Forest Carbon Partnership Facility (FCPF)
Carbon Fund

Emission Reductions Program Document (ER-PD)

ER Program Name and Country: *Mai-Ndombe Emission Reductions Program, Democratic Republic of Congo*

Date of Submission or Revision: *January 15th 2016*

DRAFT VERSION OF THE DOCUMENT

- *This document is a DRAFT of the Mai-Ndombe Emission Reductions Program Document.*
- *The ERPA revenue sharing agreement is proposed for information only for the purposes of illustrating the practical application of the principles and to lay a basis for discussion with all partners in the run-up to signature of the ERPA and the implementation of the final revenue sharing plan.*

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ACRONYMS

A/R	Afforestation / Reforestation
CAFEC	Central Africa Forest Ecosystems Conservation
CAFI	Central African Forest Initiative
CARG /CART	Agricultural Rural and Management Council/Rural Management Council
CBFF	Congo Basin Forest Fund
CCBA	The Climate, Community & Biodiversity Alliance
CDM	Clean Development Mechanism
CDF	Congolese Franc – (1US$ equivalent to 927,6 CDF – 2016.01.31)
ESFM	Environmental and Social Management Framework
CIRAD	Agricultural Research Center for International Development)
CLD	Local Development Committees
CSO	Civil Society Organizations
CTB	Belgian Technical Cooperation
CTR	Technical Committee for Reform Monitoring and Evaluation, Ministry of Finance
DGRAD	Directorate-General of Administrative, Judicial, State Land and Share Charges of the DRC)
DIAF	Department of Forest Management and Inventories
DTE	Decentralized Territorial Entities
DVI	Department of Internal Control and Audit
ER	Emission Reductions
ERA	Ecosystem Restoration Associate
ERC	Emission Reduction Credits
ERPA	Emission Reductions Payment Agreement
ERPD	Emission Reductions Program Document
ER-PIN	Emission Reductions Program Idea Note
ESMP	Environmental and Social Management Plan

FAO	Food and Agriculture Organization of the United Nations
FCPF	Forest Carbon Partnership Facility
FGRM	Feedback and Grievance Redress Mechanism
FIB	Wood IndustriesFederation
FIP	Forest Investment Program
FLEG	Forest Law Enforcement and Governance
FLEGT	EU Initiative on Forest Law Enforcement, Governance and Trade
FPIC	Free, Prior and Informed Consent
GHG	Greenhouse Gas
GI-Agro	Groupe d'Initiatives pour l'Agroforesterie en Afrique (Agroforestry Initiative Group for Africa)
GIZ	Deutsche Gesellschaft für Internationale Zusammenarbeit (German Agency for International Cooperation).
GPRSP	Growth and Poverty Reduction Strategy
GTCR	Working Group on Climate and REDD+
HFLD	High Forest Cover Low Deforestation
HPP	Human People to People
ICCN	Institut Congolais de la Conservation de la Nature (Congolese Institute for Nature Conservation)
ICRAF	International Center for Research in Agroforestry
IFAD	International Fund for Agricultural Development
IMO	Independent and Mandated Observer
IP	Indigenous Peoples
JNR	Jurisdictional and Nested REDD+
JICA	Japanese International cooperation agency
KFW	*Kreditanstalt für Wiederaufbau* – German Development Bank
LDC	Local Development Committee
LEA	Local Executing Agency
MECNDD	Ministry of Environment, Nature Conservation and Sustainable Development
MINAGRI	Ministry of Agriculture of the DRC
MRV	Measuring, Reporting and Verification
CN-REDD	National REDD+ Coordination
NGO	Non-Governmental Organization
OGF	Forest Governance Observer (a NGO)

OSFAC	Organisation Satellitale des Forets d'Afrique Centrale (Satellite Observatory for the Forests of Central Africa)
PDEF	Planned Deforestation
PDEG	Planned Forest Degradation
PES	Payment for Environmental Services
PIREDD	Integrated REDD+ Project
R&D	Research & Development
RCI	REDD+ Climate Initiative
RCWG	REDD+ Climate Working Group
REDD+	Reducing Emissions from Deforestation and Forest Degradation
REL	Reference Emission Level
REPALEF	Réseau des populations autochtones et locales pour la gestion durable des écosystèmes forestiers (Network of indigenous and local populations for the sustainable management of DRC forest ecosystems)
SDD	Sustainable Development Department of MEDD
SDP	Sustainable Development Plans
SES	Social and Environmental Safeguards
SESA	Strategic Environmental and Social Assessment
SIS	Safeguards Information System
SNV	Dutch Development Organization
UCL	Université Catholique de Louvain (Catholic University of Louvain)
UNDEF	Unplanned Deforestation
UNDEG	Unplanned Degradation
UNDP	United Nations Development Program
UNEP	United Nations Environment Program
UNFCCC	United Nations Framework Convention on Climate Change
USAID	United States International Agency for Development
USFS	United States Forest Services
VCS	Verified Carbon Standard
VPA-FLEGT	Voluntary Partnership Agreement - Forest Law Enforcement, Governance and Trade
WRI	World Resources Institute
WWC	Wildlife Works Carbon
WWF	World Wide Fund for Nature

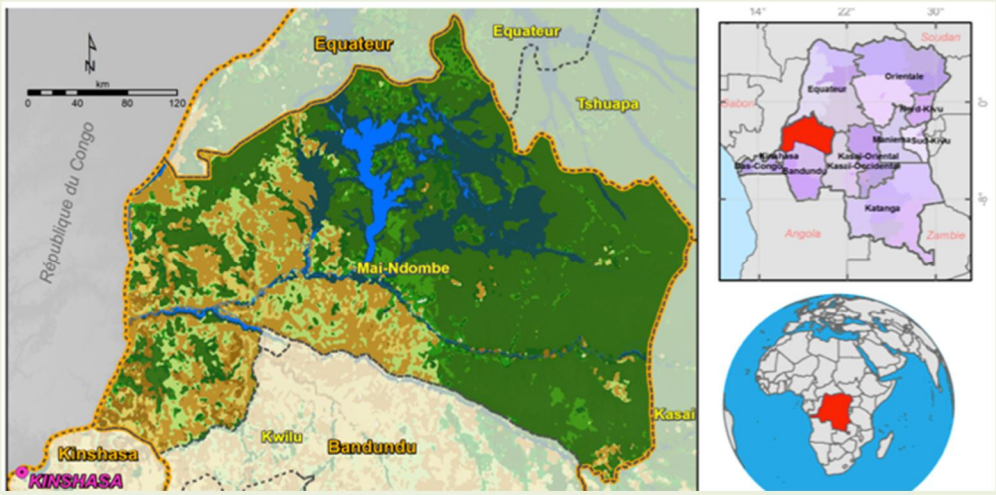
MAI NDOMBE EMISSION REDUCTIONS PROGRAM DOCUMENT EXECUTIVE SUMMARY

SNAPSHOT

The Government of DRC views the Maï-Ndombe Emission Reductions (ER) Program as a first step in implementing the country's national REDD+ strategy at jurisdictional level, as a model for green development in the Congo Basin, a key test of climate action on the African continent and for REDD+ results-based payments in HFLD countries. The ER Program is a unique opportunity to secure long-term public and private finance for delivering on the Paris Agreement's goal and sustainable development.

Program goal:	The ER Program aims at implementing the country's green development vision at scale by providing alternatives to deforestation and rewarding performance to address the challenges of climate change, poverty reduction, natural resource conservation and protection of biodiversity.
Jurisdiction:	Maï-Ndombe province, Democratic Republic of Congo • 12.3 million hectares total area • 9.8 million hectares of forest
Duration:	The program has a long-term perspective of 20 years with an ERPA period of 5 years (2016 – 2021)
CO_2 Reductions:	30 million tCO_2 estimated to 2021
Budget:	USD 70 million of up-front investment finance and a potential of results-based payments for 30 million tCO_2 over 5 years

The Proposal is for the Forest Carbon Partnership Facility (FCPF) Carbon Fund to sign an Emission Reduction Payment Agreement for 15 million tCO_2.



CONTEXT AND AMBITION

The Democratic Republic of Congo (DRC) is a key player to address global deforestation and mitigate climate change. The country has the second largest swath of rainforests in the world—152 million hectares, accounting for most of the remaining rainforest in the Congo Basin. Although rates of deforestation in the DRC are low compared to tropical forests in the Amazon and Southeast Asia, almost half a million hectares are lost each year. As one of the least developed countries (LDC) in the world, economic development is a top priority and the country's forests are under increasing threat. Representing a High Forest Cover and Low Deforestation (HLFD) country, DRC is at a critical juncture. 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 of DRC is committed to implementing this objective through a low carbon development pathway including REDD+. It views the environment and efforts to combat climate change as one of the strategic areas of its national policy and submitted to the UNFCCC an Intended Nationally Determined Contribution (INDC) on mitigation that presents specific emission reduction goals for the land sector including reducing deforestation, increasing reforestation, and improving agricultural practices. In particular, the DRC Government is committed to slowing, and eventually halting, forest loss. In 2012, it adopted a National REDD+ Strategy, which illustrates a vision for how a country can meet its long-term development aspirations through a green economy. The strategy aims to stabilize forest cover on two–thirds of the country's land area by 2030 and maintain it thereafter. The DRC has been engaging in and championing the REDD+ process since 2008 and has developed a large-scale REDD+ program for result-based payments in the Mai-Ndombe Province to deliver significant climate impact, critical development benefits and unprecedented learning for the FCPF Carbon Fund. The country was one of the first to submit an Emission Reduction Program Idea Note (ERPIN) in April 2014 and the first to present a Readiness-Package in Mai 2015. The design of the Emission Reductions Program Document (ERPD) for Mai Ndombe has progressed over a period of nearly two years in close and frequent consultation with local, national and international stakeholders, including civil society and Indigenous Peoples.

The ambition of the Mai-Ndombe ER-Program is to implement a model for green development at provincial level that provides alternatives to deforestation and rewards performance to mitigate climate change, reduce poverty, manage natural resources sustainably and protect biodiversity. The program is designed to combine different sources of funding, such as the Forest Investment Program (FIP), the Congo Basin Forest Fund (CBFF) and the Central African Forest Initiative (CAFI), and to leverage private funding to scale up pilot activities and support the shift of a land use trajectory at large scale.

Consultations and information in the design phase of the Mai Ndombe ER Program has taken place at multiple levels. Beyond the extensive consultations in the context of the REDD+ readiness process, significant efforts have been undertaken to inform and consult local stakeholders in Mai Ndombe (Indigenous Peoples, local communities, civil society organisations, decentralized administration, companies) through meetings in every territory, outreach activities and trainings in the capitals of the former as well as the new province (Bandundu Ville and Inongo).

DRIVERS AND UNDERLYING CAUSES OF DEFORESTATION AND FOREST DEGRADATION

The main direct drivers of deforestation and forest degradation in the program area are slash-and-burn agriculture, fuelwood production, uncontrolled bush fires, artisanal logging and industrial logging. The underlying reasons for these drivers are population growth, poverty, the absence of economic and technical alternatives, poor management of natural resources, and unregulated land tenure. These direct

and indirect drivers constitute strong trends towards increased pressure on forests. The Mai-Ndombe Province is located at the frontier of the Kinshasa supply basin for agricultural and wood products and the primary forest of the Congo Basin. Agricultural production is the main source of income for 90% of the households in the province. Cassava and maize are the main cash crops sold primarily to Kinshasa and Mai-Ndombe has become an important source of charcoal supplies for Kinshasa as a result of the depletion of the forests of the Lower Congo between 2000 and 2010. This pressure on Mai-Ndombe's forest resources will continue to be exacerbated as demand from Kinshasa rises and the surrounding forests shrink. Moreover the demand for slash-and-burn farming land is significant (if unsuitable or occupied land is excluded the remaining forested area represents approximately 46% of the province's total area). With a population growth rate of 3% it is estimated that in approximately 33 years the non-concession and non-flooded forests of Mai-Ndombe will be totally lost to agriculture.

