	7,051,659	4,525,477	1,599,005	597,202	390,528	14,163,873

We can see in the above that the main component of the adjustment is the actualization of GHG emissions to the 2013-2016 level.

Table 53. Importance of each adjustment over the total adjustment (without considering the cap)

ER-PA term year t	Adjustment 2013-2016	Adjustment based on population growth	Adjustment considering addition forestry concessions	Ajustement considering oil palm plantations
1	75%	8%	11%	6%
2	72%	12%	11%	6%
3	68%	15%	10%	7%
4	66%	18%	10%	6%
5	63%	21%	9%	6%
6	61%	24%	9%	6%

However, these adjusted GHG emissions are capped according to the MF to 0.1% of total carbon stocks. The carbon stocks are calculated as follows using the definition of carbon stocks provided in the methodology framework, i.e. using the average emission factor and multiplying by the area of forest. Therefore, the total cap is equal to **5,396,069 tCO2/year**.

Table 54. Estimation of total carbon stocks and adjustment cap

	Value	Confidence interval at 95% of confidence
Forest area (ha)	11,053,883	1%
Average emission factor (tCO2/ha)	488	29%
Carbon stocks (tCO2)	5,396,069,333	29%
0.1% of the carbon stocks (tCO2/year)	5,396,069	29%

A comparison between actual adjustment calculation (Table 52) and the adjustment estimation applying the cap (Table 54) indicates that the actual adjustment is above the capped adjustment in all years.

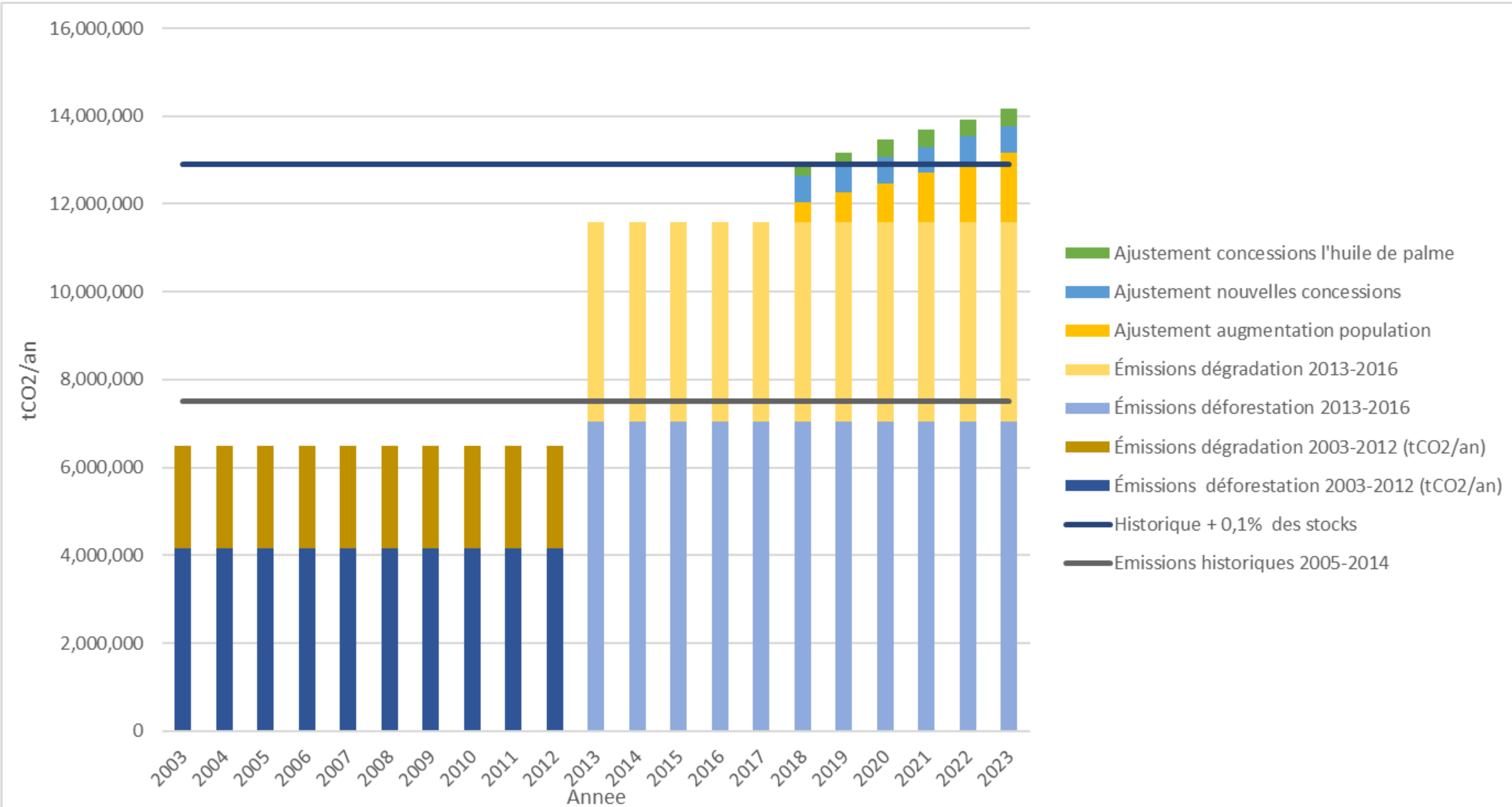


Figure 26. Historical emissions, adjusted emissions and the MF cap

88% of the total adjustment is due to the adjustment using empirical data from 2013-2016.

Table 55. Contribution of each adjustment component to the final adjustment, capped to 0.1% of carbon stocks

ER-PA term year t	Adjustment 2013-2016	Adjustment based on population growth	Adjustment considering additional forestry concessions	Ajustement considering oil palm plantations
1	75%	8%	11%	6%
2	75%	10%	9%	5%
3	75%	12%	8%	5%
4	75%	13%	7%	5%
5	75%	14%	6%	4%
6	75%	15%	6%	4%

8.5 Estimated Reference Level

The ER-Program REL is:

Table 56. ER-Program Reference Level

ER-PA term year t	Emissions from deforestation (tCO2/yr) reference period	Emissions from degradation (tCO2/yr) reference period	Adjustment (tCO2/year)	Total Reference Level (tCO2/yr)
1	4,742,795	2,764,933	5,396,069	**12,903,797**
2	4,742,795	2,764,933	5,396,069	**12,903,797**
3	4,742,795	2,764,933	5,396,069	**12,903,797**
4	4,742,795	2,764,933	5,396,069	**12,903,797**
5	4,742,795	2,764,933	5,396,069	**12,903,797**
6	4,742,795	2,764,933	5,396,069	**12,903,797**

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, 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 57. 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,*	• 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*"

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 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[100], 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,[101] the main elements of the FRL were based on the FRL provided in the ER-PIN presented to the Carbon Fund in June 2014.[102] 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.[103] The proposed adjustment for planned deforestation was also

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

[101] CN-REDD/ Congo, 2015. Draft excel spreadsheet with initial calculations of the FRL. Version June 2015

[102] 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

[103] 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.

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[104] 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;
- 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

[104] CN-REDD. 2016. Budget for activities in fiscal year 2017

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[105] and February 2016[106] various consultations between CN-REDD, FAO, and the FCPF took 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.

[105] FCPF. 2016. Meeting minutes on the meeting for ensuring consistency between the national and sub-national FRLs

[106] CN-REDD. 2016. Meeting minutes of the ER-PD validation workshop held in the Brazzaville, 1-3 February 2016

The ER-Program is currenty working to align the results of the ER-Program's FRL with the national level GHG inventory, and the national level FRL is working to align itself with the results of the ER-Program FRL.

Table 58. Differences between Regional FRL and National FRL.

(dark green)	Regional and national levels are consistent
(light green)	The regional level is more complete or accurate or conservative than the national level
(orange)	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	-
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	CO_2	CO_2	-
Reference Period	2005-2014	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;	• the minimum area of 0.5 hectare; • The minimum height of 3 meters;	-

FRL Elements	ER-Program FRL	National FRL	Comments
	• tree crown cover Minimum rate of 30%	• tree crown cover Minimum rate of 30%	
Forest Types	Primary, Secondary, and 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	• Deforestation • 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			
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 counterveiling 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 59. Comparison of estimates of national FRL and ER-Program FRL for Sangha and Likouala.[107]

Component	National FRL[108]	ER-Program
GHG emissions in the Reference Period (2000/2005-2014) (tCO_2e/year)	**10,109,147**	**7,507,728**
Deforestation (tCO_2e/year)	2,437,198	4,742,795
Unplanned Degradation (tCO_2e/year)	19,991	2,764,933
Planned Degradation (tCO_2e/year)	7,651,959	
Adjustment (2015/2018-2023) (tCO_2e/year)	**15,365,129**	**5,396,069**
Unplanned Deforestation (tCO_2e/year)	0	-
Planned Deforestation (tCO_2e/year)	12,547,892	
Unplanned Degradation (tCO_2e/year)	0	-
Planned Degradation (tCO_2e/year)	2,817,236	
Total (tCO_2e/year)	**25,474,276**	**12,903,797**

Although the final estimates 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 are:

- Average historical emissions in the Reference Period:
  - Deforestation: 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. Moreover, the ER-Program has a reference period that is slightly moved towards a higher deforestation period. The same definitions have been used and the same team has collected the data.
  - 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.

[107] The adjustment for the ER-Program in this table is calculated for 2017-2024 for comparison purposes, and therefore is slightly different from calculations for the ER-PA period.

[108] The attribution to Sangha and Likouala of national GHG emissions was done for the ERPD as the national RL does not report per department.

- 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.).

How the RL informs the national GHG inventory

The Congo is currently in the process of revising its GHG inventory to be presented as part of its third National Communicaton. CN-REDD is currently in the process of ensuring that the latest information collected as part of the REDD+ process is used for the national GHG inventory. Since the ER-Program RL is informing the national FREL as indicated above, it is expected that the ER-Program RL will indirectly inform the national GHG inventory.

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.

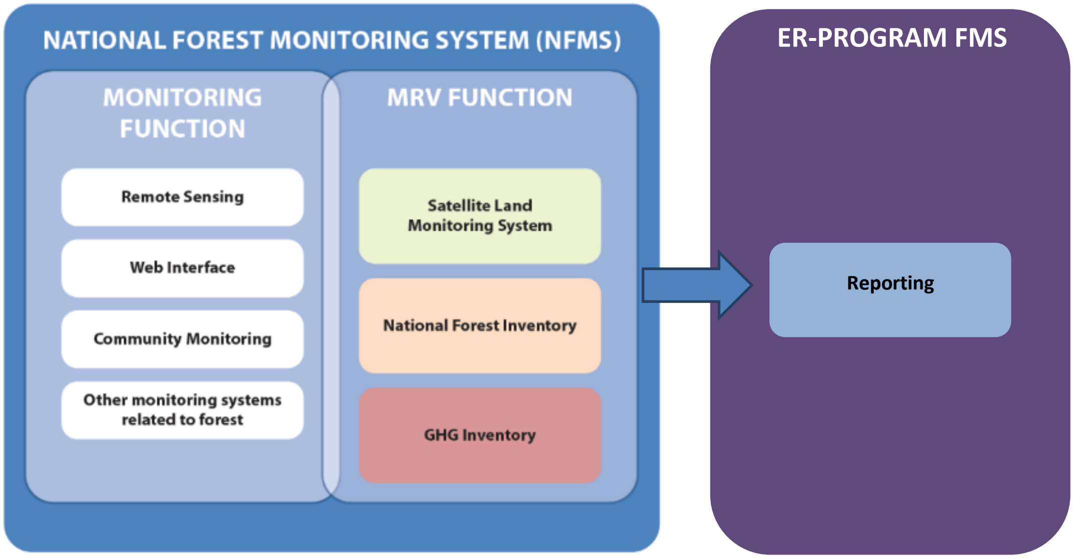


Figure 27. Overall structure of the NFMS

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 60. Parameters Measured for MRV

Activity Data		REDD+ activity
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

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:

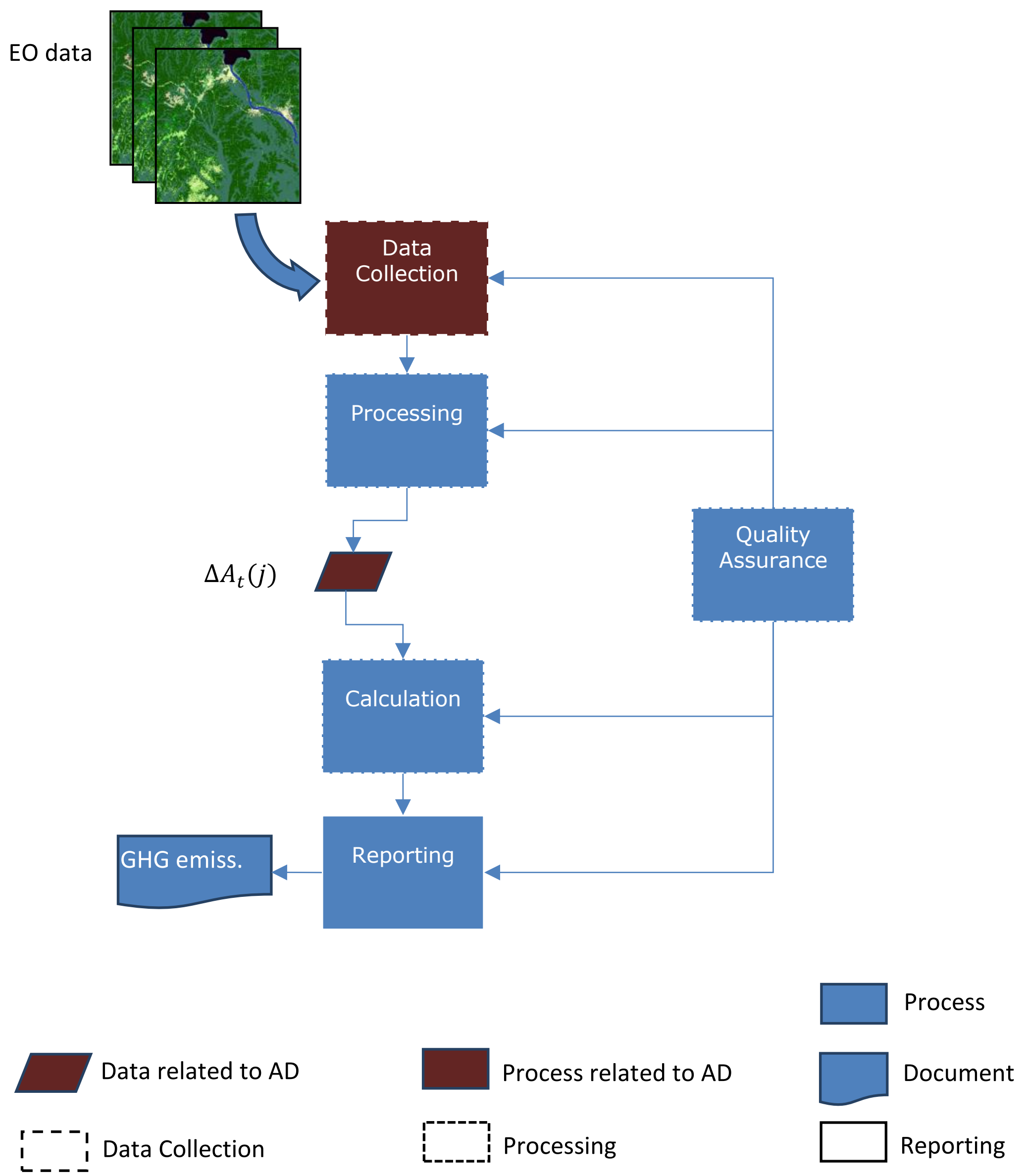


Figure 28. Process diagram of the FMS

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 61. 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 and sample reference data following the same methods used for the reference level.

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>Use of maps</td><td>Stratified estimator using forest cover change maps for stratification</td></tr>
<tr><td>Type of sensor</td><td>Landsat 8 or similar sensor</td></tr>
<tr><td>Assessment unit</td><td>0.09 ha square corregistered to the stratification map</td></tr>
<tr><td>Classification system</td><td>The following classification system of the maps:
• Deforestation ‘Terra firma’ forest
• Deforestation wetland forest
• Degradation ‘Terra firma’ forest
• Degradation wetland forest

The stratification map should ideally have these classes, plus a stable forest class and a non-forest class.</td></tr>
<tr><td>Positional accuracy</td><td>1 pixel</td></tr>
<tr><td>Thematic accuracy</td><td>Estimation of uncertainties of the AD at the 90% confidence level using estimates derived</td></tr>
</table></td></tr>
</table>

	from change detection accuracy assessment. Follow Olofsson et al. (2014)[109]
	Methods: The LULC maps will be produced following the same methods as described in Chapter 8 above 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.
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 classification protocol and the manual of interpretation. • Training: Training procedures in order to ensure that the staff that will collect the data or apply the procedures is dully trained; • QA: Staff not involved directly on the 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.
Identification of sources of uncertainty for this parameter	A description of sources of uncertainty in area estimates through remote sensing techniques may be found in GFOI (2014).[110]
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.

[109] 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.

[110] 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.

	This parameter will also be used to monitor GHG emissions from peatlands. These GHG emissions are not requied for accounting purposes by for reporting purposes.

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. GHG emissions from peatland draining will also be estimated, though not for accounting purposes, but reporting purposes. More information on the estimation and monitoring is provided below.

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_2e year^{-1}.
$\boldsymbol{RL}_{i,t}$	=	GHG emissions of the RL in REDD+ activity i in year t; tCO_2e 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,[111][112] will serve to define the conservativeness factor to be applied in order to define the amount set aside in the buffer reserve.

Table 62. 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%

111

112 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.

$$ER_{LU} = \sum_{i} \sum_{t}^{T} (RL_{i,t} - \Delta C_{LU,i} \times T) \times (100 - CF_i)/100 \quad \textbf{EQ 8}$$

Where:

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.

Peatlands

Methodological approach

The 2013 IPCC Wetland Supplement compiles the current knowledge on GHG accounting in wetlands and provides guidance and good practices in the estimation of GHG emissions from wetlands. This Supplement provides additional information to the 2006 IPCC GL for different types of wetlands, ranging from drained organic soils, rewetted organic soil, coastal wetlands, inland wetland mineral soils and other wetlands.

The comments from CFPs referred to the peatland soils present in the program area, which under the 2013 Wetlands supplement are considered as organic soils. Although removals and emissions occur naturally in wet organic soils or as part of change in management practices within wet organic soils, the main potential source of anthropogenic GHG emissions would be the conversion of wet organic soils to dry soils, i.e. water table is below its natural levels usually due to anthropogenic activities which control this. In this case, the applicable guidance may be found in Chapter 2 of the 2013 IPCC Wetlands Supplement related to drained organic soils.

According to Chapter 2 of the 2013 IPCC Wetlands Supplement, GHG emissions from drainage of organic soils can come from three sources: on-site emissions (CO2, CH4, N2O); off-site emissions either as dissolved organic/inorganic carbon (DOC, DIC) or particle organic carbon POC (CO2, CH4); emissions due to fire (CO2, CH4).