INTERVENTION STRATEGY AND PROGRAM ACTIVITIES

In order to be transformational, the program is designed to provide a balanced combination of (i) enabling activities, such as strengthening governance, capacity building, local level land-use planning, and securing land tenure, and (ii) sectoral activities, such as improved agricultural practices, reduced impact logging, agroforestry, fire management and charcoal production. The operationalization of a green development model means for the province to offer a sustainable supply of fuelwood, lumber and agricultural products for the megalopolis of Kinshasa while at the same time increasing the incomes of the local population and maintaining significant forest cover.

More specifically on the set of sectoral activities, the program strategy is geographically adapted and involves a land-use planning process centered on the sustainable development of natural resources. This includes (i) offsetting the demand for unsustainable wood products from the province-city of Kinshasa with reforestation and regeneration activities on savanna lands and along the river, in particular in the district of Plateau, (ii) orienting agricultural production in the forest towards practices that are less land-consuming than fallow-slash and burn farming, such as perennial crops and agroforestry (iii) incentivizing the conservation and sustainable management of forests.

A summary of the program's activities in line with the seven pillars of the national REDD+ strategy is provided the following table:

Pillars	Sectoral activities	Enabling activities
Agriculture	• Agroforestry and improvement of cultivation techniques • Perennial crops development in non-forest areas (coffee, cocoa, palm oil and rubber)	• Strengthening agricultural value chains
Energy	• Assisted natural regeneration for charcoal production • Afforestation/Reforestation for charcoal production	• Formalization and strengthening of the fuelwood sector
Forest	• Reduced impact logging • Conservation of local community forests • Conservation concession • Afforestation/Reforestation for lumber production	• Strengthening forest and wildlife law enforcement • Legal compliance of industrial logging operations • Development of community forestry • Support management of protected areas

Governance, demography, land planning and tenure	Capacity-building of decentralized State services Multi-level capacity-building and Sustainable Development Plans design Implementation of collective and strategic facilities Family planning

REFERENCE EMISSION LEVEL

The Reference Emission Level (REL) is stratified in accordance with the analysis of the drivers of deforestation and forest degradation and the ER-Program mitigation strategy. This stratification allow (i) to use different methods of estimating carbon emissions appropriate to different drivers of deforestation and forest degradation and (ii) to provide adapted performance-based incentives to different actors in line with their mitigation activities. The following table provides information about the strata, their associated drivers, the methodologies and results of the REL as well as the potential of Gross Emission Reductions (including ERs to be set aside in buffer accounts) according to the program strategy.

The net Emission Reductions (i.e. excluding buffer accounts) for the 5 years period amount to 30 million tCO2.

Stratum (associated drivers)	Methodologies in compliance with Carbon Fund Methodological Framework	2004-2014 historic REL (tCO_2/year)	Capped adjustment (tCO_2/year)	ER Gross potential (tCO_2 for a 5 year period)
Unplanned Deforestation & Degradation (agriculture, fuelwood, artisanal logging)	Manual classification of sampled remotely sensed imagery, consistent with IPCC Approach 3 techniques, which uses an intelligent filter to recognize and ameliorate potential land-use transition anomalies.	101,648,395	To be monitored (cap 2,751,811)	36,349,393
Planned Degradation (industrial logging)	Based on existing methodologies such as VM0010, VM0011 and methodologies developed by Hirsh et al. (2013) and Schmidt (2014).	701,555	2,507,683	1,872,281
Afforestation/Reforestation (plantations and natural regeneration)	Small Scale CDM methodology 'Afforestation and Reforestation Project Activities implemented on Lands other than Wetlands', Version 3	0	0	601,466
	Total	102,349,950 tCO_2/year	5,259,494 tCO_2/year	38,222,275 tCO_2 for 5 years

BENEFIT-SHARING

Beneficiaries of the REDD+ revenues will include participants with direct and indirect influence including legal or de facto managers of forest resources, actors in the different value chains of commodities as well as political and administrative stakeholders. Indigenous Peoples will receive special recognition by the program according to the recognition of their historical role in sustainable forest management.

The benefit sharing arrangements will take into account the origin of the up-front funding and also the non-carbon benefits generated by the program Revenues from the sale of Emission Reductions will be allocated through three windows in the benefit sharing plan:

- Performance-based payments based on the amount of carbon not emitted or sequestered (Emission Reduction Credit) for forest concessions, conservation concessions and others actors willing to own directly the Emission Reductions titles;
- Performance-based payments based on proxy indicators for carbon performance, such as the number of non-deforested, regenerated, or planted hectares, to communities, private companies, medium-scale farmers and other stakeholders;
- Pooling of a share of the revenues for reinvestment in enabling and communities sectoral activities, leverage of private finance and operating costs, including a risk management mechanism for the case of under-performance of the program.

An indicative benefit-sharing plan is provided in the ERPD and will be reviewed in the context of the further ERPD development and ERPA negotiations

Beyond the revenues from sale of Emission Reductions, the program will increase household incomes and deliver socio-economic investments, such as roads, agricultural storage facilities and other infrastructure, on the ground. It will also catalyze private investments in the jurisdiction, reinforce good governance, for example tenure security, law enforcement, participation and transparency, and produce environmental co-benefits, such as biodiversity and soil fertility.

IMPLEMENTATION AND MONITORING ARRANGEMENTS

The Government of DRC, through the Ministry of Environment, Nature Conservation and Sustainable Development and the provincial government of Mai-Ndombe, will be the signatory of the ERPA.

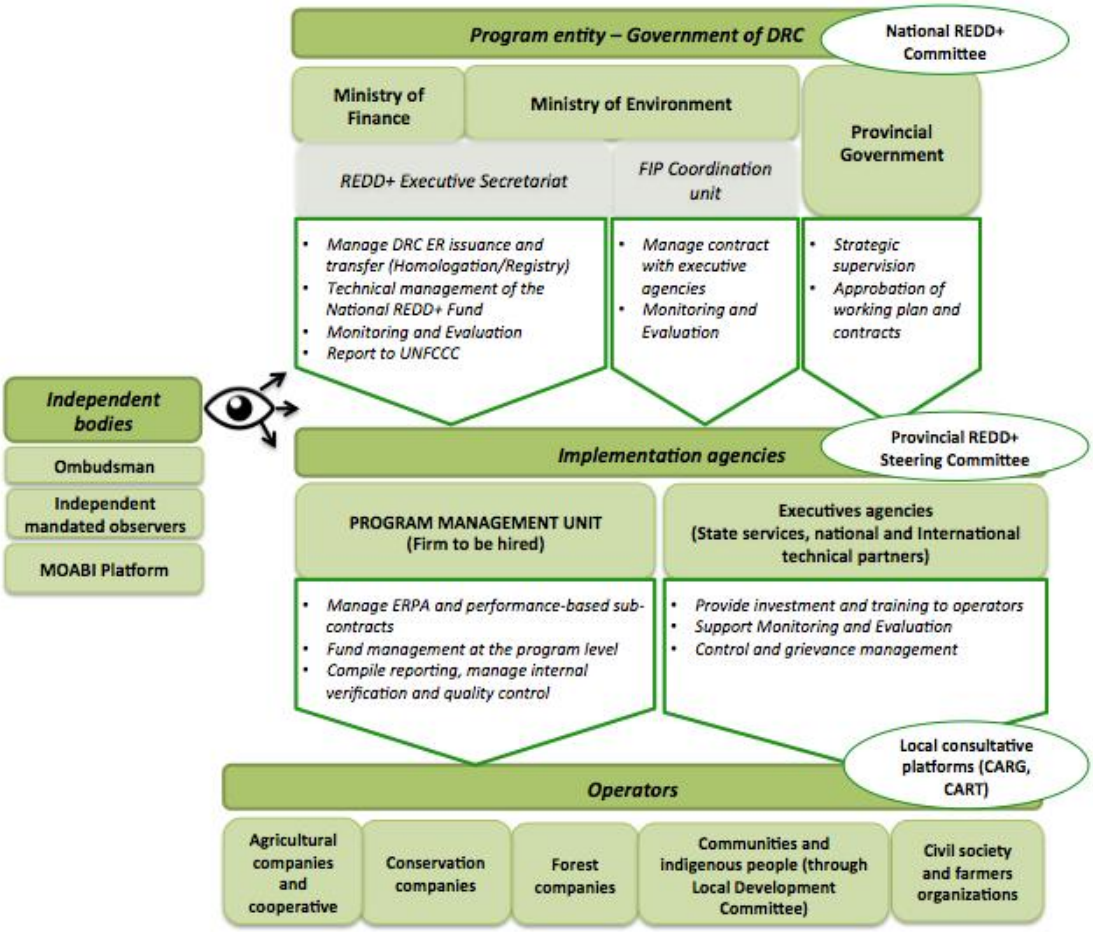
At the national level, the Ministry of Environment and the Ministry of Finance will co-chair the National REDD+ Fund through the National REDD+ Committee and its technical body; the Executive Secretariat. This Executive Secretariat will be the entity in charge of technical tasks in relation with the National REDD+ Fund, the homologation of carbon projects, ER issuance and transfer through the National REDD+ Registry and monitoring, evaluation and reporting to the UNFCCC at national level. The Executive Secertariat will coordinate with the FIP Coordination Unit to ensure the contractual and financial management of the main investment programs in the area.

The provincial government of Mai Ndombe is the main agency responsible for the program implementation and will be technically supported by the Program Management Unit. While the provincial government's role is focused on steering and policy coordination, the Program Management Unit will be in charge of the day-to-day management of the program, including administrative and financial management, carbon and non-carbon monitoring and reporting of the program, and management of the performance-based contracts with the operators. It will also be the interface with the Carbon Fund. This unit will be a firm with a track record and recognized skills. The Program Management Unit will work closely with the provincial government and build its capacities with the perspective of transferring the program management functions to the provincial administration in the medium term.

The provincial government will furthermore be supported by the Provincial REDD+ Steering Committee, which will include representatives from all ministries, civil society, Indigenous Peoples, private sector, and the different executing agencies involved in the implementation of the ER program. The Committee will be in charge of reviewing and approving work proposed by the Program Management Unit (e.g. approve sub-contracts, work plans and budgets, validate monitoring reports) and provide strategic and policy directions).

Program activities on the ground will be implemented by various operators, such as communities and Indigenous Peoples, civil society and farmer's organization, and companies involved in logging, conservation and agriculture. These operators will be supported and accompanied by local executing agencies and decentralized State services.

The monitoring and evaluation of the program will be structured mainly around the production of two progress reports: First, a monitoring report on the emission reductions will trigger payments by the Carbon Fund and other emission reduction purchasers. This report will also be the basis for performance-based payments defined in contracts with the operators. Second, a monitoring report on safeguards and non-carbon benefits will compile information of impact studies and compliance with safeguard measures when necessary. The institutions responsible for monitoring and evaluation of the program include the Directorate of Inventory and Forest Management (DIAF), local consultative platforms (CARG and CART), independent mandated observers, the non-governmental Moabi platform and independent auditors and verifiers.



SOCIAL AND ENVIRONMENTAL RISKS MANAGEMENT

The ER Program's intervention strategy has been developed in alignment with the National REDD+ Strategy Framework and has taken into account the recommendations resulting from the Social and Environmental Strategic Assessment (SESA) process and national Environment and Social Management Framework (ESMF).

The DRC has also defined its National Social and Environmental Standards in order to put in place its own national regulatory framework and ensure the integration of social and environmental considerations in the implementation of REDD+, in full compliance with the Cancun Safeguards. The program will apply these safeguards instruments during implementation and operationalize the risk management matrix that has been prepared. The management of social and environmental impacts of the program is fully integrated into the identification, design, monitoring, and evaluation of its activities. All projects/activities implemented by the program will need to comply with the requirements of the ESMF at every step of implementation.

The sound application of safeguards as well as the generation of non-carbon benefits will be disclosed through the following channels: (i) regular information posted in the national REDD+ registry (ii) an independent information platform (MOABI) and (iii) a regularly published monitoring report checking compliance with the National Environmental and Social Standards.

In order to manage potential complaints and conflicts, a Feedback Grievance and Redress Mechanism (FGRM) is currently being designed and will be the responsibility of the Program Management Unit and the implementing agencies. From the middle of 2016, the FGRM will be tested and the national REDD+ registry will provide a transparent platform for filing complaints and monitoring their handling.

A PARTNERSHIP AMONG:

DRC GOVERNMENT	PRIVATE SECTOR	CIVIL SOCIETY
	WILDLIFE WORKS, Vodacel, Groupe ORGAMAN	WWF, GTCR RDC, MOABI DRC, og, International Institute for Applied Systems Analysis

WITH THE FINANCIAL SUPPORT OF:

cbff, Climate Investment Funds, Programme ONU-REDD, Forest Carbon Partnership, World Bank Group, Norad, USAID, Bundesministerium für Umwelt, Naturschutz und Reaktorsicherheit, kfw, Department for International Development, afd Agence Française de Développement, CTB, JICA

Further information:
Victor Kabengele wa Kadilu, CN-REDD abckab@gmail.com

1. ENTITIES RESPONSIBLE FOR THE MANAGEMENT AND IMPLEMENTATION OF THE ER PROGRAM

1.1 ER PROGRAM ENTITY THAT IS EXPECTED TO SIGN THE EMISSION REDUCTION PAYMENT AGREEMENT (ERPA) WITH THE FCPF CARBON FUND

Name of the entity	Ministère de l'Environnement, Conservation de la Nature et Développement Durable (MECNDD) / Ministry of Environment, Nature Conservation and Sustainable Development
Type and description of the organization	Ministry in charge of environment, forestry and especially management of environmental services. The Ministry has been in charge of the REDD+ process since 2009. It ensure the coordination of REDD+ related activities through the REDD+ National Coordination. The ministry of environment signed the Letter of Intent with the Carbon Fund in June 2014.
Main contact person	*Mr Vincent KASULU SEYA MAKONGA*
Title/Function	General Secretary – UNFCCC Focal point
Address	*15 Papa Lleo Street, Kinshasa, Gombe*
Telephone number	*+243814510594/ +243999905957*
Email	*kaseyamak@yahoo.fr*
Website	*www.medd.gouv.cd*

1.2 ORGANIZATION(S) RESPONSIBLE FOR MANAGING THE PROPOSED ER PROGRAM

Name of the organization	Provincial government of Mai-Ndombe supported by a Program Management Unit
Type and description of the organization	The provincial government of Mai-Ndombe will be responsible of coordinating the implementation of the different activity on the ground and especially the management of the performance-based payment system. It will chair the program steering committee that will be responsible to approve the orientation of the implementation and the working plans of the different executive agencies. The provincial government will be supported by a Program Management Unit that will be hired by the Ministry of environment. This unit will be responsible for the daily management of the program and will be based partly in the capital of the province of Mai-Ndombe (Inongo). It will be responsible of (i) administrative and financial management, (ii) Strategic and technical coordination, (iii) Carbon and non-carbon reporting and (iv) marketing of the program. (see Section 6.1 and Annex 8)
Organizational or contractual relationship between the organization and the ER Program entity identified in 1.1 above	The provincial government will be involved through an agreement protocol with the Ministry of Environment. The Program management unit will sign a service provider contract with the Ministry of Environment.
Main contact person	*Mr. Gentiny Ngobila*
Title/Function	*Special commissioner of Mai-Ndombe province*
Email	*ngobila@gmail.com*

1.3 PARTNER AGENCIES AND ORGANIZATIONS INVOLVED IN THE ER PROGRAM

Name of the partner	Name of the contact person, telephone number and email address	Core capacities and role within the ER program
CENTRAL GOVERNMENTAL ENTITIES		
National REDD+ Steering Committee	To be defined	*National steering of the REDD+ process and of the National REDD+ Fund* *Members: Ministers of Environment, Finance, Planning, Land-use Planning, Agriculture, Mines, Water Resources and Electricity, Hydrocarbons, Land Tenure; representatives of the private sector and of civil society.*
National REDD+ Coordination (CN-REDD)/MECNDD	Victor Kabengele wa Kadilu, National REDD+ Coordinator abckab@gmail.com	*Coordinates the REDD+ process in the DRC and the design phase of the Mai- Ndombe ER program*
Sustainable Development Department (SDD)/MECNDD	Benjamin Toirambe, Director of SDD be_toirambe@yahoo.fr	*Responsible for the National Greenhouse Gas Inventory*
Department of Forest Management and Inventories (DIAF) / MECNDD	Sébastien Malele, Director of DIAF semalele@yahoo.fr	*Responsible for the national forest monitoring system*
Ministry of Finance, Technical Committee for Reform Monitoring and Evaluation (CTR)	Félicien Mulenda, CTR Coordinator and focal point for the FIP and National REDD+ Fund Fmulenda2000@yahoo.fr	*Focal point for monitoring the reforms under the economic governance matrix, including REDD+ reforms* *Focal point for the National REDD+ Fund*
Coordination Unit of the Forest Investment Program /MECNDD	Clément Vangu-Lutete, Coordinator of the FIP vangulutete@gmail.com	*Financial and administrative management of the Forest Investment Program (FIP)*
PROVINCIAL GOVERNMENTAL ENTITIES		
Provincial Government of Mai-Ndombe	Gentiny Ngobila – Special commissioner of Mai-Ndombe province (interim governor) ngobila@gmail.com, Guy Ipenga - Provincial REDD focal point ipangaguy@gmail.com	*Pilot the implementation in the province and president of the REDD+ provincial steering committee. Work closely with the program management unit and has a steering and political coordination role.*
Provincial REDD+ Steering Committee	To be defined	*Provincial steering of the program, approval of the work plans and budgets for the program, validation of monitoring reports* *Members: Ministries (Agriculture, Environment, Energy, Health, Land-use Planning, Land Tenure), territorial administration, decentralized agencies, the provincial REDD+ focal point and representatives of the private sector, civil society and local communities and Indigenous Peoples.*
CIVIL SOCIETY		
Working Group on Climate and REDD+ (GTCR Rénové)	Guy Kajemba, kajembaguy@yahoo.com Joseph Bobia, jb.bobia@gmail.com	*Coordination of the participation of civil society in the REDD+ process and the ER-Program development, at national and provincial levels*
REPALEF (Réseau des populations autochtones et locales pour la gestion durable des écosystèmes forestiers)	Rigobert Mola, jr.mola@yahoo.fr Keddy Bosulu, bosulumola@yahoo.fr	*Coordination of the participation of Indigenous Peoples representatives in the REDD+ process and the ER-Program development, at national and provincial levels*

WWF - DRC	Flory Botamba fbotamba@wwfcarpo.org Bruno Perodeau Bperodeau@wwfcarpo.org	*Program design and implementation partner and execution agency of the FIP PIREDD in the Plateau District*
Forest Governance Oberserver (OGF)	Essylot Lubala, essylot@yahoo.fr	*Independent observer of the FLEG process, mandated by the Ministry of Environment. Has worked since 2014 on the development of independent observation of the REDD+ process*
NGO MOABI	Léo Bottrill, leobottrill@crowdcover.org Benoit Thuaire, benoit.thuaire@gmail.com	*Manages an independent collaborative mapping platform for independent observers and local civil society*
GI-Agro	Jean Lejoly jeanlejoly@gmail.com	*Supports several villages in South Kwamouth on the development of REDD+ activities (agroforestry, regeneration etc.)*
CARITAS CONGO Asbl	André Mathunabo amathunabo@caritasdev.cd Thadée Barega, barega_th@yahoo.fr	*Supports agricultural producer organizations in the Diocese of Inongo on the improvement of agricultural production, their structuring and support for the strengthening of economic capacities.*
PRIVATE SECTOR AND PROFESSIONAL ORGANIZATIONS		
Wildlife Works Carbon (WWC)	Bolambee Bwangoy-Bankanza jrbwangoy@wildlifeworks.com Mike Korchinsky mike@wildlifeworks.com	*Program design and implementation partner, Mai-Ndombe REDD+ project holder approved by VCS and CCBA*
NOVACEL	Olivier Mushiete, olivier@mushiete.cd	*Company specializing in agroforestry techniques, processing and commercialization of agricultural products. Implements the NOVACEL REDD+ pilot project of South Kwamouth funded by the CBFF and is currently setting up an agricultural cooperative called GICET.*
Wood Industries Federation (FIB)	Gabriel Mola, President, gabrielmola58@yahoo.fr	*Network of industrial logging companies in the DRC*
SODEFOR	José Albano, jamt@sodefor.net Raphael Barbiche, gestion_durable@sodefor.net	*Forest company owner of 11 concession in the ER-Program area*
SIFORCO	Mateos Phillis, dgsiforco@siforco.com	*Forest company owner of 1 concession in the ER-Program area*
Maison NBK	Victor Ngla Mumume, victornbk@gmail.com	*Forest company owner of 1 concession in the ER-Program area*
Congo National Confederation of Agricultural Producers (CONAPAC)	Mutombo Simplice sarmutombo@hotmail.com	*Network of agricultural producers in Congo*
SOGENAC	Jean-Francois Van Braekel; vbk@vodanet.cd	*Director of a livestock concession in Bolobo and Mushie. Volunteer for the development of savanna and forest protection activities within this concession.*
SOCALCO company (Dewji International Group)	Rizwan Dewji rdewji@dewjiintl.com	*High-quality match manufacturing company based in Kinshasa; committed to developing agroforestry reforestation activities in the program area, to setting up an R&D center and to introducing local wood processing activities in order to increase local employment and revenue generation*
PERMIAN Global	Peter Carr peter.carr@permianglobal.com	*Support for conservation programs focusing on carbon performance through existing conservation concessions and facilitation for the creation of new conservation concessions.*