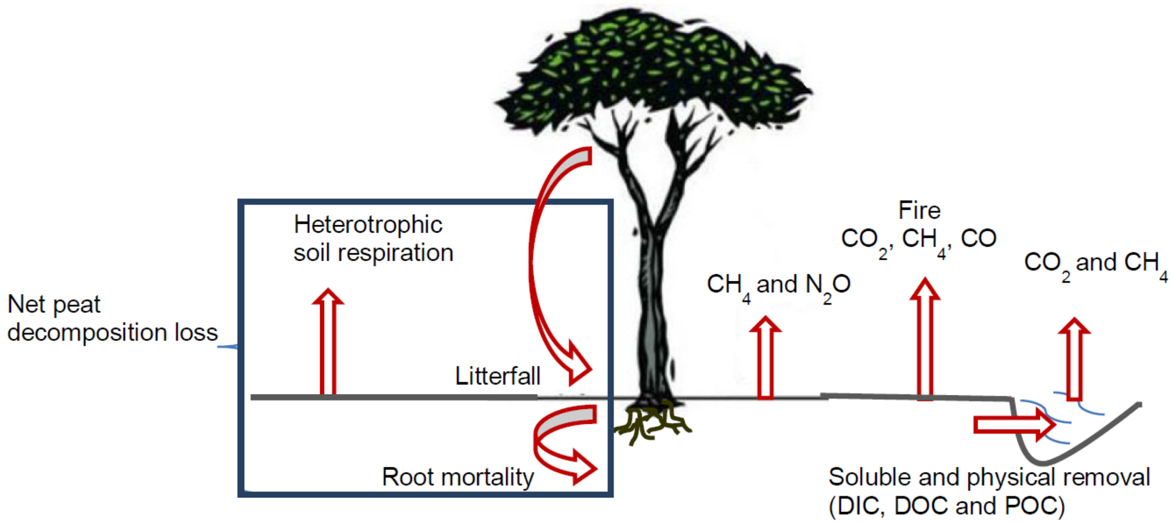


Figure 29. Figure from the 2013 IPCC Wetlands Supplement

The 2013 IPCC Wetlands Supplement provides guidance for achieving Tier 1, Tier 2 and Tier 3 for the main sources, except for the POC and the DIC for which the uncertainties are high.

	CO2	CH4	N2O	Inclusion under
On-site (primarily)	X	X	X	On-site CO2-C emissions can be important. The Wetlands Supplement provides guidance for Tier 1, Tier 2 and Tier 3.
Dissolved organic carbon	X			DOC represents the largest component of waterborne carbon export. The Wetlands Supplement provides guidance for Tier 1, Tier 2 and Tier 3.
Particulate organic carbon	?			At present available data is insufficient to derive default factors.
Dissolved inorganic carbon	?	?		At present available data is insufficient to derive default factors.
Burning	X	X		GHG emissions from fires represent the main potential source. The Wetlands Supplement provides guidance for Tier 1, Tier 2 and Tier 3.

Table 63. Scope covered by the 2013 IPCC Wetlands Supplement.

However, there is no Tier 2 data to quantify these GHG sources, so only Tier 1 data and methods may be used. Since Activity Data is also missing in terms of drainage, it is assumed conservatively that deforestation in wetland areas derive on drainage of soils and lowering of the water table. The following assumptions are made:

- SOC pool

    - Deforestation in wetland forests: Tier 1 methods and data were used in order to estimate emissions from the SOC pool.
    - Degradation in forests: Following the guidance of the 2006 IPCC GL, changes in SOC in forestland remaining forestland was assumed to be zero. Therefore it is assumed that degradation does not cause a loss in SOC.
- Non-CO2 emissions:
    - Deforestation in wetland forests: Tier 1 methods and data were used to estimate non-CO2 emissions.
    - Degradation in forests: It is assumed that degradation does not cause a lowering of the water table so these GHG emissions are zero.
    - Fires: It is assumed that emissions from fires is zero.

Calculation of GHG emissions

Using the above assumptions, it gives us the following emission factors for GHG emissions from peatlands.

Emission factor per gas	Value
EFCO2e (tCO2e/ha/year)	17.0
EFCH4-CO2e (tCO2e/ha/year)	0.147
EFCH4-CO2e (tCO2e/ha/year)	2
Emission factor (tCO2e/ha/year)	20

Multiplying by the activity data for the different subperiods and projecting these areas into the future, the result would be the following:

Year	Cumulative Activity Data (ha/year)	Emission factor (tCO2/ha/year)	GHG emissions (tCO2/year)
2003	301.92	19.59	5,915.28
2004	603.84	19.59	11,830.56
2005	905.76	19.59	17,745.85
2006	1,207.67	19.59	23,661.13
2007	1,509.59	19.59	29,576.41
2008	1,811.51	19.59	35,491.69
2009	2,113.43	19.59	41,406.98
2010	2,415.35	19.59	47,322.26
2011	2,717.27	19.59	53,237.54
2012	3,019.19	19.59	59,152.82
2013	3,019.19	19.59	59,152.82
2014	3,019.19	19.59	59,152.82
2015	3,019.19	19.59	59,152.82
2016	3,019.19	19.59	59,152.82
2017	3,019.19	19.59	59,152.82
2018	3,019.19	19.59	59,152.82
2019	3,019.19	19.59	59,152.82
2020	3,019.19	19.59	59,152.82

2021	3,019.19	19.59	59,152.82
2022	3,019.19	19.59	59,152.82
2023	3,019.19	19.59	59,152.82

59,000 tCO_2e/year represents a small fraction of GHG emissions of the Reference Level. Emissions will be measured against this reference level of 59,000 tCO_2e/year.

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 ME, 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.

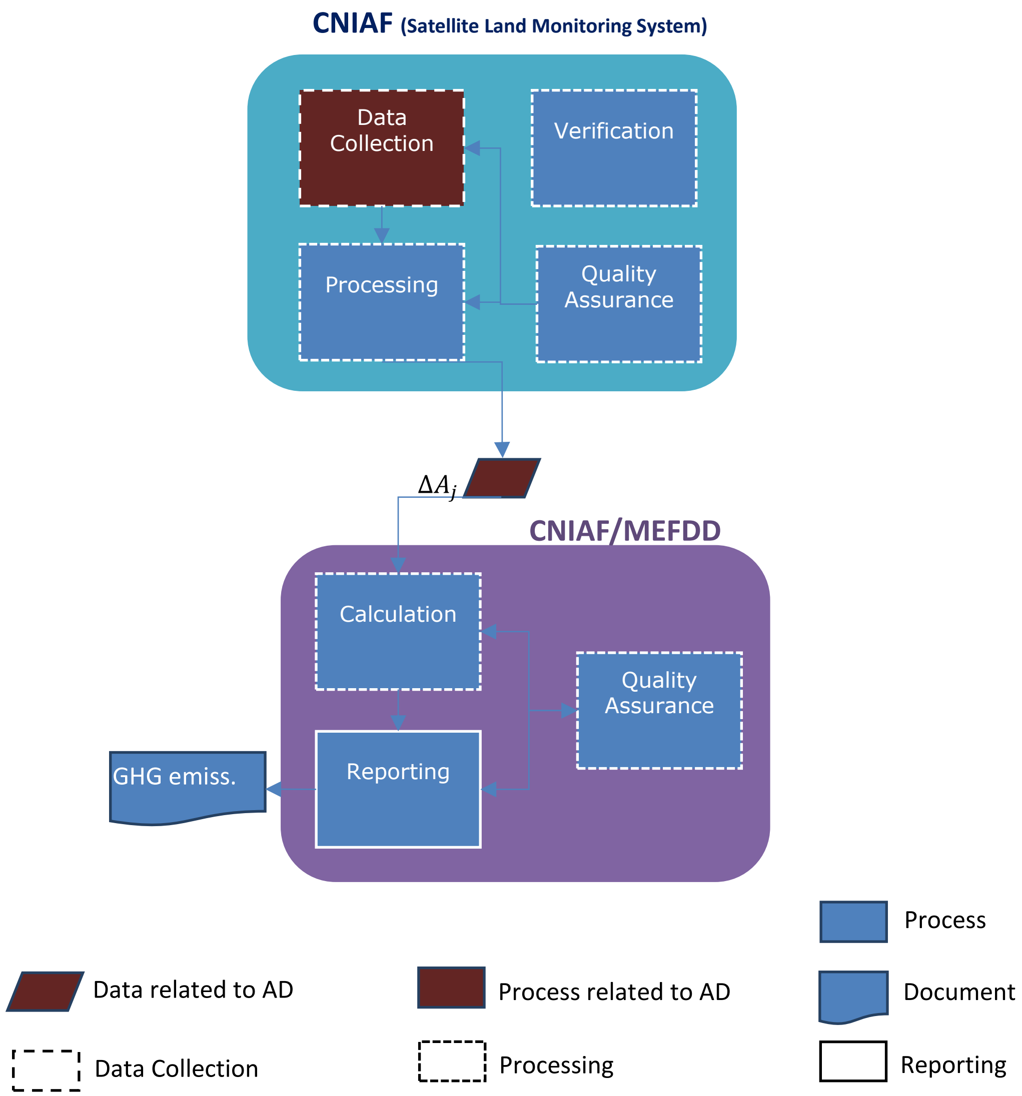


Figure 30. Data flows of the FMS system and responsibilities

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.

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.

However, Congo does not have financial resources in order to ensure the biennial monitoring. To secure this, the country is rellying on different funding sources:

- FCPF grant will be available through 2018;
- FAO will provide support to Congo with around 300,000 USD per year, mostly through human resource support;
- FAO has submitted to the GCF a readiness proposal that includes support for the institutionalization of MRV;
- The US Department of State is financing a climate fellow who will support the implementation of MRV and will be able to finance some activities.

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 64. 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 alternative livelihoods	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. As it is not accounted for in the context of the United Nations Framework Convention on Climate Change (UNFCCC) and often considered negligible,

Displacement Category	Type	Description
	NOT INCLUDED	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 65 identifies for each of the ER-Program Measures the associated risk for Displacement (Indicator 17.1), with risk mitigation strategies included in Table 66 (Indicator 17.2).

Table 65. 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 and planted in oil palm beyond that which is	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 unlikely to cause them to increase production outside the ER-Program Areas (PL-NGC).

REDD Measures	Driver of deforestation or degradation	Risk of Displacement (L, M, H)			Explanation / justification of risk assessment
		PL-GC	PL-NGC	SL-M	
	legal and biophysically suitable. This may impact the amount of palm oil that they can produce.				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 66. 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 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 a 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%**

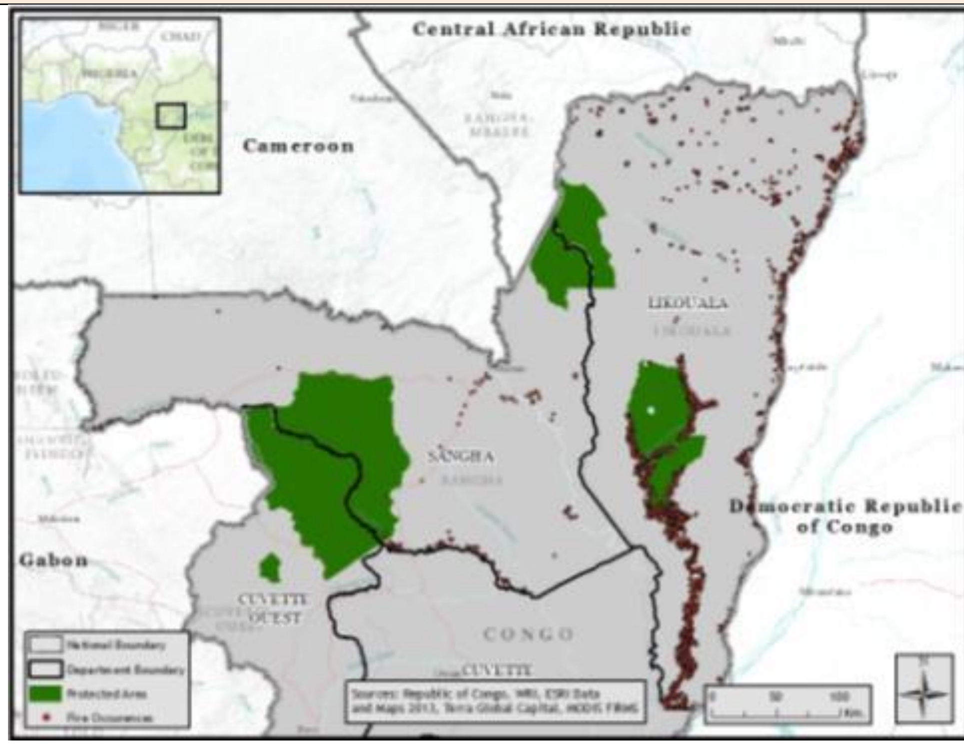
Risk Factors	Chosen Risk Indicators	Discount (increment)	Resulting Reversal Risk Set-Aside %
D. **Exposure and vulnerability to natural disturbances**	**Indicator D.1:** Is natural wildfire is present in the Accounting Area significantly threatening the ER-Program through the loss of the accumulated 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*[113]*, 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*[114]*. Over the previous decade, a persistent drought throughout the Congo Basin has increased vulnerability to large wildfire events.*[115] *Historical data suggests a severe drought return internal of roughly 30 years.*[116] *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 below) 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%**

[113] 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

[114] 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.

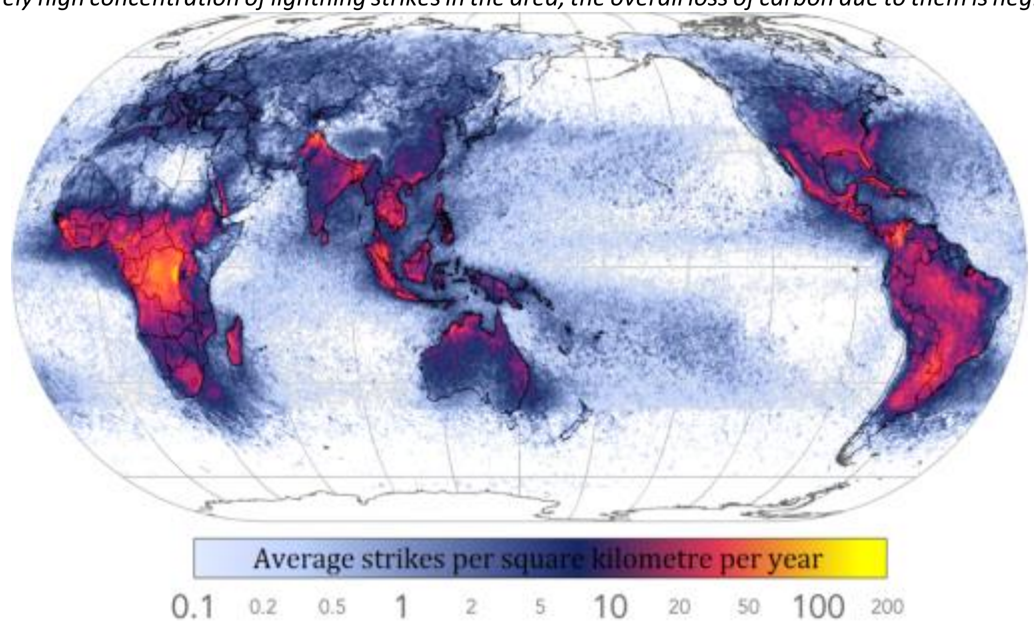
[115] Zhou, Liming; Tian, Yuhong; Myeni, Ranga; Ciais, Phillipe; Saatchi, Sassan; Liu, Yi; Piao, Shilong; Chen, Haishen; Vermote, Eric; Song, Conghe; Hwang, Taehae. 2014. Widespread decline of Congo rainforest greenness in the past decade. *Nature* 509: 86-90.

[116] 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.

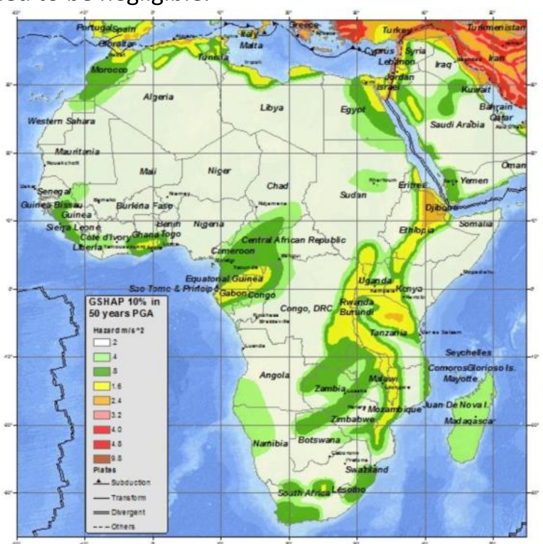
Risk Factors	Chosen Risk Indicators	Discount (increment)	Resulting Reversal Risk Set-Aside %
D. Exposure and vulnerability to natural disturbances (CONTINUED)	 Figure 31. Fire Occurrences Between 2005-2015 (Source: Terra Global Capital, MODIS FIRMS Archive Data)		

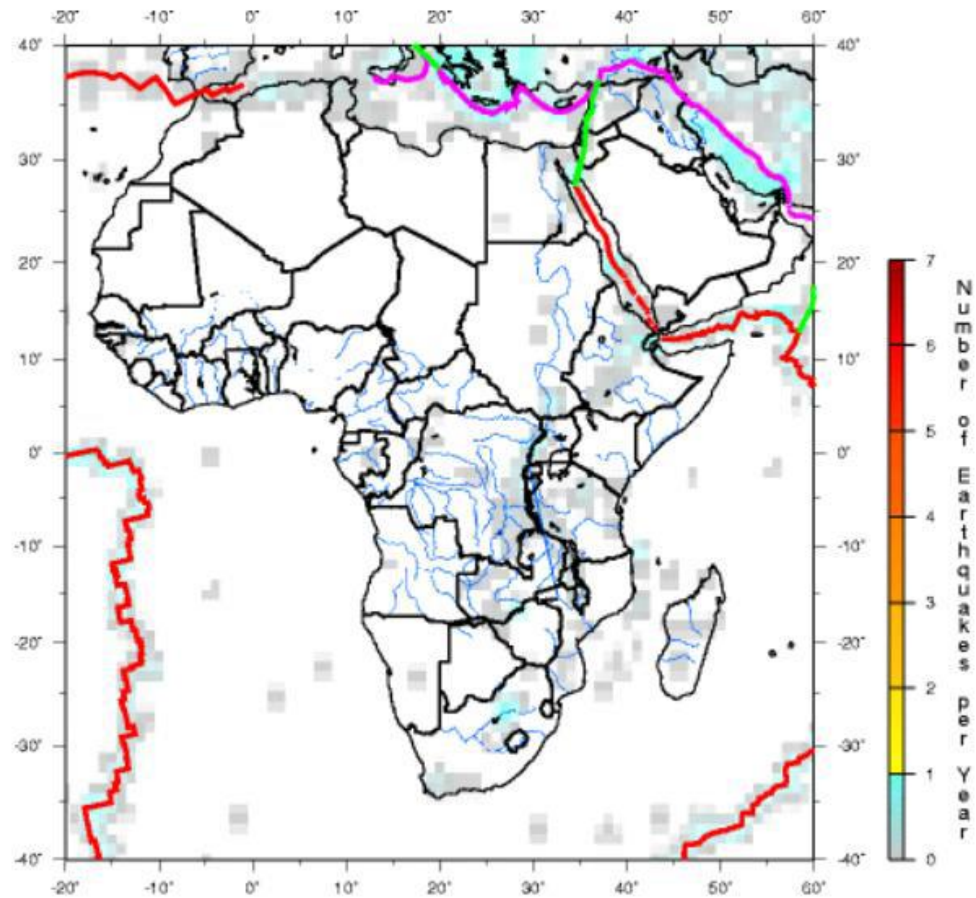
Risk Factors	Chosen Risk Indicators	Discount (increment)	Resulting Reversal Risk Set-Aside %
D. Exposure and vulnerability to natural disturbances (CONTINUED)	**Indicator D.2:** Do forest insects and disease present in the Accounting Area significantly threaten the ER-Program through the loss of the 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.[117]		

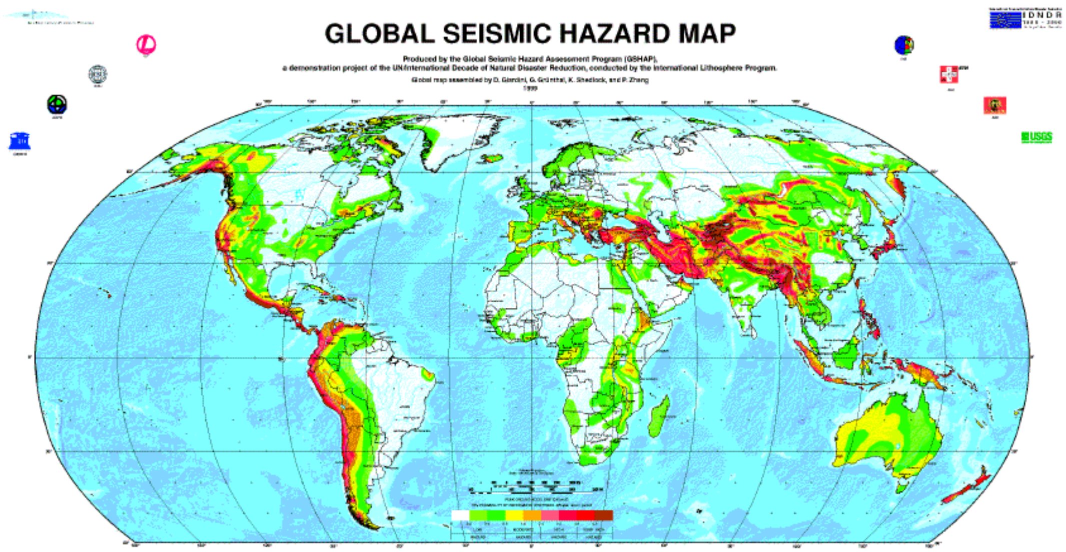
[117] U.N. Food and Agriculture Organization (FAO). 2009. Global review of forest pests and diseases: a thematic study prepared for the framework of the Global Forest Resources Assessment 2005.