FUNDING PARTNERS AND TECHNICAL SUPPORT		
Forest Carbon Partnership Facility (FCPF)	Daniela Goehler, country focal point for DRC, 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 ERPD.*
Forest Investment Program (FIP)	Loic Braune, Task Team Leader, lbraune@worldbank.org	*Technical and financial support for the implementation of the Forest Investment Program in DRC and particularly the Improved Forested Landscape Management Project (P128887) and the FIP Dedicated Grant Mechanism to Indigenous People.*
UN-REDD Program	Leslie Ouarzazi (UNDP/DRC office, Kinshasa), leslieo.cnredd@gmail.com Josep Garí (UNDP/Africa, Nairobi), josep.gari@undp.org Philippe Crete (FAO/Rome), philippe.crete@fao.org Daniel Pouakouyou (UNEP/Nairobi), daniel.pouakouyou@unep.org	*Technical and financial support for REDD+ readiness including support for the national MRV system and the National REDD+ Fund*
Congo Basin Forest Fund (CBFF)	Clotilde Mollo Ngomba c.ngomba@afdb.org	*Financing of integrated REDD+ pilot projects*
Norwegian Agency for Development Cooperation (Norad)	*Tore Langhelle* Tore.Langhelle@norad.no	*Financing of WWF and VCS initiatives for implementing and testing the jurisdictional approache of REDD+*
German Development Bank (KFW), funded by the German Government (Ministry of Environment)	*Uwe Klug* Uwe.Klug@kfw.de	*Financial support through the Carbon Map and Model project (LiDAR etc.)*
European Forest Institute (EFI)	Adeline Dontenville adeline.dontenville@efi.int	*Technical and financial support for various aspects of implementation of REDD+ in the DRC (communication and awareness raising, support for local operators, support for independent observation and South-South cooperation)*
JICA /JAFTA	SHU MIZUSHINA Senior advisor, international Cooperation group smizushina@jafta.or.jp	*Technical and financial support for the strengthening of the DIAF's capacities for inventories and monitoring of forest cover in the Province of Mai Ndombe*
Verified Carbon Standard (VCS)	Julianne Baroody jbaroody@v-c-s.org	*Supporting the development and introduction of an REDD+ jurisdictional framework and ensuring the successful application of VCS JNR requirements combined with the Methodological Framework (MF) of the Carbon Fund.*
USAID-CARPE	Julie Fischer, Climate Change Advisor jufischer@usaid.gov	*Financial support through partner NGOs and other agencies involved in participatory activities of land-use planning, REDD+ awareness raising and fire management among communities, strengthening of capacities for REDD+ implementation with a particular focus on environmental and social safeguards.*
United States Forest Service (USFS)	Jean-Solo Ratsisompatrarivo National Coordinator usfs.drc@gmail.com	*Support for the DIAF and for fire management activities in the region of Mai-Ndombe*
Satellite Observatory for the Forests of Central Africa (OSFAC)	Landing Mane lmane@osfac.net	*Technical support for the development of the national and provincial MRV system*
Dutch Development Cooperation (SNV)	Samuel Martin smartin@snvworld.org	*Development of the fuelwood sector in the Kinshasa supply basin and support for the identification of development areas for perennial crops in Mai-Ndombe*

Forest Resources Management Ingenierie (FRMi)	Nicolas Bayol nbayol@frm-france.com	*A firm specialized in the management of forestry resources. Involved in the management plan preparation of several concession in the province. Support for the baseline for planned degradation linked to forest concession holders in the ER program.*
GFA *Invest*, funded by the German Government (Ministry of Environment)	Martin Burian martin.burian@gfa-group.de	*Technical support in the program design phase (baseline for the Afforestation/Reforestation and Planned Degradation stratum, socio-economic analyses of program activities, compliance with VCS standards etc.)*
GRET	Judicaël Fetiveau fetiveau@gret.org	*Technical support for the design of the Mai-Ndombe ER Program benefit sharing plan and for the definition of national principles.*

2. STRATEGIC CONTEXT AND RATIONALE FOR THE ER PROGRAM

2.1 CURRENT STATUS OF THE READINESS PACKAGE AND SUMMARY OF THE ADDITIONAL ACHIEVEMENTS OF READINESS ACTIVITIES IN THE COUNTRY

The DRC conducted a participatory self-assessment process regarding progress on REDD+ readiness between January and March 2015. As a result, process out of the 34 criteria of the Readiness Package Assessment Framework, national stakeholders rated 26 criteria as significantly progressed and eight as satisfactorily progressed. No criteria was found to lack the necessary degree of advancement (See Annex 2).

The consensus reached among the various national stakeholders on the status of REDD+ readiness demonstrates that the DRC is sufficiently advanced to enter into the REDD+ investment phase, even though some components still require further improvement. A work program has been prepared to consolidate the remaining activities in order to complete the readiness phase and operationalize the main REDD+ tools. Ten years after embarking on REDD+, the DRC is convinced that only entering the investment phase will allow the country to adjust and improve REDD+ tools by testing them on the ground. (See Annex 3)

The Readiness-Package, which takes into account previous recommendations on DRC's readiness process, was assessed by an independent expert. The independent review provided positive feedback on both the process and the results of the self-assessment including the work program (ref: TAP Independent Review of the R-Package Submitted by DRC on the FCPF website).

Finally, at the 19th FCPF Participants Committee Meeting (PC19), held from 17 to 19 May 2015 in Washington DC, the DRC presented its Readiness-Package. The FCPF Participants Committee endorsed it and emphasized the importance of the work program to complete the readiness work. (Ref: Resolution PC/19/2015/1).

The DRC will provide a summary of progress on the work program together with the submission of the final ER-PD in early 2016.

2.2 AMBITION AND STRATEGIC RATIONALE FOR THE ER PROGRAM

As the first large-scale REDD+ green development program in the Congo Basin, the Mai-Ndombe Emission Reductions Program seeks to promote climate change mitigation actions by establishing a framework for holistic and coordinated land-use planning and capacity building as the basis for sustainable development and in order to reduce the pressure on primary forests. The program is expected to have a significant impact on poverty reduction and improve livelihoods, to satisfy energy needs and support food security, as well as to promote the conservation and sustainable management of

natural resources and the protection of diversity of the local fauna and flora and essential ecosystem services.

The overall objective of the program is to develop a provincial model of green development that offers alternatives and incentives based on results-based payments in order to address climate change, reduce poverty, protect natural resources and maintain biodiversity.

This program will be one of the first tests of payment for results at large scale within the REDD+ framework. In alignment with the Forest Investment Program (FIP), it will develop activities corresponding to the seven pillars of the National REDD+ Strategy Framework: agriculture, energy, forests, land-use planning, land tenure, governance and demography. Furthermore, the additional investments required for the implementation of the program have been integrated into the National REDD+ Investment Plan 2015-2020 prepared by the DRC in the context of the capitalization of the National REDD+ Fund. The REDD+ Investment Plan builds on an earlier version from 2013 and has been updated for submission to the newly established Central African Forest Initiative (CAFI).[1] The DRC signed the CAFI Joint Declaration in September 2015. Finally, the Mai Ndombe ER Program will enable the DRC to test all the REDD+ tools developed during the readiness phase; such as the national REDD+ registry, safeguard instruments, the feedback and grievance redress mechanism (FGRM), the benefit sharing mechanism , the reference level and the national forest monitoring system (NFMS).

According to the DRC's forest cover change detection map for the period 1990-2010, prepared in 2015 by the DIAF with the support of FAO, the DRC had a forest cover of approximately 152 million hectares in 2010 and an annual deforestation rate of approximately 0.30% between 1990 and 2010. The DRC can therefore be classified as a country with high forest cover and low deforestation (HFLD). The HFLD classification was accepted by the Carbon Fund Participants of the FCPF with the inclusion of DRC's proposed ER Program in the FCPF Carbon Fund's pipeline based on the Emission Reductions Program Idea Note (ERPIN).

The Mai Ndombe Province covers an area of 12.3 million hectares, out of which 9.8 million hectares are forests. The main drivers of deforestation and forest degradation in Mai Ndombe, such as artisanal logging for fuelwood, illegal timber logging and widespread slash-and-burn agriculture, are related to its location in between the Kinshasa supply basin for agricultural and wood products and the humid tropical forest. At the same time, the potential to establish an alternative development model is high: many project developers and NGOs are already present in the area, savanna land is available to reorientat agricultural production systems and there is significant potential to grow perennial crops and develop the value chains for fishery, aquaculture and livestock.

The ER Program seeks to achieve five objectives combining carbon and non-carbon benefits in line with the UNFCCC framework for REDD+: They relate to climate, biodiversity, rights, livelihoods, and finance and governance. The objectives take into account the FIP results framework as well as the five guiding principles of REDD+.

[1] The objectives of the CAFI initiative are to accelerate political and governance reforms in order to counter deforestation in the region and to mobilize international finance in order to implement these reforms and fund investments for sustainable development within the forested regions.

Main objectives of the program until 2021
1. CLIMATE: Emission reductions of 45 million tons CO_2 are achieved compared to the reference level and the pressure on forests is reduced
2. BIODIVERSITY: Biodiversity is maintained and ecosystems services are improved
3. RIGHTS: The legal and customary rights over land, territories and resources are recognized, respected and strengthened
4. LIVELIHOODS: REDD+ benefits are shared equitably, improve local livelihoods in the long-term and the well-being of stakeholders, with a particular focus on the most vulnerable groups
5. FINANCE AND GOVERNANCE: Immediate, sufficient and predictable resources are mobilized in order to reward performance in the priority forest areas in an equitable, transparent, participatory and coordinated manner

2.3 POLITICAL COMMITMENT

The Mai-Ndombe ER Program mirrors the country's high-level political commitment to green growth and reducing deforestation. It is aligned specifically to the pillar "Environmental protection and combating climate change" of the Growth and Poverty Reduction Strategy Paper for the period 2011-2015[2] (GPRSP-II). This pillar is one out of four that were identified jointly by the DRC Government as priorities for development and will enter also in the country's National Development Plan, which is work in progress.

Political and cross-sectoral commitment on REDD+ is also evidenced by the incorporation of REDD+ measures into the Economic Governance Matrix, namely necessary reforms related to land tenure, land-use planning and REDD+ standards in the hydrocarbon and mining sectors. The Governance Matrix is tracked on a monthly basis by the Technical Committee for Reform Monitoring and Evaluation (CTR) under the oversight of the Ministry of Finance. The table below shows the progress achieved on Measure 13 "Implementation of the REDD+ process" according to the CTR progress report of November 2015.

Table 1 Progress on Measure 13 "Implementation of the REDD+ process" of the DRC's Economic Governance Matrix (CTR report of November 2015)

Activities	Responsible entity	Observations	Indicators
a) Publication of progress made with the "Readiness Package"	Ministry of the Environment	Achieved. R-Package report submitted and approved by the FCPF in May 2015.	Satisfactory progress on completion
b) Consistent with the national REDD+ strategy framework, adoption of a	Ministries of Land-use Planning and	In progress. Road map drawn up during a retreat in May 2015. Land-use planning reform launch	Land-use planning policy developed; national plan

[2] Growth and poverty reduction strategy papers are prepared by the International Monetary Fund (IMF) member countries following a lengthy consultation process with the stakeholders and development partners, including the services of the World Bank and IMF. They form the subject of annual progress reports and they outline the macroeconomic, structural, and social policies conducted by countries to support growth and poverty reduction, as well as external financing needs and the main sources of financing in this area. GPRSP-II documents may be obtained upon request from: publications@imf.org, or directly on the IMF website: http://www.imf.org

national land-use plan	Environment	workshop held. The CAFI initiative will help to move this reform forward considerably.	finalized and published
c) Consistent with the national REDD+ strategy framework, definition of the land tenure reforms needed to support economic development zones and conduct REDD+ pilot initiatives	Ministry of Land Affairs	In progress. CONAREF (National Commission for Refugees) operationalized. 2015-2016 mission statement adopted. The CAFI initiative will help to move this reform forward considerably.	Law on land tenure promulgated
d) Adoption of REDD+ standards for mining and hydrocarbons in the forest zones	Ministry of Environment/Mines/Hydrocarbons	In progress. Work plan developed and adopted. First site visit conducted in June 2015; second visit scheduled for September	Tools on REDD+ finalized
e) Operationalization of the National REDD+ Fund through the mobilization of external resources	Ministries of Finance and Environment	In progress. National REDD+ Investment Plan updated. Capitalization of the Fund through the CAFI initiative by the end of 2015	National Fund operationalized

Furthermore, the DRC has demonstrated its political commitment on REDD+ and the Mai-Ndombe ER Program during the following events in the past four years:

- October 2011 –President Joseph Kabila organized a High-Level Forum on Climate Change, where he outlined DRC's green growth vision by 2035 and called for "development combining forest preservation, combating climate change, and robust, rapid and sustainable economic and human development";
- December 2011 - The Ministry of Environment presented the ER Program idea at a DRC-hosted side-event at COP17.
- June 2012 - First presentation of the ER Program Idea Note (ER-PIN) at the FCPF Carbon Fund meeting in Santa Marta, Colombia;
- December 2012 – The Deputy Prime Minister and Budget Minister, accompanied by the Minster of Environment and the Deputy Minister of Finance, presented the DRC's National REDD+ Strategy Framework, the National REDD+ Fund and the ER-PIN at COP18 in Doha, Qatar;
- February 2013 - The Minister of Environment, with the participation of the Governor of Bandundu and the Provincial Minister of Environment, led an workshop organized by the National REDD+ Coordination (CN-REDD) in Kinshasa, to finalize the ER-PIN;
- March 2013 – The Council of Ministers approved the first version of the ER-PIN, which was then presented at the FCPF Carbon Fund meeting in Paris on 24-25 June;
- March 2014 - The Council of Ministers approved the revised ER-PIN for re-submission to the FCPF Carbon Fund Participants;
- April 2014 – The Minister of Environment presented the DRC's ER-PIN at the FCPF Carbon Fund meeting, where it was accepted into the Fund's pipeline;

- September 2014 - The DRC signed the New York Declaration on Forests, a joint commitment by numerous forest and donor countries to provide significant economic incentives to reduce deforestation and restore degraded forest ecosystems. The Minister of Environment presented the Mai-Ndombe ER Program to various potential financial partners at a parallel event to the New York Climate Summit;
- December 2014 - The DRC signed the "Lima Challenge", a declaration by 14 forest countries, conforming their commitment to reduce emissions from deforestation and calling upon the international community to mobilize the necessary financial support;
- February 2015 - A workshop to launch the design phase of the ERPD for Mai Ndombe was held in the capital of the Bandundu Province under the patronage of the Governor. It contributed to build ownership ofa the ER Program by communities and local institutions, and encouraged the participation of all interested stakeholders, in particular at provincial level. The almost 250 participants included representatives from national and provincial governments, the provincial parliament and public administration, provincial civil society organizations as well as industrial and small-scale operators.
- August 2015 - The DRC submitted its Intended Nationally Determined Contribution (INDC) to the UNFCC Secertariat, which outlines a commitment to reduce GHG emissions by 2030 by 17% compared to 2000. Main mitigation measures to achieve that goal include reducing deforestation and forest degradation.
- September 2015 - An additional investment program to enable the implementation of the Mai-Ndombe ER Program was included as an integrated program in the DRC's National REDD+ Investment Plan. It will be submitted to CAFI for financial support from the multi-donor initiative.

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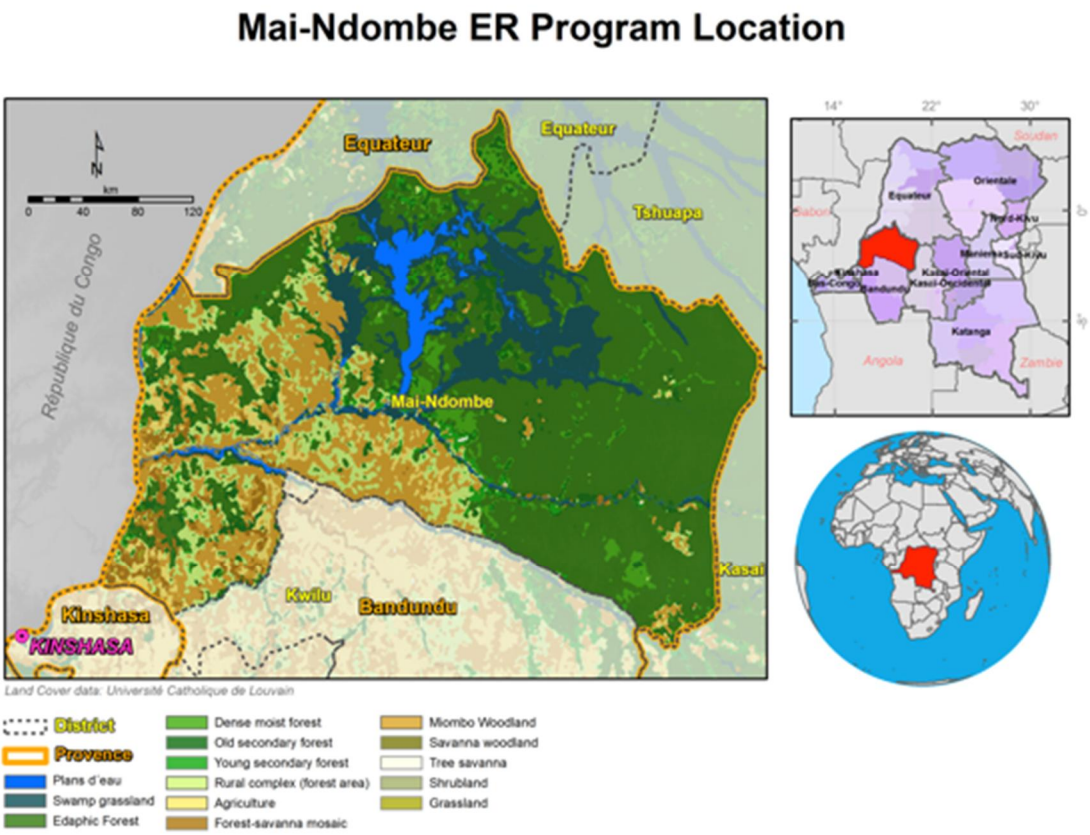
3. ER PROGRAM LOCATION

3.1 ACCOUNTING AREA OF THE ER PROGRAM

The accounting area of the ER Program is the new province Mai-Ndombe, located in the west of the country and north of the capital and province Kinshasa. The Constitution of the DRC (2006) and the Law on Decentralization[3] define the boundaries of the country's new provinces. The Mai-Ndombe Province, which covers an area of 12.8 million hectares, consists of two former districts, which previously were part of the Bandundu Province: Plateau and Mai-Ndombe.



Map 1: Location and vegetation cover in the Mai-Ndombe ER Program area (Source: UCL – Design: J. Freund/WWC)

[3] Organizational law n•08/016 of 7 October 2008 related to the composition, organization and operation of the decentralized territorial entities and their relationship with the State and the provinces.

In early 2015, the National Assembly voted a law on the new administrative division of the country, stipulating the establishment of the new provinces within 12 months by setting up a combined commission of central and provincial representatives. The intermediary executive and legislative authorities of the Mai-Ndombe Province have been established in the second semester of 2015. The province of Mai-Ndombe is currently governed by a Special Commissioner and sectoral Commissioner (interim forms of the governor and provincial minister). An assembly has been constituted with the former deputies of Bandundu. This interim governmental and legislative bodies will be operational until the future election of provincial governors and deputies that should take place in 2016.

The launch of the ER Program thus coincides with the creation of the new province and its governmental structures. It is a unique opportunity to align the development priorities of the province with the opportunities offered by the program. In fact, the main economic activities in the new province are related to the exploitation of forest resources.

3.2 ENVIRONMENTAL AND SOCIAL CONDITIONS IN THE ACCOUNTING AREA OF THE ER PROGRAM

ENVIRONMENTAL CONDITIONS

The Mai-Ndombe Province is located on the western fringes of the great equatorial forest of the Congo Basin, at the frontier of the Kinshasa supply basin for agricultural and wood products and the primary forests of the Congo Basin. Since the beginning of colonization, human activity has been substantially changing the vegetation cover in the western part of the province (Territories of Kwamouth, Bolobo, Yumbi, Mushie and Kutu) where almost half of the forests have been lost in the last 100 years. However, it continues to have a large forest area, as the Map above shows. At the same time, there are extensive grass or shrub savanna lands in the south on sandy soil (Kwamouth) and a forest-savanna mosaic in the center on more stable soils (Mushie, Kutu). In the northern territories (Inongo, Kiri) and Oshwe, larger peat swamp forests can be found, which is characteristic for the Lake Tele-Lake Tumba (ecological) landscape. Together, the flooded, semi-flooded and terra firma types of humid tropical forests form a Ramsar[4] biodiversity site (hotspot) of great ecological value offering a variety of habitats and unique ecosystem services.

Annual rainfall varies between 1,900 mm in the north and 1,600 mm in the south. Rainfall occurs mainly in the two rainy seasons (September to December and March to May) with the two dry seasons in between (June to August and January to February), which are less featured in the north. The perceptions of the population with regard to climate change – which cannot be confirmed by an adequate series of meteorological findings - are higher temperatures in recent years, more intense dry seasons and more frequent and longer dry periods during the rainy season. Concerns about climate change are widespread among both the urban and rural population.

Virtually all soils in the zone can be categorized as ferrosol and arenoferral soils under savanna (south-west quadrant) and as ferrosol and arenoferral soils under large equatorial forests (north-west, south-west and north quadrants). In ferrosols and arenoferrals (lateritic soils with a high iron content), organic

[4] This Ramsar site is one of the biggest complexes of wetlands in Africa and contains habitats that are critical for several species of freshwater birds, monkeys (Bonobos), forest elephants (Loxodonta africana cyclotis), and leopards.

matter is generally low. They degrade rapidly when slash-and-burn practices occur and become more acid and poor of organic matter to the point that they only support grass or shrub covered savannas (of man-made origin). The uncontrolled and repeated use of fire, for hunting purposes and/or for the renewal of the forage grass stratum, is also a major factor in the progressive increase in the proportion of savanna coverage in the west of the province.

SOCIAL CONDITIONS

Mai-Ndombe is one of the biggest provinces in the DRC. Its population (1,500,000 inhabitants) and density (13 inhabitants /km2), however, make it one of the least populated provinces. The population density varies widely within the province between 80 inhabitants / km2 in the small Yumbi territory and 7 in the Kwamouth territory. A gradient that widens in relation to forest-covered surfaces, as shown in the table below growth is estimated at approximately 3% per year[5].