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 32*). 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 32. Global Lightning Strikes (Source: Lightning Imaging Sensor)**		

Risk Factors	Chosen Risk Indicators	Discount (increment)	Resulting Reversal Risk Set-Aside %
D. Exposure and vulnerability to natural disturbances (CONTINUED)	*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 33*). 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 33.Flooding-Prone Wetlands and Rivers in Likouala and Sangha**		

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 34 and Figure 35). 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. 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 34. 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 35. 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 67. 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 ER-Program includes the following measures to manage the risk of reversals described in Chapter 11.1:

Broad and sustained stakeholder support:

- Continuation of stakeholder consultations throughout ER-Program implementation. There is budget foreseen for consultations and communication for 2018 under the FCPF readiness grant. Thereafter, costs to maintain stakeholder engagement have been budgeted in the operational costs of ER-Program management (see Annex 1).
- The FIP will also include resources to support stakeholder outreach at all levels.
- The CODEPA REDD will be strengthened to fulfill their role at departmental levels to inform and consult stakeholders as well as to prevent and manage conflicts related to the implementation of the ER-Program. Respective capacity building measures will be supported through the World BBank IDA “Integrated Public Sector Reform Project” (see Chapter 6.1).

Long-term effectiveness in addressing underlying drivers:

- The ER-Program is composed of enabling and sectoral activities to promote transformational change. In particular, the various enabling activities target underlying drivers of deforestation (see Table 9).
- The Republic of Congo has developed its National REDD+ Investment Plan, which identifies priority investments to address direct as well as underlying drivers of deforestation in the country. Enabling programs in the investment plan include, among others, land use planning and governance. A consultation process is ongoing to define steps to secure the long-term implementation of the investment plan (e.g. CAFI funding, proposal to Green Climate Fund - GCF).
- In this context, it is important to note that the ER-Program is not implemented in isolation but embedded into the national REDD+ approach.
- The Republic of Congo has integrated the national REDD+ strategy into the new NDP, which is currently being prepared. This political commitment and integration into national development planning is key to ensure long-term effectiveness in addressing underlying drivers of deforestation.

Institutional capacities and/or ineffective vertical/cross sectoral coordination:

- The ER-Program entails a capacity building strategy and has secured financial resources to strengthen capacities during ER-Program implementation (see Chapter 6.1).
- The partition of CONA-REDD into a Ministerial and a Technical Chamber has been decided precisely to promote cross-sectoral coordination. Efforts are underway to revise and formalize the respective REDD+ decree.

11.3 Reversal Management Mechanism

Table 68. 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. The buffer credits will be transferred at least one year prior to the end date of the ER-PA to a designated risk management mechanism administered by the ER-Program to ensure continuity of risk mitigation and prevent reversals beyond the ER-PA time frame.

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 a reversal event occurs, within 90 calendar days (Indicator 21.2) the program entity will produce a reversal report and will submit it to the Carbon Fund. The reprt will include the following information:
  - A conservative estimate of potential reversals;
  - The potential emission reductions to put on-hold on the non-permanence buffer account until the upcoming verification.
- 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.

12 UNCERTAINTIES OF THE CALCULATION OF EMISSION REDUCTIONS

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).[118] 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 REL activity data in terms of land cover and land use change included development of wall-to-wall mosaic for each year.
- **Google Earth Landsat Processing:** Uncertainty associated with the lack of data 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-

[118] 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.

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 **Error! Reference source not found.**). We made use of cloud-free Landsat mosaic imagery for the period of 2000-2003 before the starting date to replace pixels with any remaining residual effects of clouds and SLC. This process provided improved imagery for the activity data without introducing any errors in the results. We followed the same approach for developing the mosaic for the year 2012. The use of earlier cloud free pixels in 2003 and 2012 image mosaics will potentially reduce the number of deforestation and degradation throughout the reference period and provide a relatively conservative estimate of activity over the program domain.

- **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 segmented as degraded. The segmentation process was modified to allow for a minimum seven pixels (area of each pixel is 0.077 ha) 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 (**Error! Reference source not found.**) 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.*

Random & Systematic Errors

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.

Sources of uncertainty 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 (**Error! Reference source not found.**).
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 was 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.

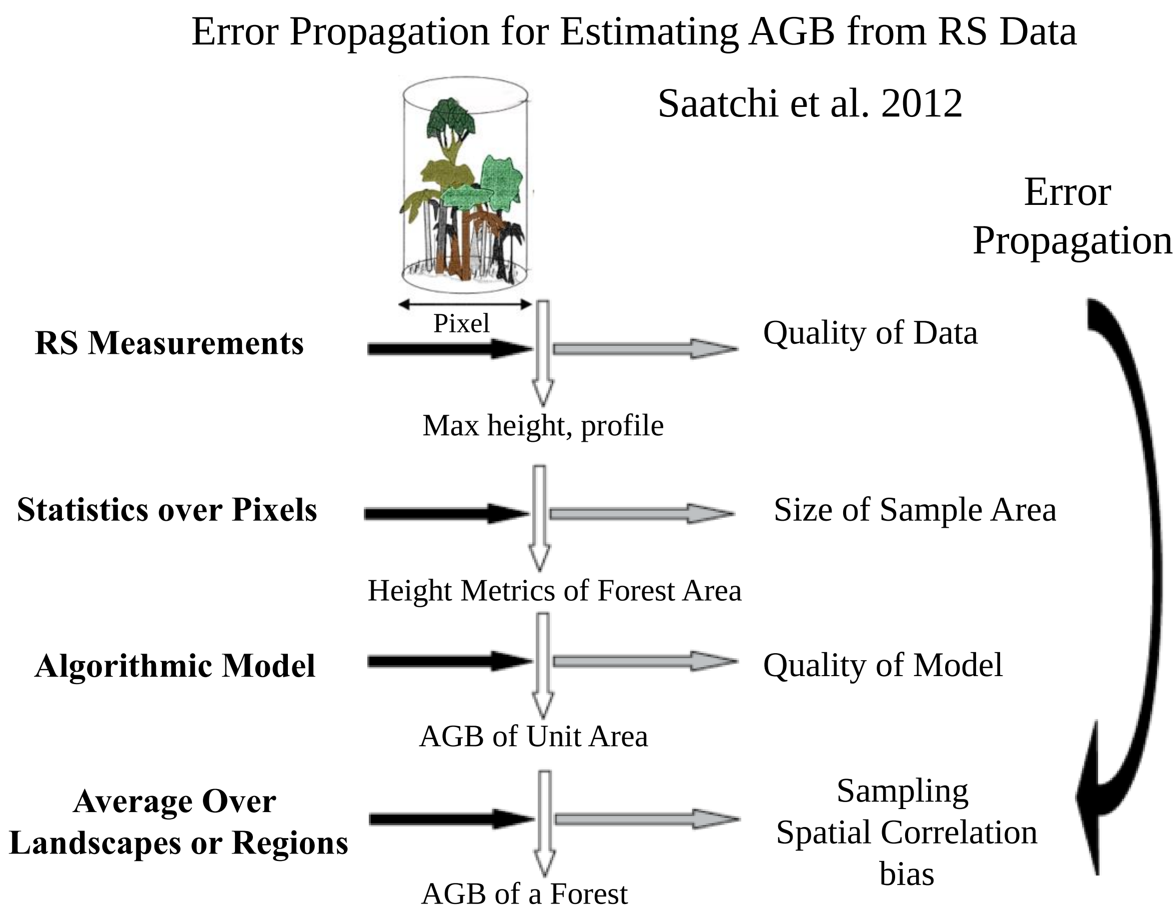


Figure 36. Schematics showing the sources of uncertainty in remote sensing estimation of AGB and the process of error propagation for uncertainty assessment

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 is: 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 is 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 mode 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 autocorrelation length is evaluated using semi-variogram methodology and is shown to be at the order of 20-50 km depending on forest types. 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 (**Error! Reference source not found.**).

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 (**Error! Reference source not found.**).

12.2 Quantification of Uncertainty in Reference Level Setting

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 using the Tier 1 method of the 2006 IPCC GL, i.e. propagation of uncertainties. The following equations were used for addition or multiplication.

For addition:

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

Where:

U_i= percentage uncertainty associated with each of the parameters

x_i= the value of the parameter

U_{total}= the percentage uncertainty in the sum of parameters

For multiplication:

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

Where:

U_i= percentage uncertainty associated with each of the parameters

x_i= the value of the parameter

U_{total}= the percentage uncertainty in the sum of parameters

Quantification of uncertainty of activity data

As indicated in section 8, a sampling based approach was used in order to estimate the activity data of deforestation and forest degradation for the 2003-2012 period and the 2013-2016 periods.

Table 69. Statistical results of activity data for the period 2003-2012

Statistic	Deforestation	Deforestation_Wetland	Degradation	Degradation_Wetland	Forest
Relative margin of error 90%	47%	117%	17%	116%	1%
Estimated area (ha)	83,571	3,019	116,521	2,894	11,634,505
Confidence interval	44315 - 122827	-499 - 6537	96238 - 136804	-458 - 6247	11533344 - 11735666
Activity Data (ha/year)	8,357	302	11,652	289	11,634,505

Table 70. Statistical results of activity data for the period 2013-2016

Statistic	Deforestation	Deforestation_Wetland	Degradation	Degradation_Wetland	Forest
Relative margin of error 90%	57%	-	46%	165%	1%
Estimated area (ha)	57,781	0	86,673	7,065	11,053,883
Confidence interval	24887 - 90676	0 - 0	46493 - 126854	-4561 - 18690	10912528 - 11195238
Activity Data (ha/year)	14,445	0	21,668	1,766	11,053,883

The presented relative margin of errors is high for deforestation an degradation of ‘terra firme’ forest mainly due to the very low deforestation and degradation observed in the region of interest. Reducing the relative margin of error would require a very significant sample size. The uncertainty of the 2005-2014 activity data was estimated through the IPCC equations for propagation of uncertainty. The result was as follows:

		2005-2014 (ha/year)	Relative margin of error at 95%
Deforestation	Forest terre ferme	9,574.8	37%
	Forest Wetland	241.5	117%
Degradation	Forest terre ferme	13,655.4	19%
	Forest Wetland	584.8	109%

Quantification of uncertainty of 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[119].

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)

$$\sigma_A = 0.34 < AGB >$$

[119] Efron, Bradley; Tibshirani, R.J. An introduction to Bootstrap. New York: Chapman and Hall, 1993.

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:

$$\sigma_M = <AGB> \left[\alpha^2 \frac{\sigma_D^2}{D^2} + \beta^2 \frac{\sigma_H^2}{H^2} + \delta^2 \frac{\sigma_\rho^2}{\rho^2} + 2\alpha\beta \frac{\sigma_{DH}}{DH} \right]^{1/2}$$

$$\alpha = \frac{\partial \ln(f)}{\partial \ln(D)}, \quad \beta = \frac{\partial \ln(f)}{\partial \ln(H)}, \quad \delta = \frac{\partial \ln(f)}{\partial \ln(\rho)}$$

$$f = a\rho D^2 H$$

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:

$$AGB_{est} = \overline{\exp\left[a + b\ln(WDh_{TCH}) + \varepsilon\right]} = \overline{\exp(\varepsilon)} \times \exp\left[a + b\ln(WDh_{TCH})\right]$$
$$\text{where}$$
$$\overline{\exp(\varepsilon)} = \int \exp(\varepsilon)N(\varepsilon)\,d\varepsilon \;\text{ with } N(\varepsilon) = N(0,\sigma^2)$$
$$\overline{\exp(\varepsilon)} = \exp(\sigma^2/2)$$
$$\text{then}$$
$$AGB_{est} = \exp\left[\sigma^2/2 + a + b\ln(WDh_{TCH})\right]$$

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 derived from NFI data for each land cover types.

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.

We can then calculate the total uncertainty in estimating AGB, assuming all errors were independent, by using the following error propagation model.

$$\varepsilon_{AGB} = \sqrt{\varepsilon^2_{measure} + \varepsilon^2_{allometry} + \varepsilon^2_{sampling} + \varepsilon^2_{prediction}}$$

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.

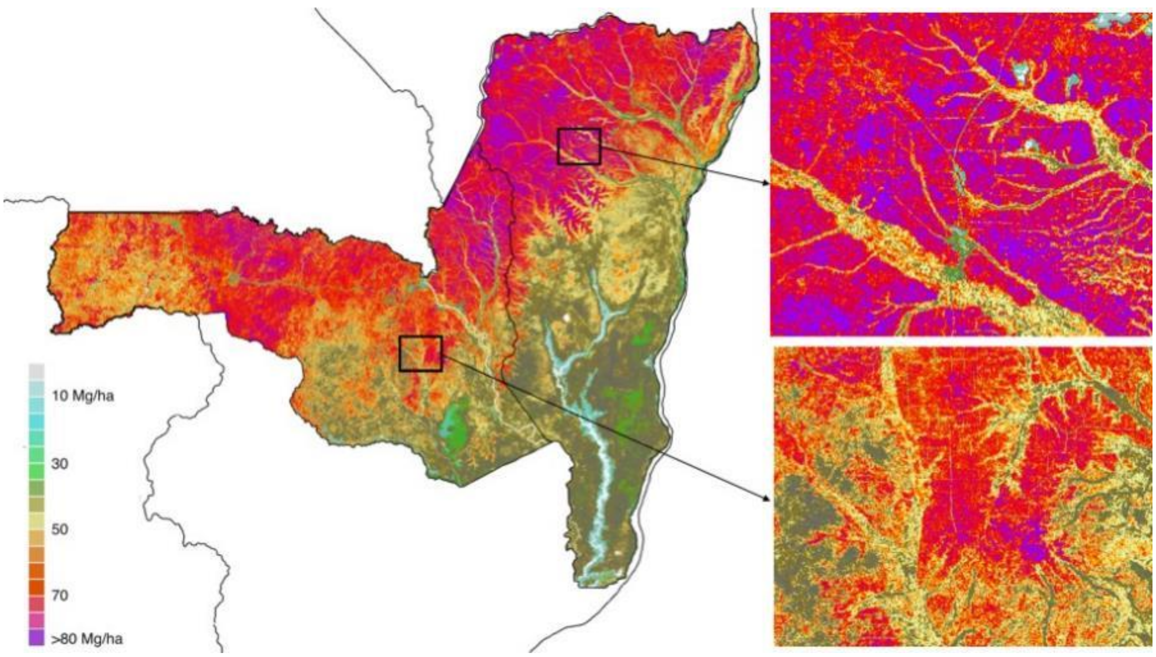


Figure 37. Spatial distribution of biomass estimation error at the pixel level in terms of Mg/ha at 95% confidence interval and including all sources of errors.

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. In the current case it was assumed that all pixels are correlated, so a conservative estimate of uncertainty was estimated based on these pixel values.

The results are provided in the following table:

Table 71. Uncertainties of emission factors

Class	Changes in carbon stocks (tC/ha)	Relative margin of error at 95%
Deforestation 'terra firma'	133.13	29%
Deforestation wetland forest	77.65	30%
Degradation 'terra firma'	50.40	29%
Degradation 'wetland forest	44.92	35%

Accounting for systematic errors in Emission Factors

To further examine the uncertainty in emissions factors and the potential presence of any systematic errors in the results, two sets of analysis were performed: 1) assessment and correction of systematic errors in spatial patterns of biomass map associated with the machine learning algorithm, and 2) assessment and correction of systematic errors associated with the final product when compared with the national inventory data.

1. To demonstrate the errors of the spatial prediction, 30% of GLAS LiDAR data selected randomly from the original data were set aside to examine if the errors were bounded and there were any spatial systematic errors.

2. To assess the overall systematic errors in emission factors and provide an unbiased estimate, the IFN data were used for comparison with pixel level biomass from the map. The analysis was performed by extracting the predicted biomass of the map (1-ha) for the location of each IFN sub-plot (0.5 ha) and by developing a model for the bias correction (Annex 7).

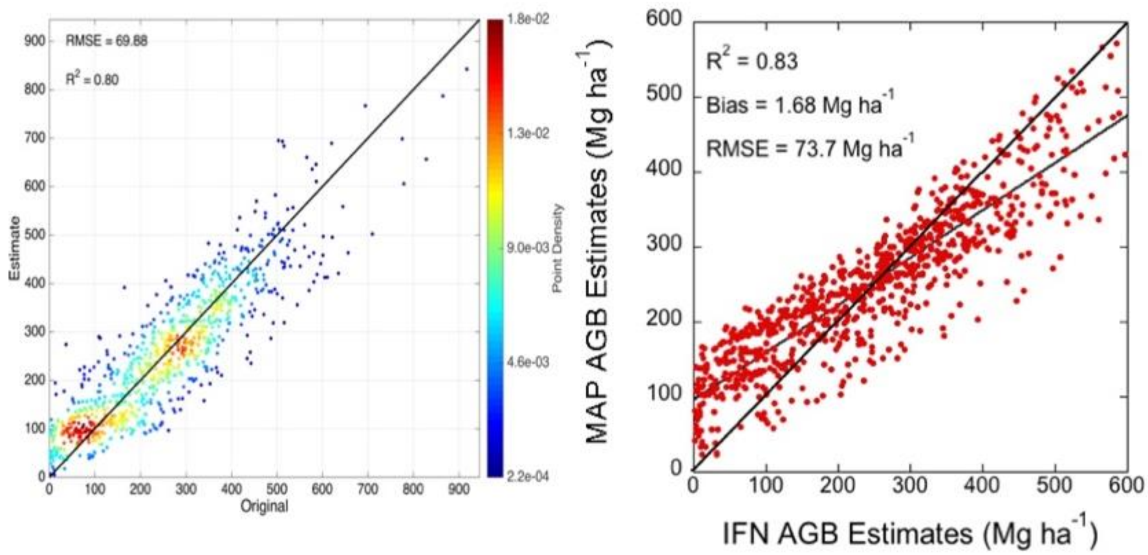


Figure 38. Validation of geospatial AGB estimation using 30% of the original LiDAR samples (left panel) and comparison of the IFN estimates of the biomass at the sub-plot basis with estimates from the map showing the effect of dilusion bias for before bias correction.

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. This bias was corrected to a large extent using the methodology (Xu et al. 2016)[120]. Three statistical measures were used to evaluate the results of this analysis: the coefficient of determination (R^2), the root-mean-square error (RMSE), and the mean signed deviation (MSD) for systematic error. For quantifying the systematic errors spatially and to account for the dilusion bias, in addition to MSD over all test samples, two additional MSD measures for both low AGB (MSD1) and large AGB values (MSD2) were calculated and used in the bias correction algorithm.

Uncertainties of the Reference Level

The uncertainties of the REL were calculated following the approach 1 of IPCC (2006) using the propagation of error method. Confidence intervals were assumed to be symmetrical in all cases. Two uncertainties were calculated for activity data and emissions factors before assessing global uncertainty related to the REL.

Table 72. relative margin of errors at 95% of historical emissions and future emissions. Relates to the estimates provided in Table 52

Year	Emissions during reference period 2005-2014	Emissions deforestation 2013-2016	Emissions degradation 2013-2016	Adjustment based on population growth	Adjustment considering addition forestry concessions	Ajustement considering oil palm plantations	Adjusted GHG emissions
2003	32%						
2004	32%						
2005	32%						
2006	32%						
2007	32%						
2008	32%						
2009	32%						
2010	32%						
2011	32%						
2012	32%						
2013		64%	52%				
2014		64%	52%				
2015		64%	52%				
2016		64%	52%				

120 Xu, L., Saatchi, S. S., Yang, Y., Yu, Y., & White, L. (2016). Performance of non-parametric algorithms for spatial mapping of tropical forest structure. *Carbon Balance and Management*, *11*(1), 18.

2017		64%	52%				
2018		64%	52%	47%	41%	29%	39%
2019		64%	52%	47%	41%	29%	39%
2020		64%	52%	47%	41%	29%	38%
2021		64%	52%	47%	41%	29%	37%
2022		64%	52%	47%	41%	29%	37%
2023		64%	52%	47%	41%	29%	36%

Since GHG emissions are capped, the uncertainty of the cap should be considered too. The uncertainty of the cap is provided in Table 54, and is equal to 29% at 95% confidence level. Considering the uncertainty of GHG emissions in the reference period, i.e. 32%, the resulting uncertainty of the reference level is 22% considering historical GHG emissions and cap.

Table 73. Uncertainties of the reference level based on the adjusted emissions or historical emissions + cap. 90% relative margin of error has been estimated by multiplying by 1.67 and dividing by 1.96

	Relative margin of error at 95%	Relative margin of error at 90%
Uncertainty of adjusted emissions	36-39%	30-33%
Uncertainty of historical emisisons + cap	22%	18%

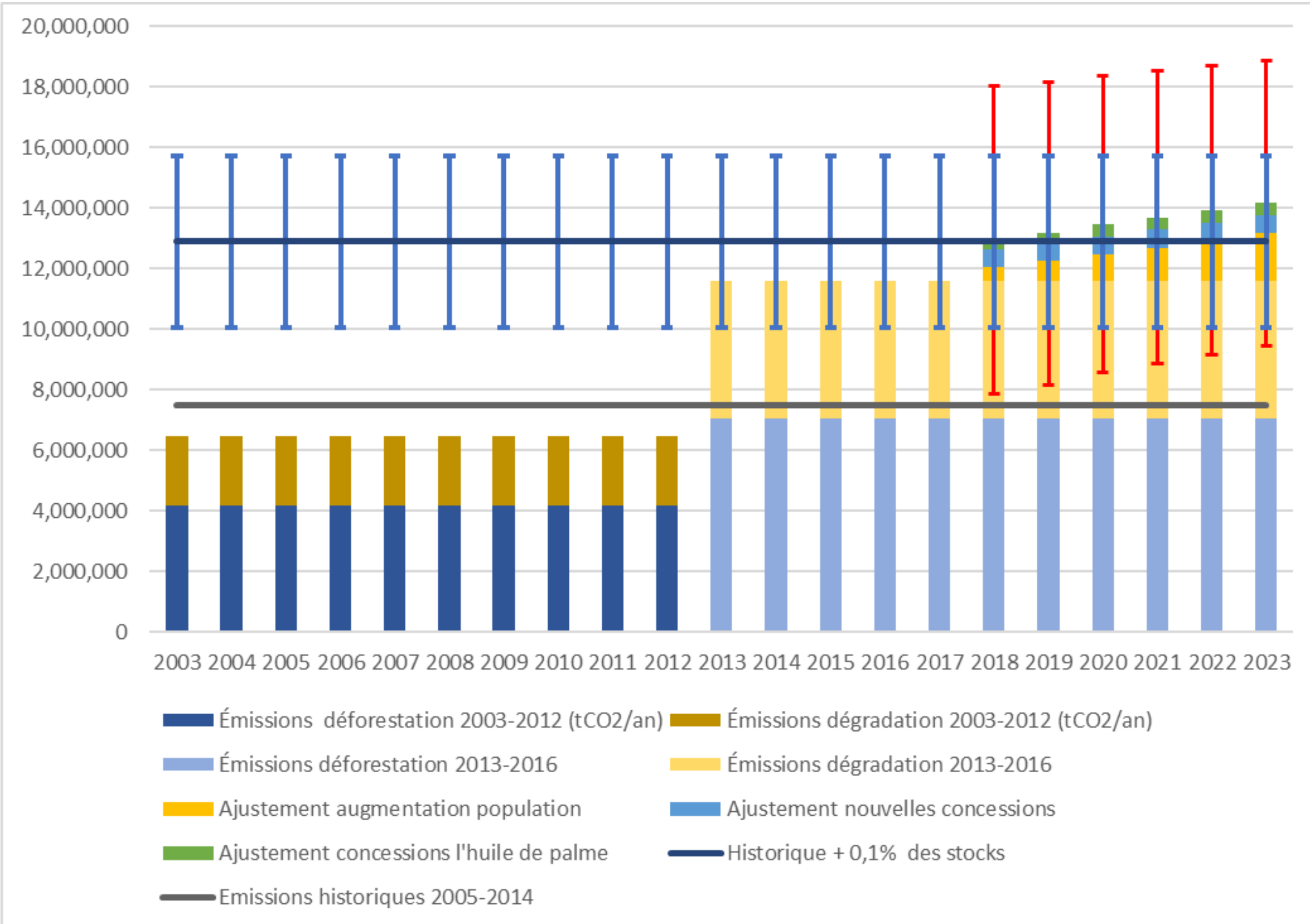


Figure 39. Error bars for both cases. Red is based on the uncertainty of adjusted estimates. The blue are for the reference leve which is based on uncertainty of historical emissions and the cap.

Based on the conservativness factors of the MF shown in Table 62, the conservativeness factor should be 4% or 8% depending on the method used. We are going to retain the most conservative method, so 8% is retained. This is also logical as it is expected that uncertainty of emission reductions will be higher.

Uncertainties of the Emission Reductions

During monitoring events, ER and associated uncertainties will be calculated. To comply with FCPF MF requirements, indicator 9.2, those uncertainties will be quantified using a Monte Carlo analysis (approach 2 of IPCC). As described in IPCC (2006)121, the following steps will be realized (illustrated in the Figure below):

- The different parameters to which uncertainties are associated will be identified and corresponding Probability Density Functions (PDF) will be defined (for activity data and carbon stocks, data distribution is usually normal) with mean and standard deviation;
- For each of these parameters, random values (at least 10,000) will be generated following the shape of PDF;
- Emissions will be calculated from those random values, for the same number of values, and, mean and uncertainties (90% CI) will be calculated from these estimations;
- The process will be repeated until mean and uncertainties of emissions remain stable

[121] *Vol 1, Chapter 3 - Uncertainties*

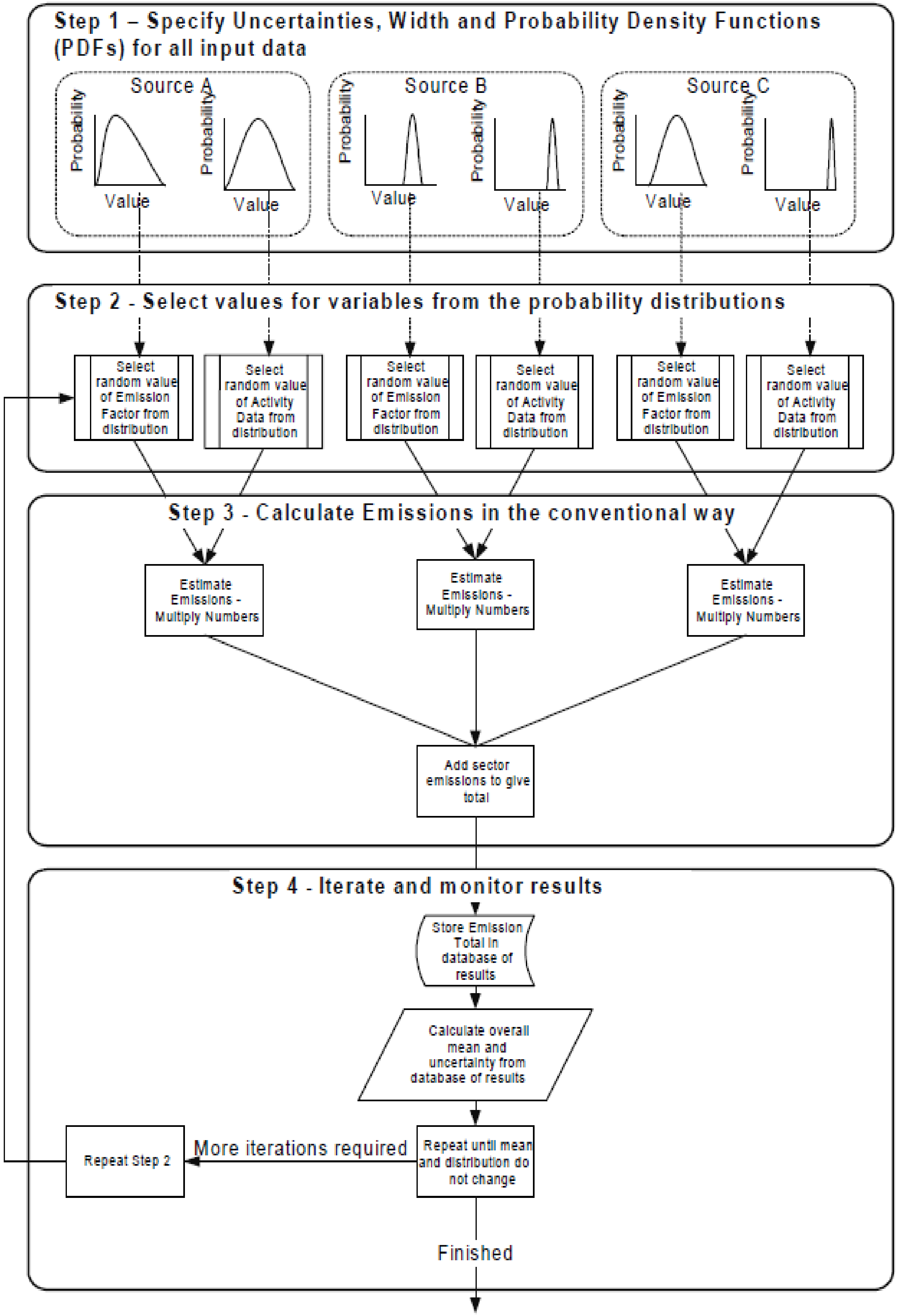


Figure 40. Steps to quantify uncertainties using a Monte Carlo analysis

13 CALCULATION OF EMISSION REDUCTIONS

13.1 Methodology to Estimate Ex-Ante Emission Reductions

The calculations of the ER Potential are based on the REL with capped adjustment. Different implementation hypotheses 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 74. Rationale and hypothesis of ER ex-ante estimation for all mitigation activities

Activity	Data	Implementation level hypothesis
Reduced Impact Logging (RIL)	Historical deforestation and degradation with capped adjustment in Forest production areas	5 concessions (among which 4 already FSC certified) practice full RIL from year 1 2 new concessions per year until year 5 3 intensity levels for RIL are considered for the different companies: reduction of 50%, 30% and 15% of the baseline emissions
Logged to Protected Forest (LtPF)	Historical deforestation and degradation with capped adjustment in Forest production areas	1 concession already converted in conservation concession (Pikounda Nord)
Reduction of Forest Conversion from Industrial Palm (HCVPalm)	Historical deforestation and degradation with capped adjustment in Palm concession	Eco-Oil, Atama, Sembe: From Year 1, +10% per year of the forested area set-asided in conservation
Smallholder shade cocoa in Community Development Zones **Palm Outgrower Schemes in Community Development Zones** **Sustainable agriculture and others livelihoods activities**	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, approx. 30% of the farmers of the

Activity	Data	Implementation level hypothesis
Smallholders Conservation Payments	Historical deforestation and degradation with capped adjustment in unplanned areas (protected area, forest concession non production area, unattributed areas)	program area will be engaged in program activities after a 5-year period. We assume that it will reduce the deforestation and degradation in 30 % of the forested area in unplanned area with an 80% efficiency.

13.2 Ex-ante Estimation of the ERs

To estimate potential net ERs, the following set-asides were determined in line with the findings of Sections 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 below to 30% which indicates that a set aside of 4 should be used. Since this uncertainty refers to the RL, it is assumed that the ERs uncertainty will be above 30% and hence a **set-aside of 8%** (i.e. applicable to overall uncertainties from 30%) is assumed.

The table below presents ER ex-ante estimations per activity. **The ER-Program may generate 10.2 million tCO_2e net emission reductions during the ER-PA term.**

Table 75. ER ex-ante estimation per activity

ER ex-ante estimation per activity							
	Reduced Impact Logging (RIL)	Logged to Protected Forest (LtPF)	Reduction of Forest Conversion from Industrial Palm (HCVPalm)	Smallholders program	Gross ERs (tCO_2e/yr)	Set-aside of ERs Risks and uncertainty	Net ERs (tCO_2e/yr)
1	1,139,459	59,455	78,106	131,724	1,408,744	410,790	997,954
2	1,433,015	59,455	117,159	145,008	1,754,637	511,652	1,242,985
3	1,567,728	59,455	156,211	286,892	2,070,287	603,696	1,466,591
4	1,701,108	59,455	195,264	775,339	2,731,167	796,408	1,934,759
5	1,728,353	59,455	195,264	1,033,786	3,016,859	879,716	2,137,143
6	1,728,353	59,455	234,317	1,128,583	3,150,709	918,747	2,231,962
7	1,728,353	59,455	273,370	1,128,583	3,189,761	930,134	2,259,627
8	1,728,353	59,455	312,423	1,128,583	3,228,814	941,522	2,287,292
9	1,728,353	59,455	351,476	1,128,583	3,267,867	952,910	2,314,957
10	1,728,353	59,455	390,528	1,128,583	3,306,920	964,298	2,342,622
6-years total	**9,298,017**	**356,731**	**976,321**	**3,501,332**	**14,132,402**	**4,121,008**	**10,011,394**
10 years total	**16,211,431**	**594,552**	**2,304,118**	**8,015,664**	**27,125,765**	**7,909,873**	**19,215,892**

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) has been conducted in an iterative way together with the finalization of the national REDD+ strategy with participation from civil society and other stakeholders. The final SESA report, will be publically available in February 2018 on the FCPF website. In the context of the SESA process, RoC has also developed the following safeguard instruments:

- Environmental and Social Management Framework (ESMF)
- Pesticides management framework,
- Cultural heritage management framework,
- Indigenous Peoples planning framework,
- Process framework, and
- Resettlement policy framework.

National stakeholders validated the safeguard instruments in January 2017. The comments made during the validation workshop are currently being incorporated in the documents. The final versions of all safeguard instruments are expected in February 2018 and will be available on the FCPF website. Subsequently, the safeguard instruments will undergo the clearance process of the World Bank.

The ESMF and sub-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. The ER-Program has served as a practical example in the SESA process and for the development of the safeguard instruments

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 10. 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+ have been an important reference document throughout the SESA process and are formally referenced in the annex of the ESMF.

The safeguards instruments as well as the PCI REDD+ will be formalized in RoC's legal REDD+ framework for any REDD+ project or program to comply with. The formalization will take place through the revised Forest Code and its legislative regulations. The ER-Program's intervention strategy has been developed in alignment with the national REDD+ strategy and will apply the safeguards instruments developed at national level. Specifically, for the ER-Program, the CN-REDD has prepared an initial risk analysis and development of a mitigation strategy on social and environmental aspects related to ER-Program activities in conjunction with the SESA consultations and ESMF development. The risk analysis is presented in ANNEX 7. 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 41. ER-Program SIS) and requirements of the ESMF and its sub-frameworks at every step of implementation.

The monitoring of safeguards application for the ER-Program will take place at two levels: First, the CN-REDD as an integrated unit of the MEF attached to the Technical Chamber of CONA-REDD (see Figure 9) will be responsible for the implementation and monitoring of safeguards for any REDD+ project or program in RoC. In addition, the PME will also be responsible for guiding and ensuring compliance with safeguard requirements for the ER-Program. That includes for the PME 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 PME 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 PME and/or CONA-REDD. It would prepare an independent report to be submitted to CONA-REDD as well.

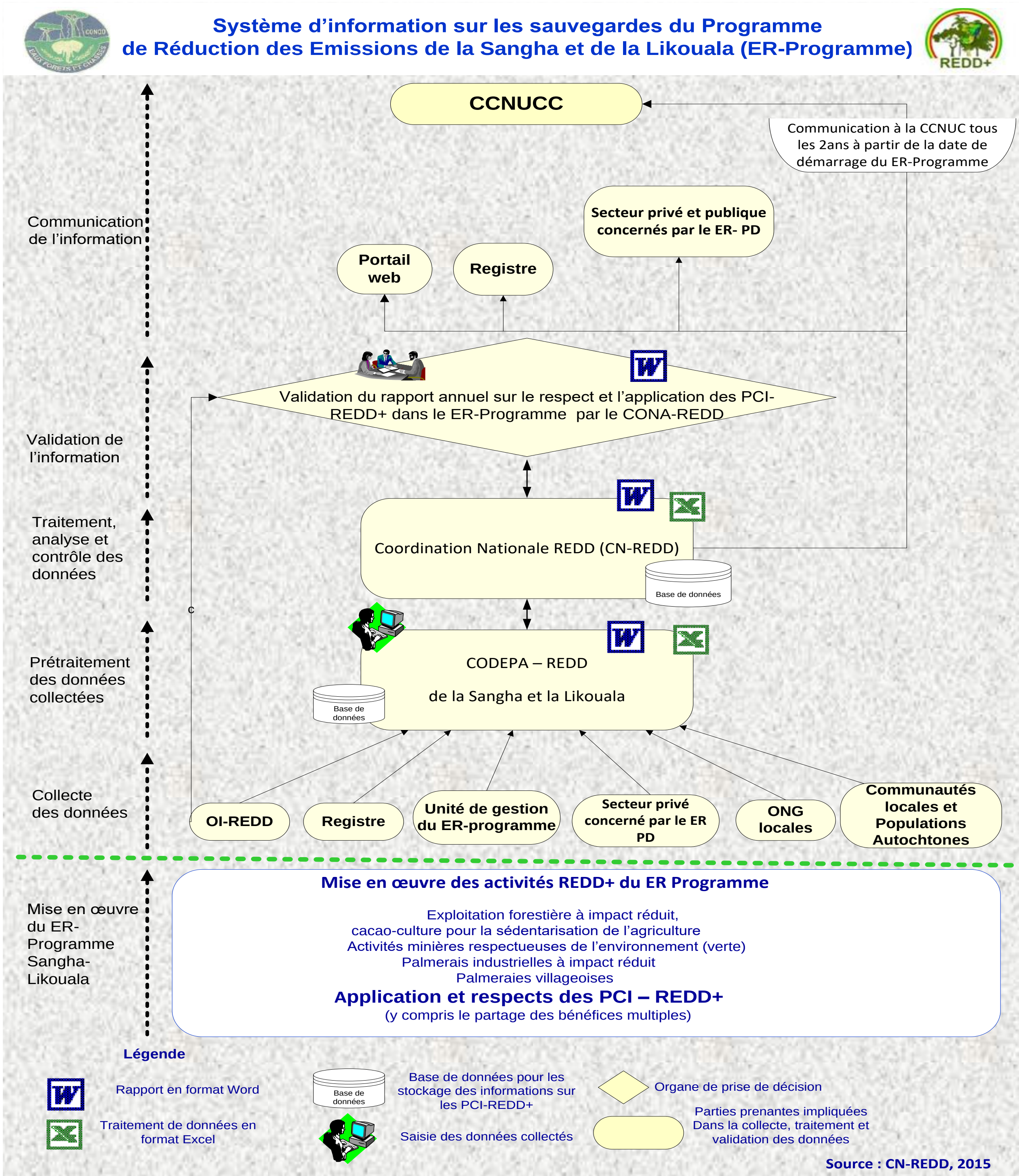


Figure 41. ER-Program SIS

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. A panel of experts developed formal procedures for the FGRM and consulted upon this draft in March 2017. A validation workshop has taken place in December 2017 to confirm and validate FGRM arrangements. The ER-Program-specific FGRM will serve as a test case and model for deriving nationally applicable principles for FGRMs.

The development of the FGRM builds on several existing grievance mechanisms in the accounting area. In addition to the formal legal system, these include the Community Management and Development Committees (CDMCs)[122], the Forest Management Cells in forest concessions, the FGRM of the World Bank-supported Forest and Economic Development Project, conflict management mechanisms in protected areas, and traditional courts.