Table 2 Territories, total areas and Forest areas, population, density in the program area (2012)

Territory	Total Area (TA) (km2)	2012 Population	Total Density (inhabitants /km2)	Forest Areas (FA) (km2)	FA to TA rate	Density in relation to FA (inhabitants /km2)
Inongo	25,132	315,630	13	21,769	87%	14
Kiri	14,133	158,200	11	13,580	96%	12
Kutu	19,237	405,796	21	16,271	85%	25
Oshwe	41,141	162,069	4	40,431	98%	4
Mai-Ndombe	99,641	1,041,695	10	92,051	92%	11
Bolobo	4,124	112,531	27	2,976	72%	38
Kwamouth	14,552	94,933	7	8,760	60%	11
Mushie	11,860	103,254	9	9,406	79%	11
Yumbi	1,215	97,112	80	844	69%	115
Plateaux	31,751	407,829	13	21,986	69%	19
Province of Mai-Ndombe	131,393	1,449,524	11	114,037	87%	13

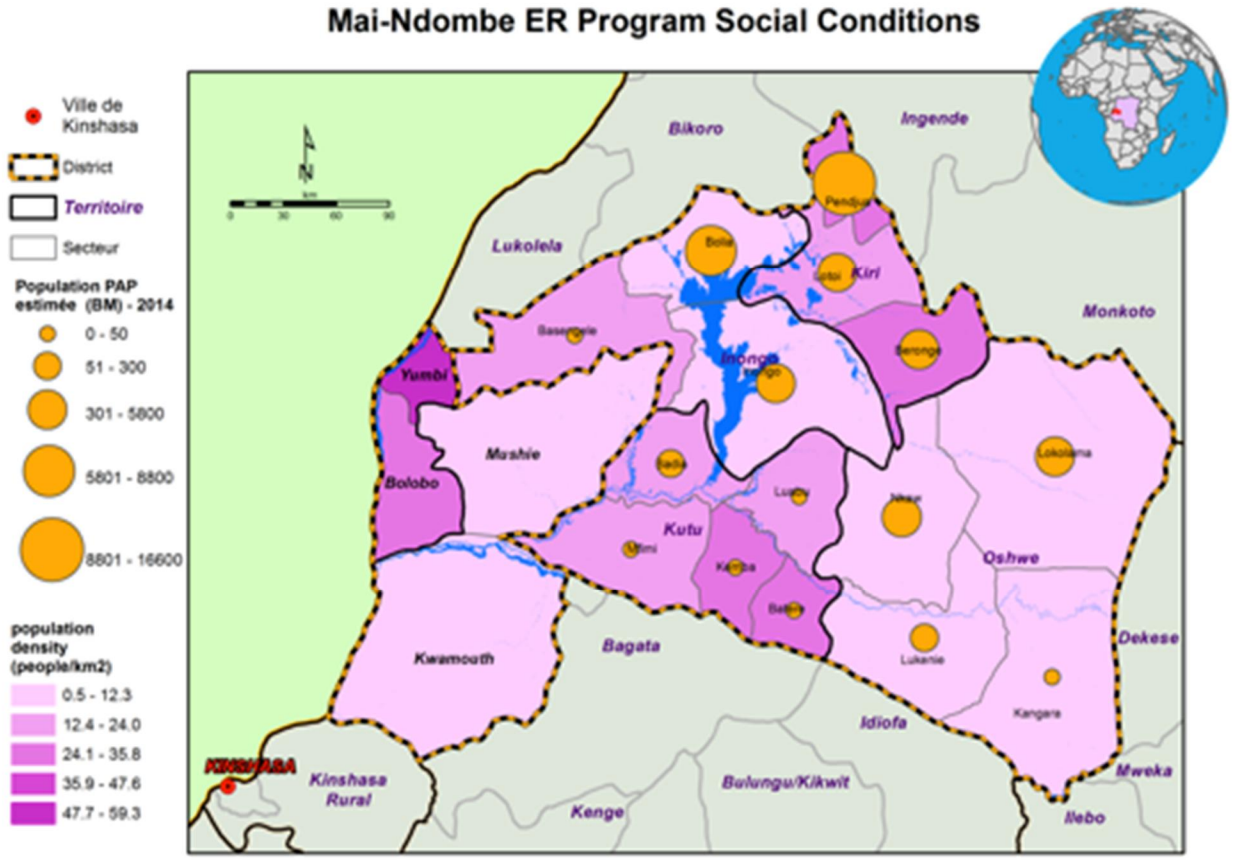
Sources: Ministry of Health, Forest Atlas of the DRC (2012), Ministry of the Interior. According to BioCFplus Mission 2014.

The administrative organization comprises two former districts, 8 territories, 23 sectors, 66 communities, 4 towns (Inongo, Kutu, Nioki, Mushie, Bolobo) and thousands of villages. Almost all the villages have a local chief appointed by the public administration. The Constitution and the Law on Decentralization establish sectors as basic territorial entities.

Logging concessions, livestock, conservation concessions and protected areas account for 30% of the province's total area. The remaining 70% is customary land, out of which 46% are forests and the

[5] For all the calculations in this report, the population growth rate in rural areas is that of Leon de Saint Moulin and of the National Statistics Institute (3.4% annual national average, 3% in rural areas and 6% in towns and cities).

remainder is savanna land. [6] The community population is organized in villages of 50 to 300 households located along the major waterways and their tributaries (Congo, Kasai, Mfimi, Molibampe, Bolongo Lule, Lutoy, Lokoro, Lake Mai-Ndombe, Lukenie) and main roads.



Map 2: Social conditions in the program area and density of Indigenous Peoples population (Source: BioCFplus mission report - Design: J. Freund/WWC)

The population of Mai-Ndombe is Bantu and Pygmies. The Bantu, namely Anamongo, Bateke, Basakata, Baboma and some others (Tende, Nunu fishermen), are distributed across all the territories with a north-south divide as regards patrilinear organization in the north (Anamongo: Kiri, Inongo) and matrilinear organization in the south (Teke in Kwamouth, Bolobo and Yumbi; Baboma in Mushie; Basakata in Kutu). Each of these groups has its own language but Lingala and French are common languages.

Indigenous Pygmy Peoples (IPP) represent some 3% of the population. The BioCFplus feasibility study found a total population of IPP of around 45,000 people living in 177 villages (10% of the total number of villages in the province, but 13% in the Mai Ndombe District). None of the villages in the Plateau District has IPP and the district is not a traditional IPP migration area. Indigenous Pygmy Peoples are strongly represented in the "Anamongo" territories, Kiri, Oshwe and Inongo. These Pygmy populations are entirely sedentary, although they use areas of around twenty kilometers around their villages for hunting,

[6] It should be noted that the communities continue to exercise usage rights inside the forest concessions (see Forest Code); 70% of the surface area is therefore at the disposal of the communities.

gathering and apiculture purposes. Their main activity is agriculture, either for subsistence or as labor on Bantu land for income generation.

The rural population of the Mai Ndombe province pursues five key economic activities: agriculture, small livestock farming, fishing, hunting and gathering. Hunting and gathering are very important for the Pygmies, but are practiced more broadly by the entire rural population. The main activity for 90% of the communities is agriculture, in particular cassava and maize as cash crops to generate income. Cash crops are also of increasing importance for the IPP and specialized fishing populations because of depleting fish resources caused by the applied fishing techniques and the increasing number of fishermen. The survey conducted by the BioCFplus feasibility study among a sample of 400 households suggests and average income of 450 dollars per household and year, out of which two-third is generated by agriculture (cassava, maize, rice). The remainder is primarily derived from fishing and livestock farming as well as hunting, gathering and product processing.

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

4.1 ANALYSIS OF DRIVERS AND UNDERLYING CAUSES OF DEFORESTATION AND FOREST DEGRADATION AND EXISTING ACTIVITIES THAT CAN LEAD TO THE CONSERVATION OR ENHANCEMENT OF FOREST CARBON STOCKS

The most recent analysis of the forest coverage change in Mai-Ndombe indicates a deforestation rate of 1.12%/year and a degradation rate of 1.49%/year for the period 2004-2014 (WWC/OSFAC, 2015). In general, the causes of this reduction in forest cover in Mai-Ndombe are identical to those identified at national level and set out below, which summarizes the national consensus obtained after numerous quantitative and qualitative studies.

This section gives a more detailed analysis of the situation in Mai-Ndombe in order better to quantify the impact of the direct causes and identify the key underlying causes in the region. The distinctive feature of the Mai Ndombe Province is its location at the intersection of various human and resource flows between the megalopolis of Kinshasa (over 10 million inhabitants) and the provinces of Bandundu and the Equator, where most of the dense humid forests of the DRC are located.

THE DIRECT CAUSES OF DEFORESTATION AND FOREST DEGRADATION IN MAI-NDOMBE

1. Slash-and-burn agriculture According to two studies in the districts of Plateaux and Mai-Ndombe, the average family uses an area of 1 hectare for farming, applying a fallow-slash and burn system on forest land[7], whereas savanna lands are only marginally cultivated or not at all. This system requires an area of 5 hectares per household on the basis of a 5-year rotation. With an annual population growth rate of 3%, every year means an additional 6,500 agricultural households, each needing 5 hectares of primary forest (or mature secondary forest) in order to achieve a stable agricultural production system, equivalent to 32,500 hectares per year. Agriculture is practiced on non-flooded land, as opposed to land that is permanently or temporarily flooded during the rainy season (precisely when cultivation takes place). Non-flooded forest and rural complex land represent an area of approximately 99,174 km^2 in the province, out of which 12% was cultivated in 2012 (Hansen et al.).

[7] BioCFplus Mission survey in the district of Mai-Ndombe (sample of 400 households) in November 2014 and surveys by the Provincial Ministry of Agriculture (Bandundu) PAB/EU/ISCO in the 4 territories of the Plateau in 2011.

2. Fuelwood production. Charcoal production has been practiced on the banks of the River Congo for several decades, in particular on the left bank which is undergoing grass savannization. Most of the charcoal produced in Mai-Ndombe contributes to the 23% of fuelwood that is taken to Kinshasa by waterway from the area to the north-east of the capital. This represents 4.7 million m^3 of fuelwood consumed per year with a market value estimated at 143 million US dollars.[8] The depletion of the forests of the Lower Congo and the reduction, as of 2010, in the cost of transporting goods by waterway have resulted in the very deep penetration of charcoal production along the rivers and around the Lake Mai-Ndombe. That means charcoal is produced more than 500 km away from Kinshasa, which together with Brazzaville is the final destination for the product. Charcoal production is often conducted by entrepreneurs who formerly operated in the Lower Congo and use young people from the villages as labor. In Mai-Ndombe, the price of a sack of charcoal is half that charged in the rest of previous Bandundu Province and the Lower Congo (4,000 CDF[9] compared with 8,000 CDF). Charcoal production is favored by the local population because it generates significant revenues in the short term. In one month, a professional with one or two assistants can produce 300 sacks at 4,000 CDF per sack, which totals 1,200,000 CDF, whereas other economic activities (cassava, maize, rice and groundnut production) generate average revenues around 400,000 CDF per year.[10]
3. Uncontrolled bush fires preventing natural regeneration. The high frequency of uncontrolled fires has a very significant impact on forest cover. In the wooded savannas and forest margins, fires prevent natural regeneration by burning young trees and seeds. These fires can cover very great distances, contributing to the maintenance and extension of anthropogenic savannas on lands largely intended to be forested. The spread of these fires can have several causes. Livestock farms, for example, use fire to regenerate pastureland[11], the local population lights fires for slash-and-burn farming to maintain paths and for hunting in order to trap animals, but also accidentally. As a general rule, the absence of control and collective responsibility together with failure to apply the law reinforce this phenomenon.
4. Small-scale or artisanal logging The region is seeing a chaotic expansion of illegal logging including small-scale logging and "semi-industrial" operators using heavy machinery. Some of these loggers do not hold permits and even when they do, logging operations frequently do not respect designated harvesting areas or authorized volumes. The result is anarchic, uncontrolled logging that is responsible for significant GHG emissions. It is estimated that 240,000 m^3 of wood[12] is illegally produced in the Mai Ndombe Province every year by informal sector operators, the traceability and sustainability of which cannot be guaranteed.
5. Industrial logging. In Mai-Ndombe, some twenty forest concessions have been allocated, 11 of them to the company SODEFOR as shown in below. These forest concessions are at different stages in the forest management process and only 2 concessions have submitted their management plans. Most of

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[8] Schure, J., Ingram, V. and Akalakou Mayimba, C. Fuelwood in DR Congo: Analysis of the Kinshasa and Kisangani channels, 2011, 92 p.

[9] 1US$ equivalent to 927,6 CDF – 2016.01.31

[10] BioCFplus Mission survey in the district of Mai-Ndombe (November 2014).