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 PME and governmental agencies (CODEPAs) will be in charge of the effective implementation of the FGRM while continuing to offer consulting and capacity building 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, 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), civil society organizations and CDMCs will serve as local focal points for collective or individual grievances. All grievances will be channeled to the CODEPAs.

[122]The CDMC is an organization that promotes 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 CDMC may be formed within a *département*, municipality, or district.

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), and investments provided in the CDZs by concessionaires. 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 infrastructure. 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 noted and defined during a consultation phase in Sangha and Likouala in September 2015 in villages near 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 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 PME, CODEPA, representatives from associations receiving grievances within the districts or district civil servants responsible, the federation offices of the CDMCs, 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 the CODEPAs. 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.

The local CACO-REDD/CDMC will receive grievances on site and then file them with the PME. The PME will be charged with processing, analyzing, and monitoring the grievances and will ensure the proper operation of the FGRM, as follows:

<u>Receive and record grievances at the local level</u>

(i) There are several channels through which aggrieved stakeholders can convey their grievances (CDMC or civil society representatives, telephone, letter, email, internet, meetings, etc.);

(ii) A centralized database supported by the PME 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.

<u>Acknowledge receipt of the grievance and describe how it will be handled, evaluate eligibility, and determine responsibility within the organization for proposing a response</u>

(i) The PME 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 PME will ensure that all grievances comply with the following eligibility criteria:

- The grievance must demonstrate 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 demonstrate 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 for 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 PME) 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 CODEPAs' missions include mediating potential conflicts between local stakeholders in the REDD+ process.

The CODEPAs have 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 CODEPAs rule on grievances when a quorum of two-thirds (or 17 people) 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 CODEPAs 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 CONA-REDD. CONA-REDD 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 CMDCs, the CODEPAs, and, if needed, the local decentralized agencies of the MEF 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 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.

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.

2. The design of the ER-Program and benefit sharing is based on 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 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:

- achieving the objectives of the ER-Program;
- integrating all stakeholders with land tenure rights (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 stakeholder's 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 are not 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 has been developed during the SESA process and is provided in the safeguards' instruments.

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 will be used by the ER-Program to cover costs for managing the program, such as carbon and safeguards monitoring, FGRM, staffing costs for PME, 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 emissions reductions sales under the ER-PA will also be reserved for re-investments in ER-Program activities. Based on the indicative benefit sharing plan, 100% of reinvestments will be channeled to community and smallholder incentives

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, e.g. in the context of an investment project or with the ER-Program, 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.

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 and Community Development Management Committees, 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.

To promote sustainable forest use at a communal and individual level, and to avoid any rebound effects from promoting profitable smallholder activities, LCIPs can 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 (investment incentives), and will be allocated a significant share of reinvestments of carbon revenue. The indicative benefit sharing plan allocates 70% of reinvestment to the Community PES scheme.

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 largely financed by grant sources, 15% 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. The cocoa outgrower scheme is initially funded by grant sources, while for palm outgrower scheme a private company has commited to invest. The indicative benefit sharing plan allocates 15% of carbon revenues under the ER-PA for reinvestment to the cocoa outgrower scheme.

For both schemes, a conservative economic analysis indicates sustainable business models for smallholders with substantial profit margins (see Figure below). Indirect benefits for communities and smallholders 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).

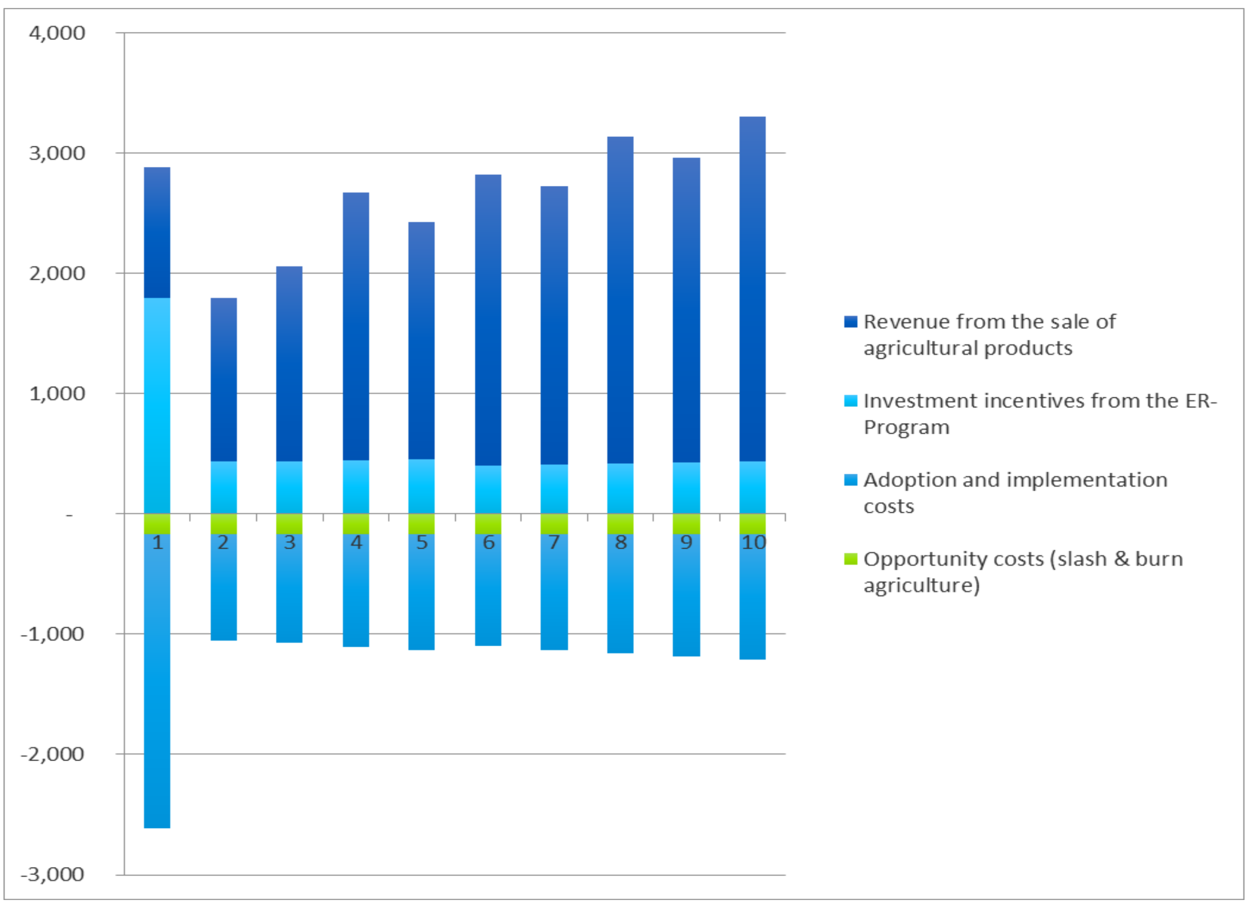


Figure 42. Sustainable smallholder business models: Average annual costs and benefits from participating in palm and cocoa outgrower scheme, and sustainable agriculture and other livelihood activities over 10 years.

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 interested in these three types of activities will make investments in improved practices without receiving any direct investment incentives from the program. Instead, they will benefit from ER-Program participation through access to markets and premiums as well as reputational gains. In addition, they will benefit from local governance improvements as a result of enabling activities supported by the ER-Program.

Palm oil companies encounter significant opportunity costs by converting production areas to conservation concessions and by setting aside HCV forest areas (e.g. literature estimates US$1.70 per ha for LtPf and up to US$800 per ha for palm oil). At the same time, benefits arise from new market opportunities through the establishment of palm oil outgrower schemes that are facilitated by the ER-Program (enabling activities and other investment incentives). As regards those agroforestry activities, one of the palm oil concessionaires (Eco-Oil, see Letter of Interest in Annex 2) has committed to invest in an outgrower scheme for palm oil smallholders, and one of the forestry concessionaires (OLAM) has confirmed interest to implement, with ER-Program support, the technical assistance program for smallholder cocoa.

Concessionaires that are interested in implementing RIL (see Letters of Interest in Annex 2) need to make upfront investments, e.g. training on RIL practices. As of today, the country context does not provide sufficient incentives to do so. The ER-Program has therefore idenitified carbon revenues based on emission reductions from RIL activities as the only short-term incentive to engage companies. Companies will be able to choose different levels of intensity of RIL (a RIL manual is work in progress finaced by the FCPF readiness grant), which will determine their potential carbon payments. The theory of change is that overcoming initial investment barriers (e.g. costs for developing RIL guidelines and training) significantly increases the chances for RIL to become a sustainable business model in the medium-term even if carbon payments seized after the ER-PA term.

Based on conservative business models for companies considering all costs and benefits, the ER-Program will allocate carbon revenues to companies to incentivize their participation in ER generating activities and help them overcome initial investment barriers. Payments 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 application of safeguards instruments).

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 2017). The government is the recipient of carbon revenues by default, but bound – by general principles of Congolese law - to distribute revenues to stakeholders in accordance with the Benefit Sharing Plan.

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 for institutional support.

Estimated allocation of investment incentives, private investment and carbon revenues allocated under the ER-PA:

Figure 43 presents an initial estimate of the magnitude of direct benefits and costs shared between LCIPs, private concessionaires and the government during the ER-PA term. The figure differentiates between investment incentives provided by the program, carbon revenues from the ER-PA (allocated either directly or through reinvesting in program activities), stakeholders' own investment, and program administration and institutional support costs. Based on this estimate:

- **LCIPs** receive the majority of direct benefits, in form of investment incentives and through carbon revenues that are channeled into reinvestments of program activities. Investment incentives are provided through secured investment sources and do not require the monitoring and attribution of emissions reductions at the level of communities and smallholders. This allocation reflects the goal of the program to incentivize the adoption of sustainable smallholder business models (See Figure 42 above on sustainable smallholder business models). Smallholder revenue from cocoa, palm oil or other agricultural activities in the program area is the program's main strategy to ensure improved livelihoods for the population and mitigate risks for communities related to performance at program level.
- **Companies** provide their own investment in LtFP, RIL and HCV activities. They do not benefit from any investment incentives, but are instead allocated a share of carbon revenues conditional upon emissions reductions. Carbon revenues will be allocated to incentivize up-front investments and the adoption of new, forest-smart practices. Companies therefore share risks related to performance at program level.
- **All beneficiaries** indirectly benefit from investment incentives channeled to enabling activities, such as land use planning and forest sector governance.
- **A share of carbon revenues** will be used to finance fixed operating costs (administrative costs and institutional support) for the program (see Table below).

Fixed costs	Cost estimation over ER-PA term (until 2023) in million US$
Program Management Entity (e.g. office costs, travel, legals costs, accounting)	6.5
Institutional support governments	0.7
Stakeholder engagement	0.8
Operationalisation of REDD+ tools: Safeguards monitoring, MRV, FGRM	4.0
Total	**12.0**

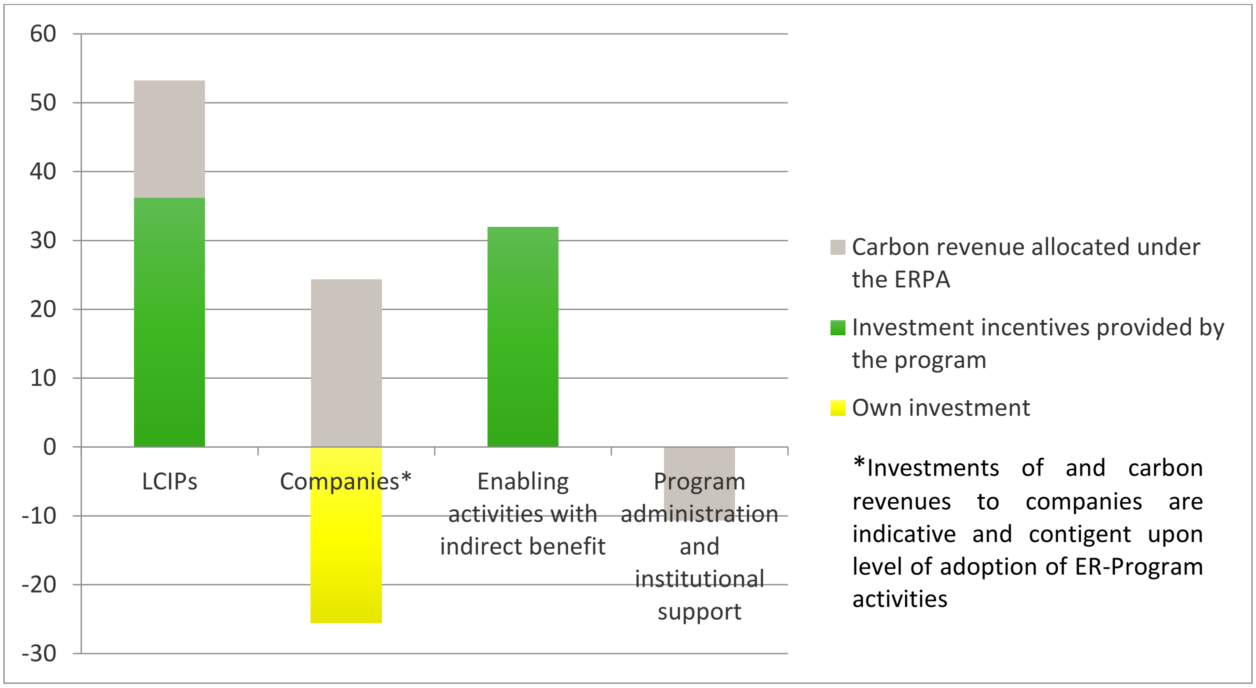


Figure 43. Magnitude of direct benefits and costs shared between LCIPs, private concessionaires and the government over 5 years (the term of the ER-PA). The figure includes benefits and costs that can be monetarily quantified and excludes private investment or investment incentives from the program that are not directly tied to emissions reductions, such as private support committed to the development of palm oil outgrower schemes.

Indicators (carbon and other performance)

For none of the program activities targeted at LCIPs, performance will be measured directly based on emissions reductions. The *PES scheme for smallholder conservation* will be based on proxy indicators for carbon performance, such as the area of forest conserved in a community. Indicators and processes for verification will be determined as part of the preparation activities for the FIP program.

For companies investing in RIL, LtFP or HCV activities, the distribution of carbon benefits will be conditional upon performance (contribution) with a share of revenues allocated to cover costs for program administration and institutional support. As a general rule, carbon performance will be measured compared to historical reference level adjusted through a risk factor. During the further development of the benefit sharing plan, criteria will be developed in order to derive at risk factors to allocate reference levels to concessionaires involves the following possible criteria to calculate the risk factor.

Contractual Arrangements for Benefit Sharing

Benefit sharing will be executed based on contractual arrangements with ER-Program stakeholders, either in the context of investment projects or through contracts with the ER-Program Entity. Contracts will assign emission reductions rights, where stakeholders are primary right holders ("communal forest" holders under FC 2017). 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 5. Consultations held during the development of the erpd.

The following topics were discussed:

- Types of activities implemented by LCIP
- 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 LCIP

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 October 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 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 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 76. 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.

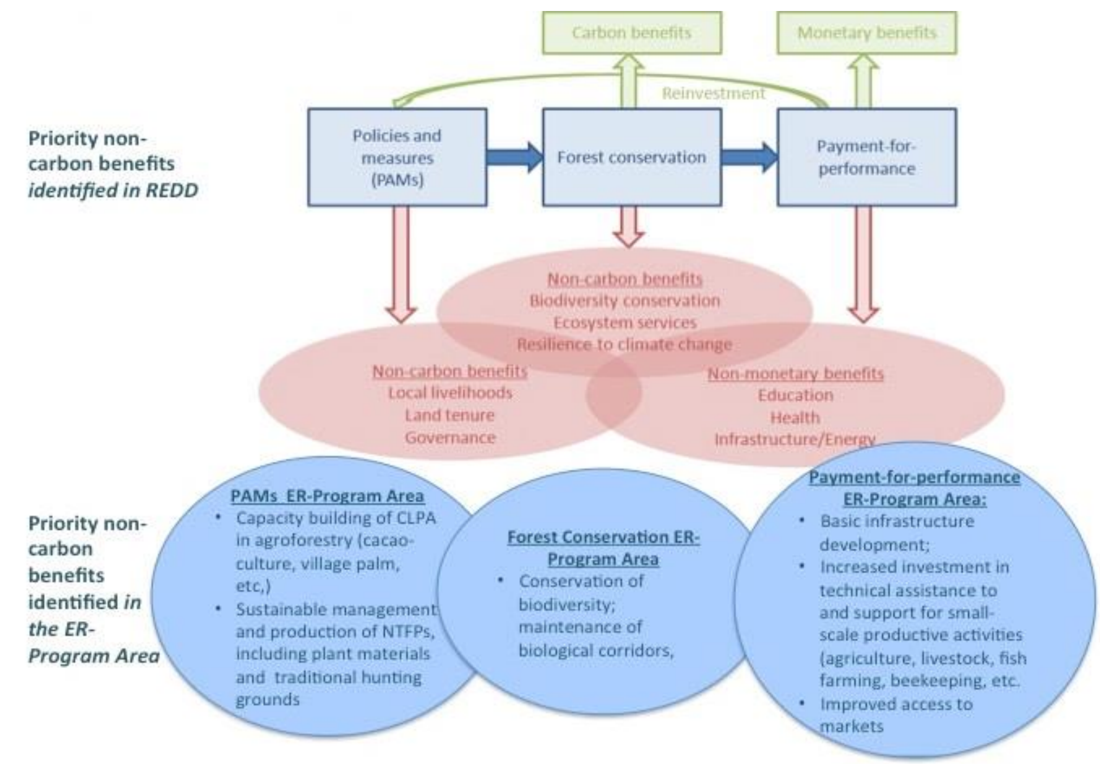
The list of potential NCB benefits identified during the consultation phase is as follows.

Table 77. 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 (MEF 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)			

Potential NCBs identified for the ER-Program area	Beneficiaries		
	Government	LCIPs	Private sector
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.



** Adapted from FCPF Carbon Fund Methodological Framework Discussion Paper #12:*

Figure 44. Priority non-carbon benefits

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 and honey.

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 taxonomy of NTFP and guidelines for managing NTFP are provided in Annexes 8 and 9, respectively.

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 78. 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. • Article 178 - 187 FC 2017.

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 (MEF) 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 MEF. 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**, all rights related to the program emission reductions are defined within a contractual relationship alone (the ER-PA).[123] 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).

As explained in chapter 4.4 above, it is for the government to secure implementation of the contractual obligation under the ER-PA, including implementation of the exclusivity guarantee, i.e. the guarantee that it will not create, sell or transfer carbon units issued for the REDD+ activities in question and that it will not allow others to do so, except where so explicitly permitted or addressed under the terms of the ER-PA.

This commitment binds the government with respect to third parties in that it will not authorize a REDD+ project or intervention within the boundaries of the ER-Program, except where such intervention itself is addressed by the ER-Program and complies with the ER-PA terms.

FC 2017

The government will retain the exclusive title to the emission reductions, once the **future legislation (FC 2017)** is in place. As shown above (section 4.4), the State will be expressly authorized as the holder of all “carbon credits”. This would only be different, if the government transferred forest land authority to local communities (“collectivités locales”) or if it authorized REDD+ projects to be implemented outside the ER-Program. Neither is intended, and either would be non-compliant with the terms of the ER-PA.

As regards the newly created “carbon rights”, their carriers – holders of customer rights, independent of whether formal communal forest status has been achieved or not – will be recognized as holding specific title; yet, this title aims at (a portion of) the ER-PA revenues, not the carbon commodity (emission reductions) as such. The title to the emission reductions remains with the government.

[123] For the future legal regime – relevant after the entry into force of the Forestry Code 2016 – see below.

REDD+ Carbon Clauses

While not required by Congolese law or the requirements of the Carbon Fund[124], MEF (in its role as the program authority) or its implementing entity (PME) may consider seeing the issue of carbon rights and carbon proceeds addressed at the level of relevant stakeholders and in a designated clause. This may increase transparency of the ER-Program and may have the added benefit to individualize and confirm the benefit sharing arrangements for stakeholders.

A REDD+ carbon clause would be suitable in all formal arrangements that exist between the ER-Program operators and stakeholders or between operators of affiliated programs (e.g. FIP) and stakeholders. When a community is accredited for a particular FIP agroforestry measure, for instance, the accreditation letter could make a direct reference to the REDD+ Program, including its carbon asset generation part. The relevant clause would need to be agreed within the relevant (e.g. FIP) governance framework, but it could run along the following lines:

> *Clause X.X The present intervention is a measure affiliated with the [FCPF Emission Reductions Program in Sangha and Likouala, Republic of Congo], in the following "Program". The [community] was represented in [workshop A] at which the details of the Program and the Benefit Sharing Plan were discussed.*
>
> *Clause X.Y. The community acknowledges and agrees that this intervention becomes an integral part of the Program, and it acknowledges and agrees the details of the Benefit Sharing Plan as published [on the Website B].*
>
> *Clause X.Z. The community takes best efforts to implement the Program. It hereby agrees not to allow the greenhouse gas emission reductions ("GHG ERs"), achieved as a result of the Program, to be used in any other similar program or activity aimed at generating GHG ERs. It also agrees that the Program operator is deemed the generator of GHG ERs and that the proceeds of their commercialization shall be distributed according to the Benefit Sharing Plan.*

---

[124] FCPF Carbon Fund Methodological Framework; FCPF ER-PA General Conditions.

18 DATA MANAGEMENT AND REGISTRY SYSTEMS

18.1 Participation Under Other GHG Initiatives

There is one REDD+ project in the accounting area, namely the North Pikounda REDD+ Project[125], which was granted permission by the Government in 2012 and registered under the Verified Carbon Standard (VCS) in 2013[126]. The project protects 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, which is prior to the ER-PA period. The project owner is seeking to be included in the ER-Program in full compliance with ER-Program requirements, in particular as regards the carbon accounting and ER-Program REL, the benefit-sharing plan and ER title transfer.

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

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+[127].

This integrated information system provides information not only on REDD+ projects and programs (defined as initiatives that generate carbon credits), but also on other REDD+ initiatives, sustainable natural resource management, and on institutional and legal arrangements.

The system requires essential information from REDD+ projects / programs, 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

[125] http://www.vcsprojectdatabase.org/#/project_details/1052

[126] Verified Carbon Standard (VCS): North Pikounda REDD+ Project,

http://www.vcsprojectdatabase.org/#/project_details/1052

[127] SYSTEME D'INFORMATION POUR LA GESTION FORESTIERE ET LE DEVELOPPEMENT DURABLE(SIFODD). 2016. Logiciel de gestion du registre national REDD+ CAHIER DE CHARGES OPERATIONNEL.

the Reference Level used. Hence, the management system would provide enough information as required by Indicator 37.2 of the CF MF.

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 / program 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.

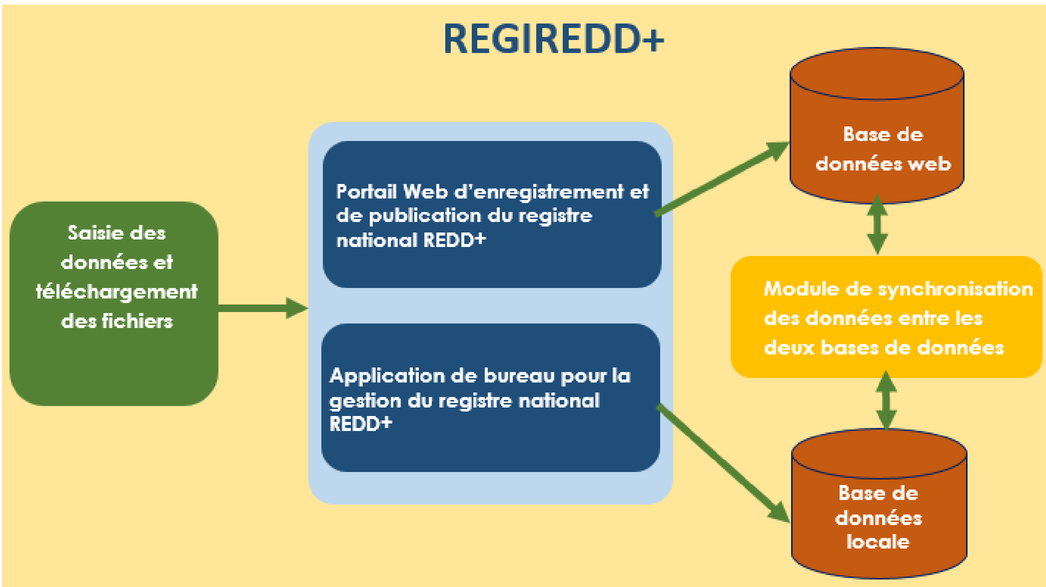


Figure 45. Functional architecture of the management system

ER Transaction Registry

The CN-REDD has coordinated with the Facility Management Team (FMT) of the FCPF regarding the development of the ER transaction registry. The FMT is currently supporting the development of a country prototype for a transaction registry including guidelines / roadmaps for each phase of the development process (

Table 79). To avoid duplication of work and since the timeframe allows it[128], the Republic of Congo will make use of the guidelines resulting from the prototype development as they become available and apply them to the national context to set up its transaction registry. The financing of the transaction registry is secured under the FCPF readiness grant (registry expert and IT expert).

[128] An operational transaction registry is required at the point of ER transfers.

Table 79 shows the four phases to develop a transaction registry, which will be implemented in the Republic of Congo in an efficient manner based on the prototype guidelines.

Table 79: Steps to develop a REDD+ transaction registry in the Republic of Congo

PHASES	STEPS	TIMELINE
1 – Needs Assessment	- Analysis of existing institutional and legal frameworks (programmatic, national, and international) - Functional and technical analysis of any existing registries including data management systems (information registries) - Gap analysis and options	1 month
2 – Functional Specifications	- Institutional and administrative operating framework - Accounting models for workflows for key transactions - Buffer accounting model and workflows - Registry architecture and chart of accounts - Security analysis - Definition and management of serial numbers and IDs (units, transactions, etc.)	1 months
3 – Technical Specifications and Registry Manuals	- System technical architecture design (incl. hosting and archiving) - IT security requirements (incl. authentication, confidentiality, traceability, and security audits) - IT performance requirements - Data exchange connections and flows with external systems - System user guides/manuals (incl. FAQs documents)	2 months
4 – System Development, Integration and Deployment	- Development (coding) and implementation of the database architecture - Development (coding) of the front-End Interface - Integration and unitary testing - Functional testing - End to end testing - Workflow and procedures, and operating modalities - Training and capacity building for users	2 months

The transaction registry will either become a module of the REGIREDD+ or could be a self-standing tool (preferd option to be assessed during the needs assessment phase). Prior to any ER transaction, REGIREDD+ requires the registration and validation of REDD+ programs and projects.

The below diagram shows the process of ER transaction for the case that the transaction registry module is integrated into the REGIREDD+:

1. The ERs reported are verified by an accredited entity 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.

The specific details of the operationalization of the ER transaction registry side of the software are yet to be defined.

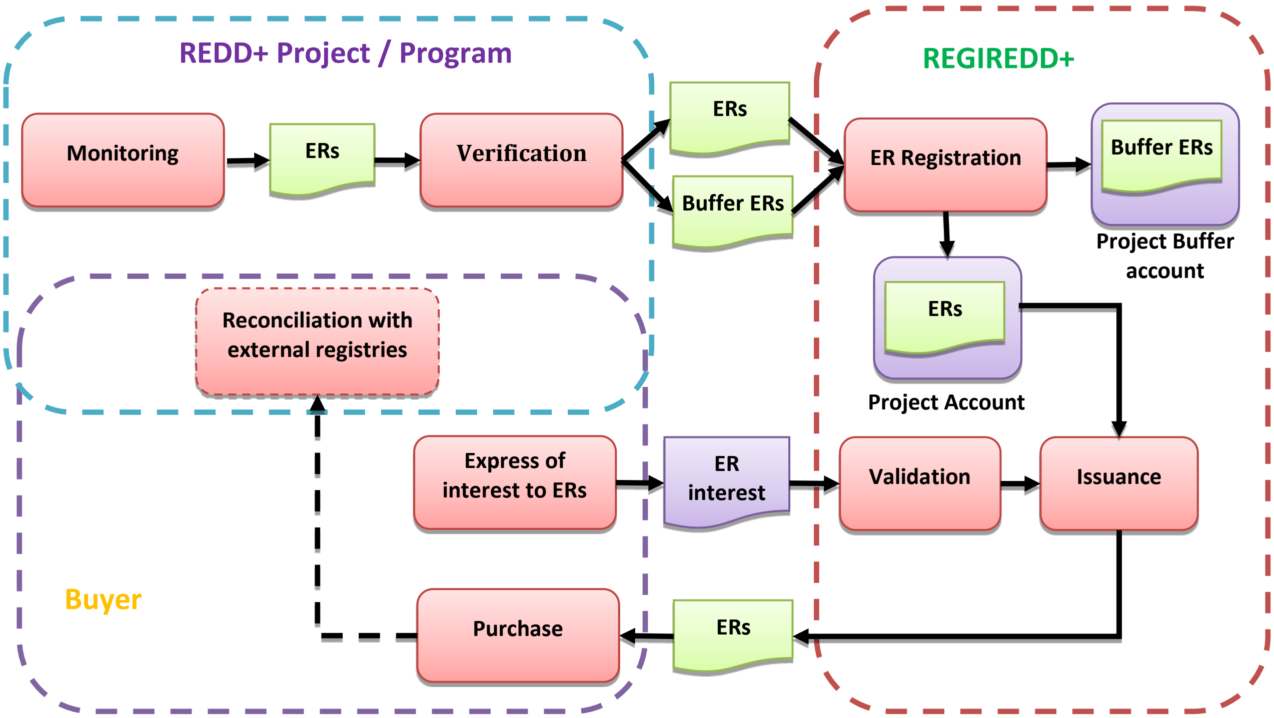


Figure 46. Process diagram indicating the issuance and transfer of ERs by REGIREDD+

ANNEX 1. SUMMARY OF FINANCIAL PLAN

Financing plan		2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	
Items	Description	1	2	3	4	5	6	7	8	9	10	TOTAL
Expected uses of funds												
Operational and Implementation Costs	***Sectorial activities***											
	Reduced Impact Logging (RIL)	1,480,709	2,256,657	1,603,620	1,724,216	1,791,860	1,791,860	1,791,860	1,791,860	1,791,860	1,791,860	17,816,365
	Logged to Protected Forest (LtPF)	58,275	58,275	58,275	58,275	58,275	58,275	58,275	58,275	58,275	58,275	582,749
	Reduction of Forest Conversion from Industrial Palm (HCVPalm)	67,500	-	266,000	32,000	294,000	96,000	96,000	96,000	96,000	96,000	1,139,500
	Smallholder shade cocoa in Community Development Zones (SH Cocoa)	976,110	1,294,841	1,938,942	2,689,287	3,220,506	1,987,655	1,242,969	1,242,969	1,242,969	1,242,969	17,079,218
	Palm Outgrower Schemes in Community Development Zones (SH Palm)	243,601	332,701	503,001	703,001	851,501	593,998	593,998	593,998	593,998	593,998	5,603,794
	Sustainable agriculture and others livelihoods activities (SH SustainAgr)	586,008	1,014,578	1,638,484	2,405,247	3,119,530	1,840,643	1,666,113	1,666,113	1,666,113	1,666,113	17,268,941
	Smallholders conservation payments (SH Cons)	120,000	120,000	240,000	400,000	600,000	697,500	1,990,000	2,585,000	3,180,000	3,180,000	13,112,500
	Enabling activities											
	Biodiversity and protected area management	1,310,433	1,310,433	1,310,433	1,310,433	1,310,433	-	-	-	-	-	6,552,167
	Community level governance	767,050	767,050	767,050	767,050	767,050	-	-	-	-	-	3,835,250
	Land-use planning	1,600,000	1,600,000	1,600,000	1,600,000	1,600,000	-	-	-	-	-	8,000,000
	Forest sector governance	3,072,208	3,072,208	3,072,208	3,072,208	3,072,208	-	-	-	-	-	15,361,040
	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*	-	-	2,470,161	-	6,539,543	-	7,598,908	-	-	-	16,608,612
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		**12,463,342**	**14,499,470**	**18,208,666**	**17,329,054**	**25,953,343**	**8,448,970**	**16,479,776**	**9,649,487**	**10,162,535**	**10,159,027**	**143,353,670**
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	1,602,300	1,602,300	1,602,300	1,602,300	1,602,300	-	-	-	-	-	8,011,500
	AFD Cocoa	1,161,380	1,161,380	1,161,380	1,161,380	1,161,380	-	-	-	-	-	5,806,900
	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
	FAO ?	-	-	-	-	-	-	-	-	-	-	-
	DFID	1,234,000	1,234,000	1,234,000	1,234,000	1,234,000	-	-	-	-	-	6,170,000
	APV-FLEGT	1,004,108	1,004,108	1,004,108	1,004,108	1,004,108	-	-	-	-	-	5,020,540
	WB IDA	300,000	300,000	300,000	300,000	300,000	-	-	-	-	-	1,500,000
Private funds to be confirmed	*(Current status of interest)*	5,907,723	5,907,723	5,907,723	5,907,723	5,907,723	-	-	-	-	-	29,538,614
Revenue from REDD+ activities (e.g., sale of agricultural products)	*Non-carbon revenues*	3,594,052	8,237,591	14,641,450	24,649,529	34,226,824	43,756,995	49,084,989	52,845,237	55,318,294	57,748,908	344,103,869
Revenue from sale of additional Emission Reductions (not yet contracted)	*ERPA with Carbon Fund*	6,500,000	-	5,838,031	-	21,510,191	-	31,218,431	-	-	-	65,066,653
Total sources		**28,619,897**	**26,763,435**	**39,005,326**	**43,175,373**	**74,262,859**	**43,756,995**	**80,303,420**	**52,845,237**	**55,318,294**	**57,748,908**	**501,799,743**
Net revenue before taxes (=total sources – total uses)		16,156,555	12,263,965	20,796,659	25,846,319	48,309,516	35,308,025	63,823,644	43,195,750	45,155,759	47,589,881	358,446,073
Net revenue w/o non-carbon revenue		**12,562,502**	**4,026,374**	**6,155,209**	**1,196,790**	**14,082,692**	**(8,448,970)**	**14,738,656**	**(9,649,487)**	**(10,162,535)**	**(10,159,027)**	**14,342,204**

ANNEX 2. LETTERS OF INTEREST FROM THE PRIVATE SECTOR TO ENGAGE IN THE ER-PROGRAM

Manifestation d'intérêt pour la participation comme partenaire de mise en œuvre du Programme de Réduction des Émissions Sangha-Likouala

Date : **08.04.2017**

Monsieur le Coordonnateur National REDD+,

Par cette lettre, je confirme que la société **Industrie Forestière de Ouesso (IFO)** a pris connaissance du draft avancé du Document de Programme de Réduction des Émissions Sangha-Likouala (disponible au lien suivant : https://www.forestcarbonpartnership.org/republic-congo) et a participé à des consultations sur les activités dudit Programme. Sur base de ces discussions, je confirme l'intérêt de la société à participer comme partenaire de mise en œuvre du Programme de Réduction des Émissions Sangha-Likouala, en particulier pour les activités liées à l'EFIR et/ou aux concessions de conservation. Notre société est prête à entreprendre des discussions techniques approfondies d'identification des actions concrètes, avec comme objectif de signer une entente formelle de participation dès que le Programme sera officiellement sélectionné par le Fonds de Partenariat pour le Carbone Forestier.

Cordialement,

Nom : **Pascal DESMEDT**

Titre : **Directeur Général**

INDUSTRIE FORESTIERE DE OUESSO
IFO
Directeur Général
BP: 135 Ouesso - Congo
Email: secretariatgeneral@ifo.congo.com

Manifestation d'intérêt pour la participation comme partenaire de mise en œuvre du Programme de Réduction des Émissions Sangha-Likouala

Date : 11/4/17

Monsieur le Coordonnateur National REDD+,

Par cette lettre, je confirme que la société Congolaise Industrielle des Bois (CIB) a pris connaissance du draft avancé du Document de Programme de Réduction des Émissions Sangha-Likouala (disponible au lien suivant : https://www.forestcarbonpartnership.org/republic-congo) et a participé à des consultations sur les activités dudit Programme. Sur base de ces discussions, je confirme l'intérêt de la société à participer comme partenaire de mise en œuvre du Programme de Réduction des Émissions Sangha-Likouala, en particulier pour les activités liées à l'EFIR et/ou aux concessions de conservation. Notre société est prête à entreprendre des discussions techniques approfondies d'identification des actions concrètes, avec comme objectif de signer une entente formelle de participation dès que le Programme sera officiellement sélectionné par le Fonds de Partenariat pour le Carbone Forestier.

Cordialement,

Nom : SCHWARZ

Titre : DG

Congolaise Industrielle des Bois
Christian SCHWARZ
Directeur Général

CONGOLAISE INDUSTRIELLE DES BOIS * BRAZZAVILLE *
C.I.B.

Manifestation d'intérêt pour la participation comme partenaire de mise en œuvre du Programme de Réduction des Émissions Sangha-Likouala

Date : 1 2 AVR 2017

Monsieur le Coordonnateur National REDD+,

Par cette lettre, je confirme que la société LIKOUALA TIMBER S.A B.P: 14 Bétou République du Congo a pris connaissance du draft avancé du Document de Programme de Réduction des Émissions Sangha-Likouala (disponible au lien suivant : https://www.forestcarbonpartnership.org/republic-congo) et a participé à des consultations sur les activités dudit Programme. Sur base de ces discussions, je confirme l'intérêt de la société à participer comme partenaire de mise en œuvre du Programme de Réduction des Émissions Sangha-Likouala, en particulier pour les activités liées à l'EFIR et/ou aux concessions de conservation. Notre société est prête à entreprendre des discussions techniques approfondies d'identification des actions concrètes, avec comme objectif de signer une entente formelle de participation dès que le Programme sera officiellement sélectionné par le Fonds de Partenariat pour le Carbone Forestier.

Cordialement,

Nom : Fuser Alessio

Titre : Directeur Generale

LIKOUALA TIMBER S.A
B.P: 14 Bétou
République du Congo

Manifestation d'intérêt pour la participation comme partenaire de mise en œuvre du Programme de Réduction des Émissions Sangha-Likouala

Date : 15 avril 2017

Monsieur le Coordonnateur National REDD+,

Par cette lettre, je confirme que la Société Thanry Congo (STC) a pris connaissance du Draft avancé du Document de Programme de Réduction des Émissions Sangha-Likouala (disponible au lien suivant : https://www.forestcarbonpartnership.org/republic-congo) et a participé à des consultations sur les activités dudit Programme. Sur base de ces discussions, je confirme l'intérêt de la société à participer comme partenaire de mise en œuvre du Programme de Réduction des Émissions Sangha-Likouala, en particulier pour les activités liées à l'EFIR et/ou aux concessions de conservation. Notre société est prête à entreprendre des discussions techniques approfondies d'identification des actions concrètes, avec comme objectif de signer une entente formelle de participation dès que le Programme sera officiellement sélectionné par le Fonds de Partenariat pour le Carbone Forestier.

Cordialement,

Nom : Laurent Cerbonney

Titre : Responsable Ressource Management&Certification Dpt.

LC.

Manifestation d'intérêt pour la participation comme partenaire de mise en œuvre du Programme de Réduction des Émissions Sangha-Likouala

Date : 16/4/2017

Monsieur le Coordonnateur National REDD+,

Par cette lettre, je confirme que la société Eco-Oil Energie a pris connaissance du draft avancé du Document de Programme de Réduction des Émissions Sangha-Likouala(disponible au lien suivant : https://www.forestcarbonpartnership.org/republic-congo) et a participé à des consultations sur les activités dudit Programme. Sur base de ces discussions, je confirme l'intérêt de la société à participer comme partenaire de mise en œuvredu Programme de Réduction des Émissions Sangha-Likouala, en particulier pour les activités liées auxPalmeraies Industrielles à faible impact (RSPO) et/ou aux palmeraies villageoises.Notre société est prête àentreprendre des discussions techniques approfondies d'identification des actions concrètes, avec comme objectif de signer une entente formelle de participation dès que le Programme sera officiellement sélectionné par le Fonds de Partenariat pour le Carbone Forestier.