[11] Livestock has become a popular activity among the most prosperous farmers and town dwellers, senior officials and traders. These people purchase "farms" of 50 to 500 hectares. Livestock is reared very intensively on these farms, and the practice of bush fires prevents natural regeneration and threatens certain agricultural and forest zones.

[12] Lescuyer G, Cerutti P.O, Tshimpanga P, Biloko F, Adebu-Abdala B, Tsanga R, Yembe-Yembe, R.I and Essiane- Mendoula E. 2014. The domestic small-scale sawing market in the Democratic Republic of Congo: State of play, opportunities, challenges. Occasional Paper 110. CIFOR, Bogor, Indonesia.

these concessions are therefore little exploited at present or not at all. (See Table *3* and , in Annexes). The forestry sector is currently slowing down and seeing a drop in demand internationally. The DRC is particularly affected as it suffers from a negative image due to frequent campaigning actions.

However, in terms of impact on forest carbon, industrial harvesting is translating into a reduction in carbon stocks per hectare within the concessions due to selective felling and the construction of associated infrastructure (roads, use of industrial tools). Furthermore, the opening up of remote regions and the economic opportunities for the local population are leading to an effect of deforestation and degradation "cascade", connected with felling/slash-and-burn activities and fuelwood production developing in and around the concessions.

Table 3 Forestry companies established in the Province of Mai-Ndombe (Source: FRMi, 2015)

Company	No. of concessions	Area (ha)	% of the area licensed to concession
Sodefor	11	2,324,745	65.4%
Somicongo	1	294,014	8.3%
Siforco	1	194,636	5.5%
La Forestière du Lac	1	185,171	5.2%
Compagnie des Bois	1	148,081	4.2%
ITB	1	127,719	3.6%
SCTP ex-Onatra	1	121,214	3.4%
Maison NBK Service	1	79,730	2.2%
Tala Tina	1	40,040	1.1%
Riba Congo	1	37,367	1.1%
Overall total	20	3,552,717	100.0%

6. Mining and oil exploitation. Mai-Ndombe has deep oil resources, which makes their exploitation difficult and has prevented it up to now. Small-scale diamond exploitation in the River Kasai is longstanding but since 2010 it has seen an acceleration due to the use of diving gear. Large mines appear and disappear from one day to the next along the river. Mining activities represent a population of thousands of people, who constitute a localized and mobile market opportunity for farmers living along the banks to sell their products at higher prices. Overall, mining exploitation is not currently an employment alternative in the Mai Ndombe Province and its impact on deforestation is very low to non-existent.

STAKEHOLDERS IN DEFORESTATION AND FOREST DEGRADATION

A number of stakeholders are involved in the dynamics of deforestation and forest degradation depending on the exact area. Stakeholders are generally representative for the situation at national level but a specificity is the proximity to Kinshasa. The agents of deforestation and forest degradation are:

a. Direct and local:
   - Local population (farmers and producers/consumers of fuelwood, charcoal and agricultural production);
   - Forest concession holders;
   - Small-scale loggers;

- Agricultural and livestock farmers.

b. Indirect and external

- Consumers of charcoal and lumber in Kinshasa;
- Consumers of lumber at international level;
- Consumers of agricultural products (maize, cassava) in Kinshasa.

Within the ER Program area, the dynamics of deforestation and degradation have been identified. They vary according to the prevalent land use and location, e.g. within a forest concession, a nature reserve or in an unallocated area. The table below shows the main elements of the dynamics of deforestation/degradation according to zone type. These elements constitute the basic information for development of the intervention strategy. It should be noted that the threats are not mutually exclusive, but can occur in succession and even exacerbate one another.

Table 4 Summary of the main agents and factors of deforestation and foret degradation according to the types of land use in the ER Program area

Zone type		Area (M ha)	Stratum	Agents	Agri.	Fuelwood	Fire	Art. Logging	Ind. logging	Infrastr. /mines
Converted logging titles[13]	Production series	1.52	PDEG	Logging companies					✓	
	Protection and conservation series	1.15	UNDEF/UNDEG	Local population		✓		✓		
	Rural development zone	0.89	UNDEF/UNDEG	Local population	✓	✓		✓		
Classified forests		2.04	UNDEF/UNDEG	Local population	✓	✓		✓		
Conservation concession		0.32	UNDEF/UNDEG	Local population	✓	✓		✓		
Zones under customary regime	Afforested	4.34	UNDEF/ UNDEG	Local population Small-scale loggers	✓	✓		✓		
(non-concession, non-classified)	Non-afforested	2.58	A/R	Local population			✓			
Emphyteutic concessions and farm leases		0.80	A/R	Farmers; livestock rearers and neighboring population			✓			
Mining sites and infrastructure		Less than 0.01	PDEF	State and mining concession holders						✓

[13] Estimates of the areas of forest concessions on the basis of existing management plans (FRMi, 2015)

THE UNDERLYING CAUSES AND KEY TRENDS

The factors underlying the reduction of forest cover are: poverty, the absence of economic and technical alternatives, poor management of natural resources, unregulated land tenure, population growth and increased demand for agricultural products, charcoal and land. Growing demand for agricultural and wood products as well as for land, which is reinforced by the rising population and economic migration, constitute strong trends towards increased pressure on forests. These underlying causes need to be addressed specifically by the program's intervention strategy.

Growing demand for agricultural and wood products. The Mai-Ndombe Province is located in the Kinshasa supply basin for agricultural and wood products, fuelwood in particular. Agriculture is the main income source for 90% of the households in the province, cassava and maize are the main cash crops sold primarily to Kinshasa. Importantly, Mai-Ndombe has become an important, or even the most important, source of charcoal supplies for Kinshasa as a result of the depletion of the forests of the Lower Congo between 2000 and 2010. This pressure on Mai-Ndombe's forest resources will continue to be exacerbated as demand from Kinshasa rises and the surrounding forests shrink.

Requirements for land, population increase and migration. The demand for slash-and-burn farming land is significant and constitutes the most important driver of deforestation in Mai-Ndombe. Furthermore, if unsuitable or occupied land is excluded (flooded forests, concessions representing approximately 41% of the province's area), the remaining forested area represents approximately 46% of the province's total area. With a population growth rate of 3% it can be estimated that in approximately 33 years the non-concession and non-flooded forests of Mai-Ndombe will be totally lost to agriculture.[14] Moreover, these estimates do not take account of the significant (and as yet unstudied) migration to the province from the savanna lands of Kwilu (Masi Manimba, Idiofa, Bulungu) and the man-made forests of northern Idiofa on the left bank of the River Kasai. The regions under greatest threat from this migration are the forests of Kwamouth and southern Oshwe.

EXISTING POLICIES AND ACTIVITIES THAT CAN LEAD TO THE CONSERVATION OR ENHANCEMENT OF EXISTING CARBON STOCKS

A number of laws and policies are contributing to the conservation and enhancement of carbon stocks or have the potential to do so (See Section 4.4). Such policies include:

a. The Forest Code of 2012, which introduced the concept of management plans as a prerequisite to any management or exploitation in the forestry sector (Articles 71 and 72). It should be noted that sustainable forest management is only mandatory within the framework of a concession title (exploitation or conservation) and therefore only applies to permanent production forests. In practice, small-scale logging still circumvents this obligation, although the regulations on small-scale logging will change with the revision of the Decree on logging. According to the Forest Code, a management plan is a prerequisite for any exploitation.
b. The Forest Code also advocates the prohibition of burning savannas, which is very poorly enforced, as described above.
c. The repeatedly asserted commitment to strengthen the existing protected areas and to extend their coverage to approximately 17% of the national territory (it is at approximately 12% today).
d. Since 2002, the application of a moratorium on the granting of new forest concession titles, as well as on their renewal or extension. Despite a number of withdrawal attempts, the

[14] BioCFplus Mission survey in the district of Mai-Ndombe (November 2014).

moratorium has remained in place up to now. However, some previously granted titles have been "recovered" in the conversion process.

The adoption and implementation of these policies and measures are hindered by a certain number of political, financial, governance- and capacity-related barriers.

A number of economic activities pursued within the program area are contributing to the conservation and enhancement of forest carbon stocks. The program will fully capitalize these initiatives, render them viable and scale them up through its innovative and predictable financing framework.

a. The WWC conservation concession. In 2010, the ERA company made a formal request to the government of the DRC to manage two concessions, whose exploitation permits had been suspended, for the purposes of conservation by leveraging the carbon revenues generated. The Mai Ndombe REDD+ project, sponsored by the joint venture ERA/WWC, was validated by the VCS and the CCBA in December 2012. The objective of the project is to address drivers of deforestation and degradation such as logging, slash-and-burn farming and the intensive production of charcoal. The activities are mostly at community scale aiming at reducing destructive practices and improving agricultural production.

b. The activities of the Novacel company, in particular the South-Kwamouth Novacel project. The Novacel company initiated the first agroforestry carbon sink project in Africa in the village of Ibi on the outskirts of Kinshasa. It has developed an innovative agroforestry model based on acacia and cassava. With financing from the Congo Basin Forest Fund (CBFF), Novacel and its partner GI-Agro are developing the Novacel South Kwamouth project in several chiefdoms in the south of the Plateau district. The activities include agroforestry plantations, assisted natural regeneration on savanna land and development of local infrastructure.

c. The production of perennial crops: coffee, rubber and cocoa. The restoration of existing plantations of perennial crops and expanding them into the savanna zones are important to generate revenues and employment for the local population and, thus, provide an alternative for slash-and-burn agriculture, which is very land consuming. In contrast to the Plateau district, the Mai-Ndombe district was previously an important area for the production of coffee and rubber as well as cocoa on a smaller scale (Inongo, Kiri, northern Oshwe). Tens of thousands of hectares of plantations were abandoned in the 1970s (Zairianization) and 1980s (drop in market prices). The NGO Trias has initiated the revival of cocoa production in Inongo. Producer cooperatives were created (which exported 120 tonnes of cocoa in 2014) and equipped with working capital and means for transportation,fermentation and drying. Furthermore, a program was launched to restore cocoa farms and train farmer about improved cultivation practices. After a period of inactivity, the rubber plantations of Inongo and Lukenie are being reactivated by the Société Congo Forêt, which owns a processing unit in Dima, near Bandundu-Ville.

Other activities outside the program area are also contributing to the conservation and enhancement of forest carbon stocks, in particular around Kinshasa related to establishing a sustainable charcoal supply and reducing pressure on forests;

a. The plantations of the Mampu and the N'Tsio project. Initially, Mampu was a peri-urban reforestation project financed by the Congolese State (Zaire at the time) in the 1960s to meet the demand for fuelwood in Kinshasa. Later, the land was given to private farmers to have better control over fires and to generate socio-economic benefits. Thus, Mampu became an agroforestry project with over 300 farmers. The project was coordinated locally by the Hanns Seidel Foundation until February 2009 and is managed by a local body, the Union of Farmers of Mampu, today. The Foundation is now developing the N'Tsio project with a number of villages

on the Batéké plateau. The new project is supporting village communities in developing agroforestry projects to promote sedentary agriculture and produce charcoal for the Kinshasa market.

b. The SNV Sustainable Charcoal project aims to develop a commercially viable sustainable charcoal supply between the charcoal production areas and the center of Kinshasa. The dual objective until the end of 2015 is i) to improve access to sustainable charcoal in the poor districts of Kinshasa and ii) to improve incomes and living conditions for the charcoal producers in the areas surrounding Kinshasa. Part of the strategy is to formalize the sector and to introduce a system of tax incentives to encourage sustainable practices. The objective is that by the end of 2015 at least 5,000 people in Kinshasa will have a steady supply of sustainable charcoal and at least 300 charcoal producers will have increased incomes. By March 2015, 434 charcoal producers had been organized into 11 cooperatives, which constructed 176 improved charcoal kilns in six months. Sustainable charcoal production quotas are currently being introduced in five villages.

c. The improved cookstove initiatives in Kinshasa. At present, several stakeholders are supporting improved cookstoves in Kinshasa. Institutions including the GIZ and SNV are supporting the dissemination of cookstoves such as the Prakti, imported from India, or the Kin Stove, produced locally by a network of craftsman. A subsidiary of Ecosur Afrique, called Biso Na Bino, produces and markets the Jiko Mamu cookstove and aims at producing 10,000 units per month by the end of 2015. This project is also registered with the Clean Development Mechanism (CDM).