Cordialement,

Nom : Makita Daniel

Titre : Directeur Administratif Juridique et des Ressources Humaines.

Manifestation d'intérêt pour la participation comme partenaire de mise en œuvre du Programme de Réduction des Émissions Sangha-Likouala

Date : 18 avril 2017

Monsieur le Coordonnateur National REDD+,

Par cette lettre, je confirme que la société MOKABI a pris connaissance du draft avancé du Document de Programme de Réduction des Émissions Sangha-Likouala (disponible au lien suivant : https://www.forestcarbonpartnership.org/republic-congo) et a participé à des consultations sur les activités dudit Programme. Sur base de ces discussions, je confirme l'intérêt de la société à participer comme partenaire de mise en œuvre du Programme de Réduction des Émissions Sangha-Likouala, en particulier pour les activités liées à l'EFIR et/ou aux concessions de conservation. Notre société est prête à entreprendre des discussions techniques approfondies d'identification des actions concrètes, avec comme objectif de signer une entente formelle de participation dès que le Programme sera officiellement sélectionné par le Fonds de Partenariat pour le Carbone Forestier.

Cordialement,

Nom : Quentin LOONTJENS

Titre : Directeur Général

DIRECTION GENERALE
MOKABI S.A.

ANNEX 3. List of environment-related conventions and agreements

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 4. 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 every two months. These focus groups will be held by the PME. Objective: collect feedbacks from LCIP on how the program works	14	14	14	14	14	7	7	7	7	7

Consultation type	Targeted groups	Comments	Frequency									
			Y1	Y2	Y3	Y4	Y5	Y6	Y7	Y8	Y9	Y10
Focus group in Likouala *	LCIP	1 per concessions (10) every 6 months during the first half of the ER-Program term and every two months. These focus groups will be held by the PME. Objective: collect feedbacks from LCIP on how the program works	20	20	20	20	20	10	10	10	10	10
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 PME. 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 PME. Objective: collect feedbacks from the private sector on how works the progam	4	2	2	2	2	2	2	2	2	2

Consultation type	Targeted groups	Comments	Frequency									
			Y1	Y2	Y3	Y4	Y5	Y6	Y7	Y8	Y9	Y10
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 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 Sangha *	CODEPA and PME	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

Consultation type	Targeted groups	Comments	Frequency									
			Y1	Y2	Y3	Y4	Y5	Y6	Y7	Y8	Y9	Y10
CODEPA permanent consultation platform on grievances and feedbacks in Likouala *	CODEPA and PME	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 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	120	120	120	120	120	120	120	120	120	120

*** Financed by the ER-Program.**

ANNEX 5. CONSULTATIONS HELD DURING THE DEVELOPMENT OF THE ERPD

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	Du 31Mai au 5 Juin 2016	Consulter les parties prenantes sur les aspects	Identification des cibles représentant le comité	Les supports de ont été transmis aux parties	32	8	30	5	5	-	-	40

environnementaux dans les départements de la Sangha et la Likouala		sociaux environnementaux à prendre en compte dans le cadre du ER-P	départemental REDD, les représentants populations autochtones	prenantes avant la tenue de l'atelier								
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	Du 04au 12 octobre 2015	Consulter les parties prenantes sur les approches de partages	Définition de la taille de l'échantillon ; Identification des districts	Présentation du contexte de consultation ;	269	100	30	-	140	-	-	369

la mise en place du plan de partage des bénéfices du ER-P dans le Département de la Likouala		des bénéfices existant et l'approche de partage de bénéfice du ER-P	et villages à consulter Consultations des autorités locales, communautés locales et populations autochtones	Tenu de focus groupe homme, femme								
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 restitution de la mission de consultation des parties prenantes					35	5						40

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 PND, DSRP, etc.)	22	09	22	02	02	00	05	31
Session de haut niveau pour consolider le document de l'ER-P Sangha-	22 Février 2016 à Brazzaville	Consulter la société civile et populations autochtone (CACO-REDD-Brazzaville) sur	Atelier de consultation des parties prenantes (Ministères clés de	- Notes d'information sur l'ER-PD ; - Notes d'informatio	36	06	25	12	05	00	00	42

Likouala avec CACO-REDD		des questions précises relatives à l'ER-Programme	REDD+ et CACO-REDD) sur l'ER-PD sur fond de questions à y répondre	n sur les options stratégiques ; Questionnaire sur la mise en œuvre de l'ER-Programme								
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-Programme	36	06	69	00	00	00	00	69
Session de haut niveau pour consolider le document de l'ER-P Sangha-Likouala avec les Ministères en charge de l'Intégration,	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	- Notes d'information sur l'ER-PD ; - Notes d'information sur les options	65	06	71	00	00	00	00	71

des Grands travaux et des Finances			questions à y répondre	stratégiques ; Questionnaire sur la mise en œuvre de l'ER-Programme								
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 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	26 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	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 processus REDD+	33	03	20	12	03	00	01	36
Atelier de restitution de la mission de consultations des parties prenantes départementales pour la mise en place d'un plan de partage de	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	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

bénéfices de l'ER-P Sangha-Likouala		l'ER-P Sangha-Likouala										
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
Consultations sur le mécanisme de gestion des plaintes Sangha Likouala	Bomassa du 15 au 16 mars 2017 ; Kabo 16 mars 2017 ; Pokola du 17 au 18 mars 2017. Souanké du 19 au 20 Mars 2017 ;	L'objectif général visait la consolidation du draft sur le Mécanisme de gestion des plaintes. Parmi les objectifs spécifiques, on note l'organisation des consultations pour faire un état des lieux des expériences locales et les pratiques			534	352	419					1305

	Sembé le 21 Mars 2017 ; Mokéko centre du 22 au 23 Mars 2017 ; Ngombé du 24 Mars 2017 Ouesso et village Péké 24 au 25 Mars 2017	traditionnelles en matière de gestion des conflits y compris dans les sociétés forestières , minières, et organisation de conservation des aires protégées. Ces consultations étaient participatives.										
Consultation des parties prenantes pour l'adaptation des PCIV-REDD+ au ER-P	Du 10 au 17 Mai 2017 Dans la sangha et la Likouala (Pokola, thanry, Betou, Mokabi, Lopola, Sembe, tala-tala)	Faire l'état des lieux des normes/standards tant sociaux et environnementaux utilisés par les sociétés parties prenantes du programme de Réduction des émissions de la Sangha-Likouala ;	Guide d'entretiens, Réunion technique,	Grille FSC, Grille APV-FLEGT, Normes ou procédures EFIR des concessionnaires forestiers	25	2	00	00	00	00	27	27

		Elaborer la mouture des PCIV-REDD+ adapté au ER-P										
Restitution et partage de la mouture des PCIV-REDD+ adapté au ER-P	Du 10 au 13 Aout 2017 à Ouesso dans le département de la Sangha	Recueillir les contributions des parties prenantes du ER-P sur la mouture des PCIV-REDD+ du ER-P.	Atelier technique	Mise à disposition du document deux semaines au préalable	27	3	5	3	2	17		30
Validation du document des PCIV -REDD+ adaptés au ER-P	Du 30 au 31 Août 2017 Brazzaville	Valider le document des PCIV -REDD+ adaptés au ER-P	Atelier technique national	Mise à disposition du document deux semaines au préalable	30	10	25	8	2	2		40
Session technique de production des données d'activités du programme des émissions Sangha Likouala (ER-P) par le du Panel MNV	**13 – 22 septembre 2017 à Brazzaville**	Collecter un certain nombre de données nécessaires pour la quantification de l'ajustement du NR du ERP de la Sangha et la Likouala, afin de répondre aux exigences du la Résolution CFM16/2017/2	- Examen de la carte d'occupation du sol ; - Détermination d'un échantillonnage stratifié sur toutes les strates de la carte ; - Validation des points d'échantillon à partir d'un système de	Rapport des travaux et base de données	10	5						**15**

			réponse : Collect Erth ; Collecte des données à partir des images satellitaires									
Atelier de validation du MGP Sangha LiKouala	Du 27 au 28 Décembre 2017 Brazzaville	Valider le Mécanisme Sangha Likouala.	Atelier technique national	Mise à disposition du document deux semaines au préalable	30	5	23	6	4	2	00	35

ANNEX 6. COMPLEMENTARY PROGRAMS

Congo is assembling a series of sources of investment finance to support its ER-Program and the broader REDD+ agenda. The government is in the process of drafting a National REDD+ Investment Plan that will outline the way it intends to plan and coordiante the array of financing instruments it is mobilizing to support REDD+. The National REDD+ Committee is the authority charged with coordinating donor efforts in support of REDD+.

The following is a summary of components relevant to the ER-Program that the Investment Plan will include:

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. This a key element in improving cross-sectoral coordination and ensuring policy coherence not only in the accounting area, but also beyond.

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 MEF'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$ 6.5 million in additional financing to the FEDP is available from the **Global Environment Facility**. This grant will support agroforestry on degraded land in the accounting area, will establish a management structure for Ntokou-Pikounda National Park, and promote the fight against wildlife crime. Also with **GEF** funding, the United Nations Development Program (UNDP) is executing a US$ 4.6 million project centered on Odzala-Kokoua National Park that will support expansion of the protected area network in the accounting area, strengthen protected area management, promote sustainable livelihoods, and address the illegal wildlife trade.

In addition, the **French Development Agency (AFD)** is preparing two projects that will support the cocoa sector and sustainable forest management in the accounting area.

The International Development Association's $100 million **Commercial Agriculture Project** is expected, among other activities, to support the National Cocoa Development Plan, enabling the government to supply high-quality cocoa germ plasm and training to interested farmers. It will also provide support to farmer groups to become more effective. This would support the agroforestry activities that are a major component of the ER-Program.

It should be noted that the FEDP, FIP, AFD, and IDA efforts to support the cocoa sector are being closely coordinated to ensure that a single, REDD+-focused cocoa production model is promoted.

The International Development Association's **Integrated Public Sector Reform Project** is reserving $1.5 million to support the CODEPAs in the ER-Program area, and to support the decentralized entities of the MEF in better monitoring formal and informal logging activities.

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 7. 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 respects 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 participative des superficies utilisables - 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	- Contractualisation avec les communautés sur la réhabilitation des sites après exploitation	Exploitants et communautés

d'un secteur minier vert			d'exploitation des mines à ciel ouvert 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 8. NON-EXHAUSTIVE TAXONOMY OF ANIMAL AND VEGETABLE NTFPS IDENTIFIED IN CONSULTATION WITH LCIPS IN THE ER-PROGRAM AREA

Table 80. 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 9. 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 10. 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*

PCI-REDD	World Bank Operational Policies (OP)
	such projects. The involvement of people in the project may include identifying appropriate conservation measures, managing protected areas 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*

PCI-REDD	World Bank Operational Policies (OP)
	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 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

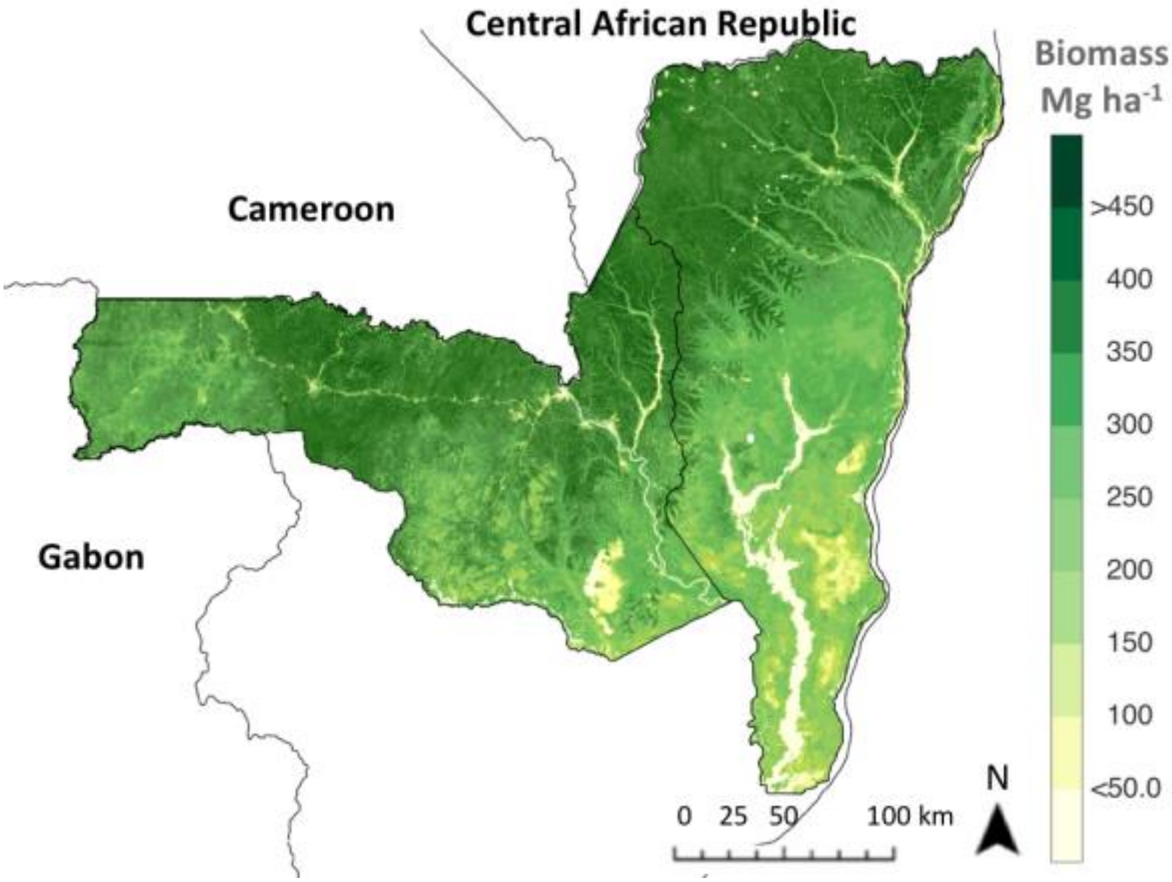
PCI-REDD	FSC Principles, Criteria and Indicators
Principle 1 - Comply with the standards of democratic governance, including those contained in national and multilateral commitments	Principle 1: Compliance with laws and FSC Principles Forest management shall respect all applicable laws in the countries 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 11. ESTIMATION OF CARBON STOCKS

Estimation of Carbon Stocks

Emission Reductions Program in Sangha and Likouala, Republic of Congo



S. Saatchi

Contributions from: V. Meyer, A. Xu, and Y. Yan,

Los Angeles, CA 90095-1496

Phone: (310) 825-5008

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 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).

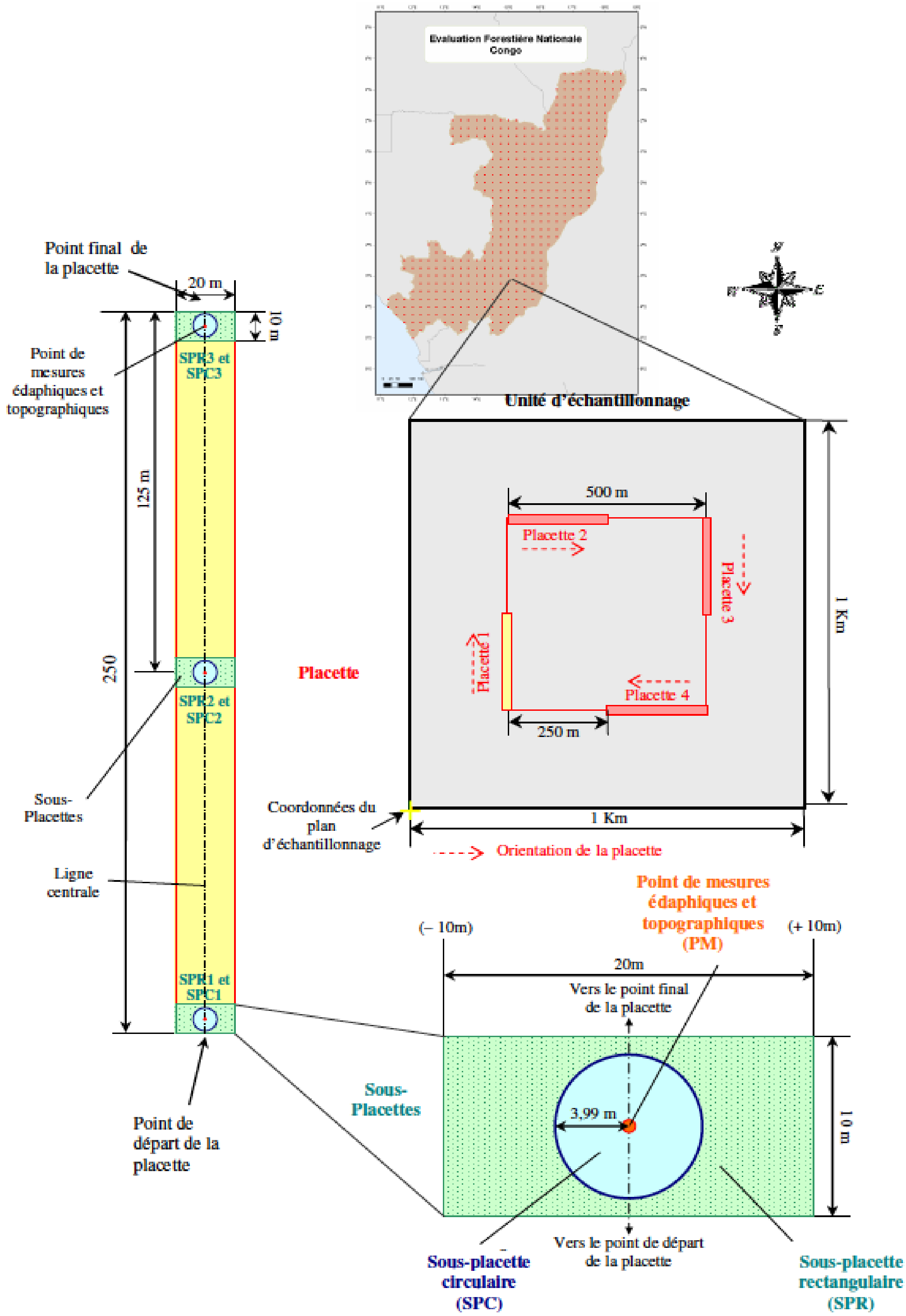


Fig. 1. Design of the permanent forest inventory plots in the Republic of Congo.

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.

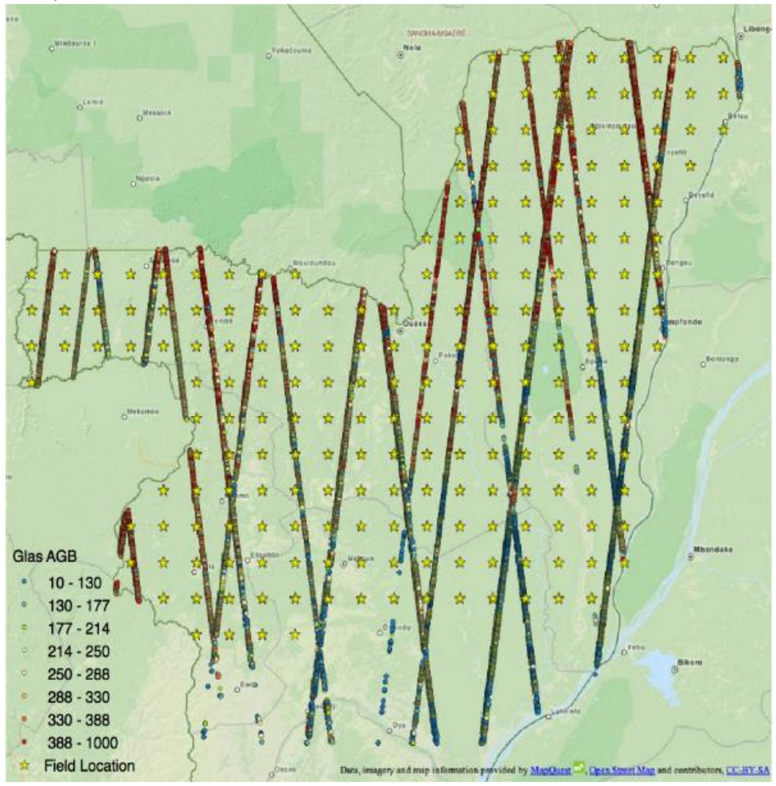
Unit	Shape	Size	Number	Measurements
Sampling Unit (EU)	Square	1 km x 1 km (1 km^2)	1	N/A
Plot	Rectangle	250 m x 20 m (5000 m^2)	4 per EU	D > 20 cm
sub-plots (SPR)	Rectangle	20 m x 10 m (200 m^2)	3 per plot	10 cm < D< 20 cm
Sub-sub-plots (SPC)	Circular	3.99 m radius (50 m^2)	3 per sub-plot	D< 10 cm, H> 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



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.

result, GLAS LIDAR samples may be considered a spatially biased or a pseudo systematic sampling (Healey et al., 2012).

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:

$$AGB_{est} = \frac{10^{-3}}{A}\sum_{i=1}^{N} 0.0673 \times (\rho_i D_i^2 H_i)^{0.976} \qquad (1)$$

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.

$$AGB_i = exp\{-1.803 - 0.976E + 0.976\ln(\rho) + 2.673\ln(D) - 0.0299[\ln(D)]^2\} \qquad (2)$$

$$AGB_{est} = \frac{10^{-3}}{A}\sum_{i=1}^{N} AGB_i \qquad (3)$$

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 ($AGB_{>10cm}$).

$$AGB_{>10cm} = 2.246 \times AGB_{>20cm}^{0.8726} \quad (4)$$

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 ($AGB_{>1cm}$).

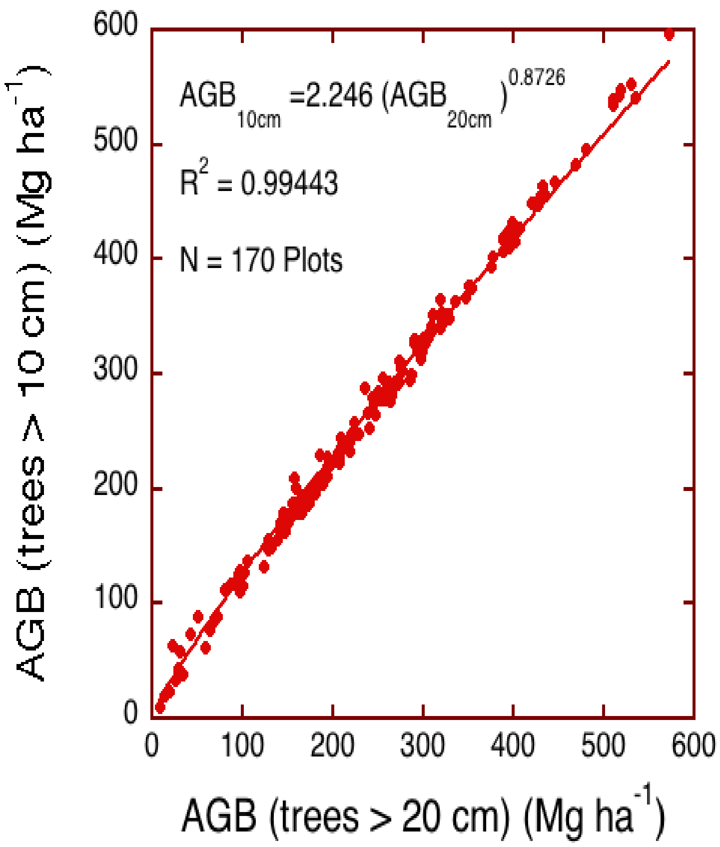


Fig. 3. Model to scale the forest biomass to all trees > 10 cm in diameter from measurements of trees > 20 cm in diameter. Plots inlcude data from ROC forest inventorya and research plots in Congo (Afritron) and border regions in Gabon and DRC in similar forest types. The plots include both terra firme and swamp forests.

$$AGB_{>1cm} = 1.872 \times AGB_{>10cm}^{0.906} \quad (5)$$

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.

$$BGB = 0.235 \times AGB \;\; if \; AGB > 125 \; Mg \; ha^{-1}$$
$$BGB = 0.205 \times AGB \; if \; AGB \; \leq 125 \; Mg \; ha^{-1} \qquad (6)$$

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:

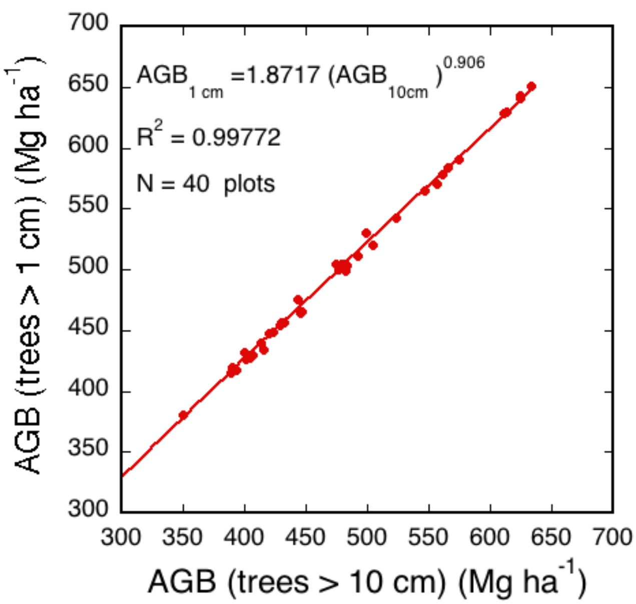


Fig. 4. Model to scale forest biomass of all trees > 10 cm to the total biomass of all trees > 1 cm diameter and minimum height of 1.3 m. Data includes plots in ROC and neighboring countries in DRC and Gabon over similar terra firme and

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.

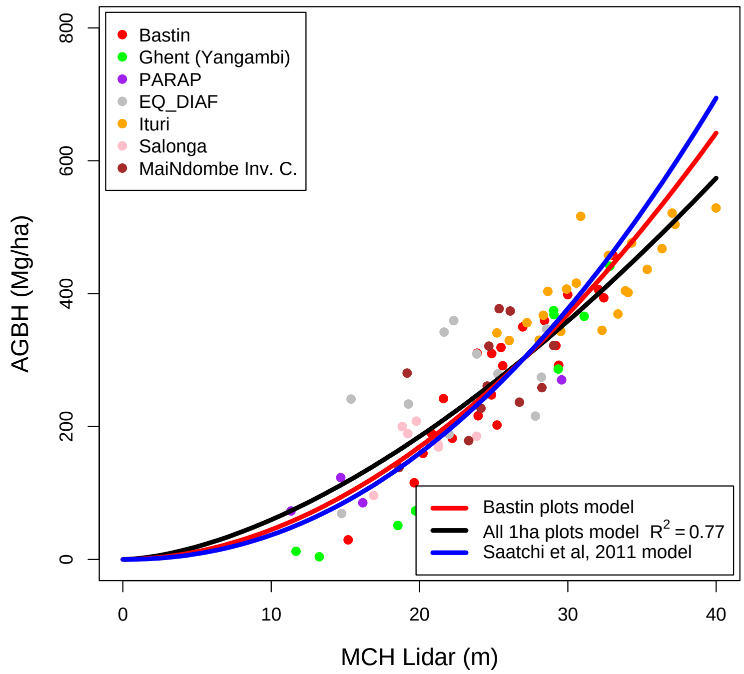


Fig. 5. Comparison of GLAS lidar biomass model (saatchi et al. 2011) and similar models derived from 1-ha research plots and airborne lidar data in DRC.

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

$$\boldsymbol{AGB_{i,j}} = \frac{\sum_{k=1}^{n} \mathrm{Pr}\left(\boldsymbol{AGBmin_k} < \boldsymbol{AGB_{i,j}} < \boldsymbol{AGBmax_k}\middle|\boldsymbol{A_k}\right)^{\boldsymbol{m}} \mathrm{Pr}(\boldsymbol{A_k})\boldsymbol{AGBmean_k}}{\sum_{k=1}^{n} \mathrm{Pr}\left(\boldsymbol{AGBmin_k} < \boldsymbol{AGB_{i,j}} < \boldsymbol{AGBmax_k}\middle|\boldsymbol{A_k}\right)^{\boldsymbol{m}} \mathrm{Pr}(\boldsymbol{A_k})} \quad (8)$$

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 $\Pr(A_k)$.

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:

Spatially over the map by using a set of the LIDAR data as an independent test and evaluate the biomass accordingly.

1. 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.
2. Evaluate the map at the average level for each stratified class by comparing the map estimated biomass with original LIDAR samples.

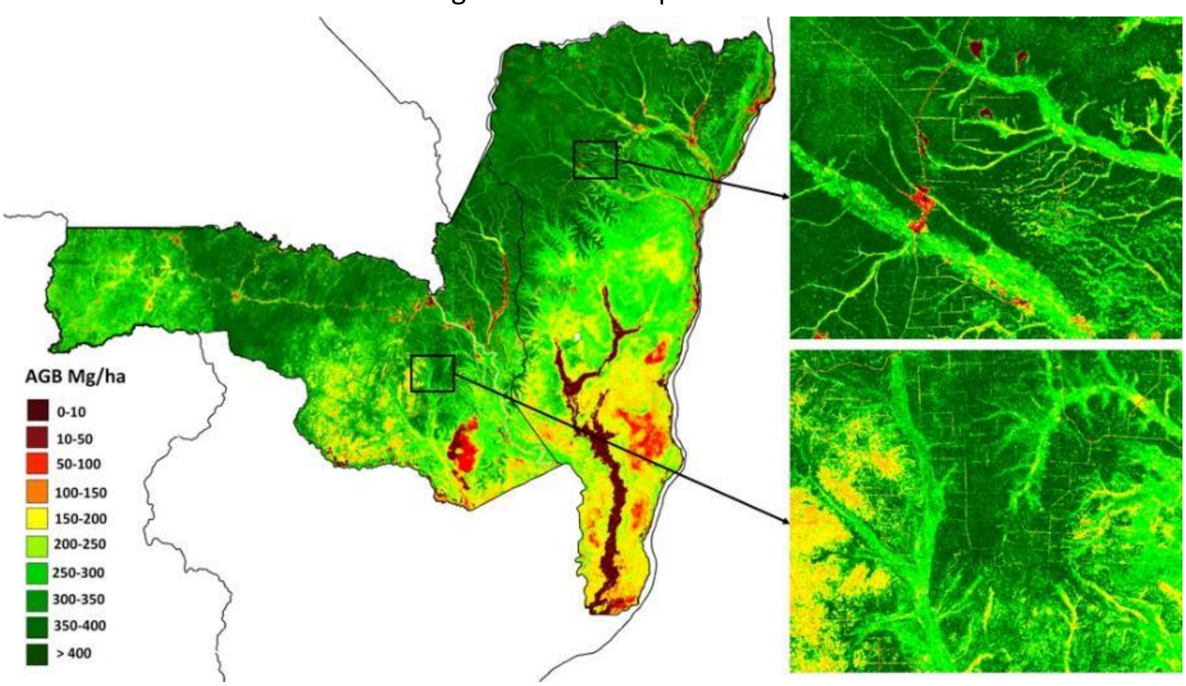


Fig. 6. Map of aboveground biomass distribution in Mg/ha at 1-ha resolution over the northern Congo covering two departments of Sangha and Likouala.

3. 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 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.

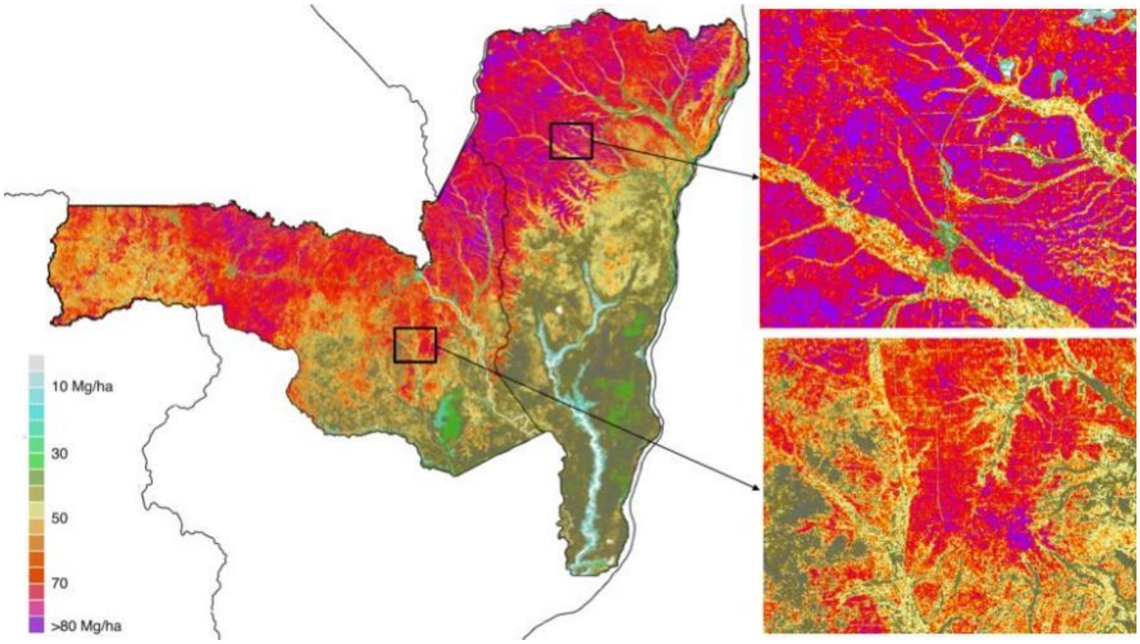


Fig. 7. Spatial distribution of biomass estimation error at the pixel level in terms of Mg/ha at 95% confidence interval and including all sources of errors.

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

$$\boldsymbol{\sigma_{\hat{B}}} = \sqrt{\frac{\sum_{k=1}^{N}\left(B_k - \hat{B}\right)^2 P_k P(A_k)}{\sum_{k=1}^{N} P_k P(A_k)}} \qquad (9)$$

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

$$\boldsymbol{\varepsilon_{AGB}} = \sqrt{\varepsilon_{ground}^2 + \varepsilon_{measure}^2 + \varepsilon_{allometry}^2 + \varepsilon_{sampling}^2 + \varepsilon_{prediction}^2} \qquad (10)$$

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).

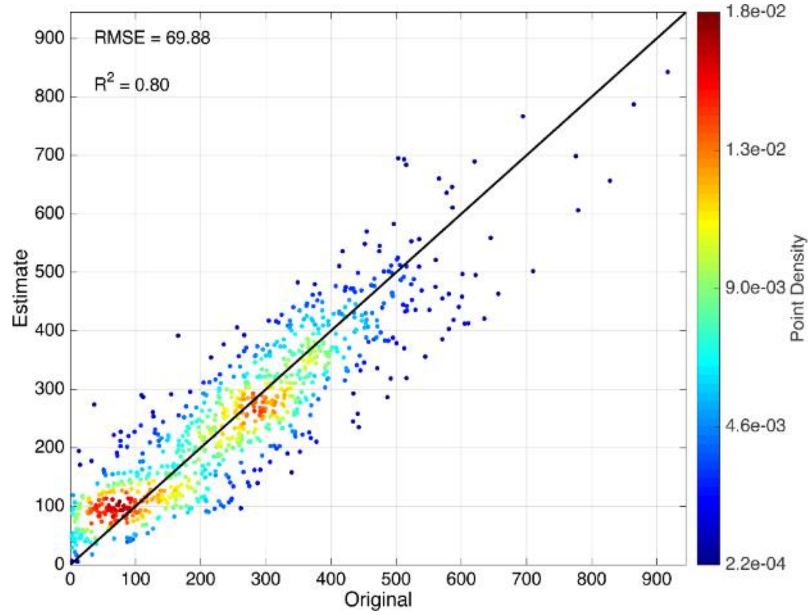


Fig. 8. Validation of the ME biomass map with independent samples (30% of the original samples).

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 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

$$MCH_{new} = \widehat{MCH}_{oob}(\boldsymbol{X}) - \left(MCH - \widehat{MCH}_{oob}(\boldsymbol{X})\right) = 2\widehat{MCH}_{oob}(\boldsymbol{X}) - MCH \qquad (11)$$

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

$$\begin{aligned}\widehat{MCH}_{BC}(X) &= \widehat{MCH}(\boldsymbol{X}) - \left(\widehat{MCH}_{new}(\boldsymbol{X}) - \widehat{MCH}(\boldsymbol{X})\right) \\ &= 2\widehat{MCH}(\boldsymbol{X}) - \widehat{MCH}_{new}(X)\end{aligned} \qquad (12)$$

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 if AGB >125 Mg ha-1

BGB =0.205* AGB if AGB ≤ 125 Mg ha-1 (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:

$$BGB = 0.489 * AGB^{0.89} \quad (14)$$

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.

$$\boldsymbol{\varepsilon_{total}} = \sqrt{\boldsymbol{\varepsilon^2_{AGB}} + \boldsymbol{\varepsilon^2_{BGB}}} \quad (15)$$

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
ε_{ground}	From ground measurements and allometry ~ 10% (Chave et al. 2003)	0.1 (10%)
$\varepsilon_{measurement}$	GLAS Lidar height measurement error	0.137 (13.7%)
$\varepsilon_{allometry}$	Lidar biomass allometry	0.16 (16%)
$\varepsilon_{sampling}$	Difference between LIDAR footprint and 1-ha pixel of the map. Estimate derived from ground plots	0.1 (10%)
$\varepsilon_{prediction}$	Derived from the MaxEnt Spatial Modeling	Variable at the pixel level
ε_{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.

$$n = \left(\frac{t\infty_{val}}{E}\right)^2 \sigma_L^2 \tag{16}$$

$$\sigma_L^2 = P^{-1}\frac{1}{m(m-1)}\left(\sum_{i=1}^{m}\sigma_{ui}^2 + 2\sum_{i=1}^{m}\sum_{j<i}^{m}\rho(d)\sigma_{ui}\,\sigma_{uj}\right) \tag{17}$$

$$\rho(d) = \exp(-\frac{d}{cr}) \tag{18}$$

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.

11. REFERENCES

Chave, J., Condit, R., Aguilar, S., Hernandez, A., Lao, S., & Perez, R. (2004). Error propagation and scaling for tropical forest biomass estimates. Philosophical Transactions of the Royal Society of London. Series B: Biological Sciences, 359(1443), 409-420.

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

Chave, J. et al., 2005. Tree allometry and improved estimation of carbon stocks and balance in tropical forests. Oecologia, 145(1), pp.87–99. Available at: https://drive.google.com/file/d/0B9

9Vlx0SkkFcWNBOTRNdVpLQnc/edit?usp=sharing.

Chilès, J.-P. & Delfiner, P., 2012. Geostatistics, Hoboken, NJ, USA: John Wiley & Sons, Inc. Available at: http://dx.doi.org/10.1002/9781118136188.ch2 [Accessed January 9, 2015].

Mokany, K., Raison, R., & Prokushkin, A. S. (2006). Critical analysis of root: shoot ratios in terrestrial biomes. Global Change Biology, 12(1), 84-96.

Saatchi, S. S., Harris, N. L., Brown, S., Lefsky, M., Mitchard, E. T., Salas, W., ... & Morel, A. (2011). Benchmark map of forest carbon stocks in tropical regions across three continents. Proceedings of the National Academy of Sciences, 108(24), 9899-9904.

Verified Carbon Standard, VT0005, Tool for measuring aboveground live forest biomass using remote sensing, 2015.

UNFCCC, 2013, AR-TOOL14, Estimation of carbon stocks and change in “Carbon stocks of trees and shrubs A/R CDM project activities.” Available at: http://cdm.unfccc.int/methodologies/ARmethodologies

Weisbin, C. R., Lincoln, W., & Saatchi, S. (2014). A Systems Engineering Approach to Estimating Uncertainty in Above-Ground Biomass (AGB) Derived from Remote-Sensing Data. Systems Engineering, 17(3), 361-373.