The Forest Investment Program (FIP). The objective of the Improved Management of Forest Landscapes Project PGAPF) in the Kinshasa supply basin is to improve the living conditions and management of forest landscapes to reduce GHG emissions generated by deforestation and forest degradation. It has $US 36.9 million in funding and was launched in the first quarter of 2015. It comprises 4 components:

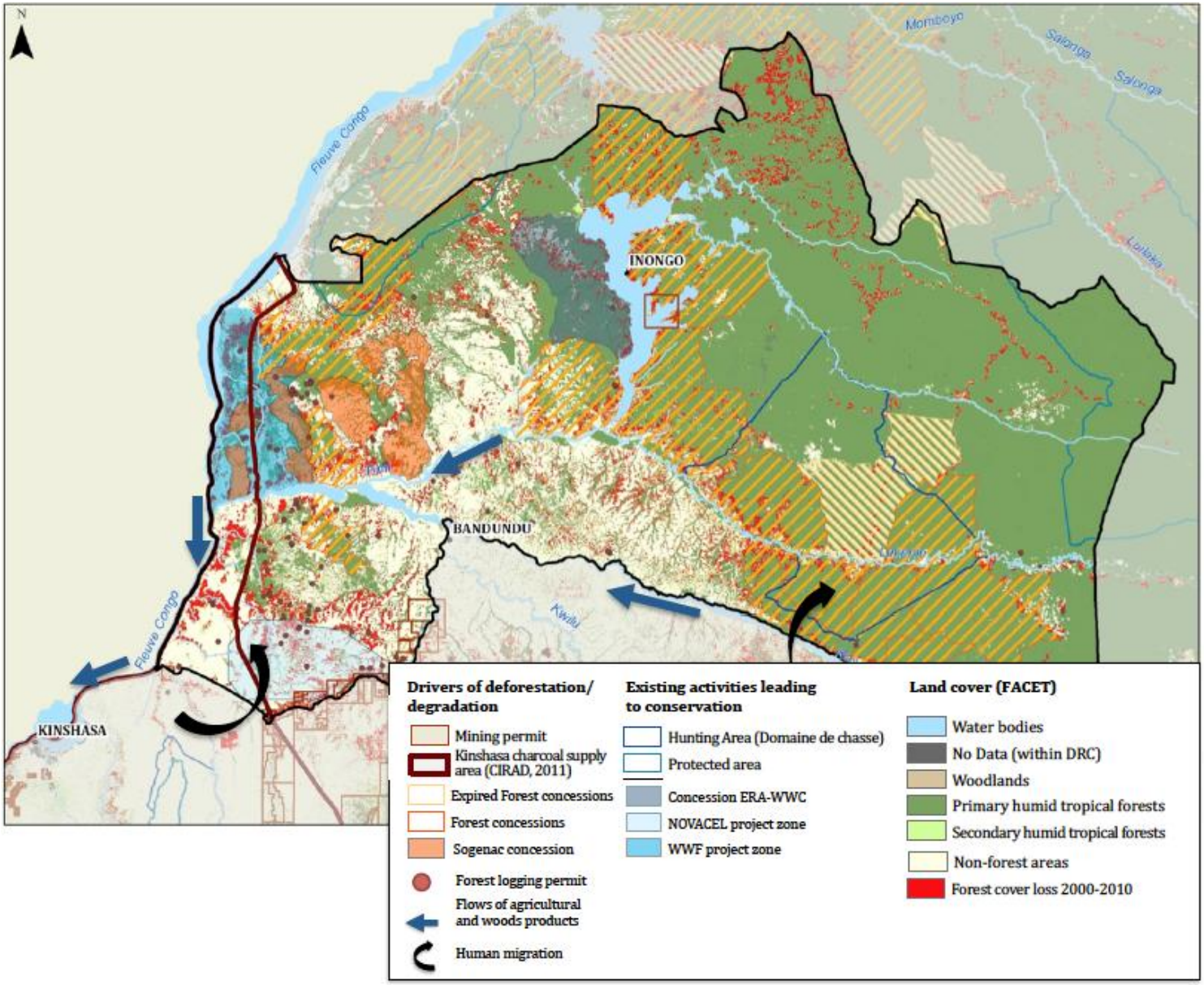
a. Component 1 ($US 14.2 million), the Plateau Integrated REDD+ Project (PIREDD Plateau), constitutes a major element of the Mai Ndombe ER Program (see below).

b. Component 2a ($US 5.9 million) concerns agroforestry plantations in the savanna (from 50 to 500 ha). It targets the cooperation with the private sector through the co-financing of investments and works through calls for proposals. Some of the ER program's plantations will thus be able to benefit from this co-financing.

c. Component 2b ($US 2.1 million) is aimed at reducing the consumption of fuelwood by urban households, in Kinshasa in particular, in support of private entrepreneurs distributing improved cookstoves that are certified for performance.

d. Component 3 ($US 10.5 million) will support seven Local Executing Agencies (LEA), most of them located in the Lower Congo Province but also on the Batéké Plateau and part of the Territory of Kenge (Bukanga Lonzo), to promote small-scale community and private agroforestry (from 1 to 50 ha) in the savanna.

e. Component 4 ($US 4.2 million) concerns the project management by the FIP Coordination Unit, which also coordinates the Integrated REDD+ Project of Mbuji-Mayi/Kisangani.



Map 3: Drivers of deforestation and activities in the Mai Ndombe Province (Sources: WRI, FACET, CADIM, CIRAD – Design: E. Marino/WWF)

4.2 ASSESSMENT OF THE MAJOR BARRIERS TO REDD+

The barriers to REDD+ are primarily the difficulty encountered by all stakeholders to develop financially viable and competitive alternatives to deforestation and forest degradation, be it government, the private sector or local communities. These difficulties are due in particular to:

a. Poverty; lack of economic opportunities and access to credit; low access to capital for rural families, who are not in a position to take risks and initiatives to improve agricultural and production practices;

b. The lack of upfront financing, incentives and knowledge transfer to allow populations to develop agricultural or energy alternatives. For example, alternative cash crops take 3 to 5 years to generate income, energy plantations take at least 7 years. At present, there is no incentive to establish plantations, making sustainable charcoal production difficult. It is therefore necessary to provide steady income during the transition period.

c. A weak business climate, which remains rather unattractive despite some recent improvements and unconducive to sustainable development and resource management projects. In particular, this limits the involvement of stakeholders in the value chains (processing, marketing etc.) for agricultural and wood products. This makes the development of perennial crops or the local processing of wood to generate revenues and employment difficult.

d. 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.

e. Weak governance and lack of institutional capacity, which prevents the transparent and rigorous enforcement of the Forest Code and environmental legislation. The lack of resources and technical capacity, in particular as regards traceability tools, is a major hindrance to law enforcement.

f. 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 the 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. In spite of recent progress in this regard, notably in the context of the development of the National REDD+ Investment Plan 2015-2020, 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+.

It should be noted that the National REDD+ Investment Plan, which will be applying for financing from CAFI, represents an important strategy to remove these barriers, in particular through the following setoral programs to implement key reforms at national level:

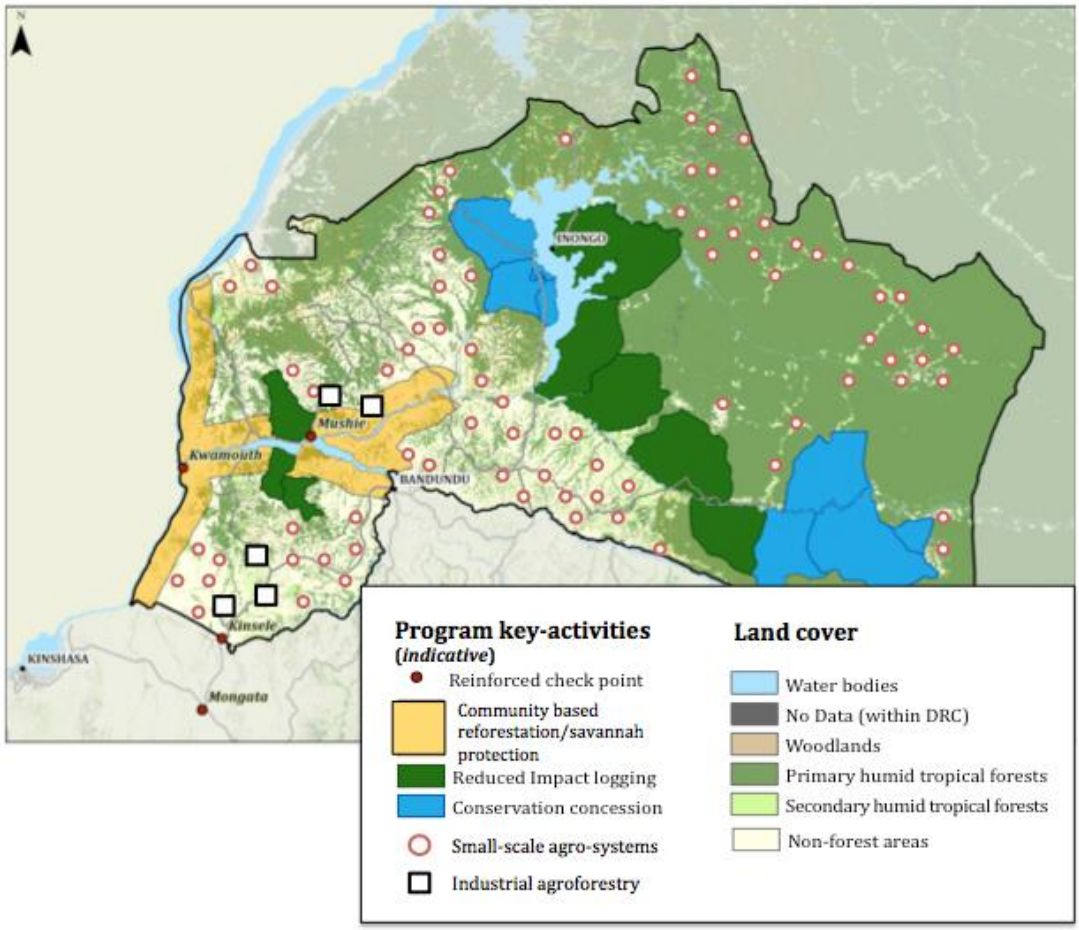
- Land-use planning ($US 12 million),
- Land tenure ($US 10 million),
- Alignment with agriculture sector and research needs ($US 5 million),
- Governance including capacity building and fund management capacity ($US 23 million),
- Sustainable forest management ($US 15 million).

4.3 DESCRIPTION OF AND JUSTIFICATION FOR ACTION AND INTERVENTIONS PLANNED UNDER THE ER PROGRAM WHICH WILL LEAD TO REDUCTIONS OR THE REMOVAL OF EMISSIONS.

STRATEGIC VISION AND APPROACH TO GREEN DEVELOPMENT IN THE PROVINCE OF MAI-NDOMBE

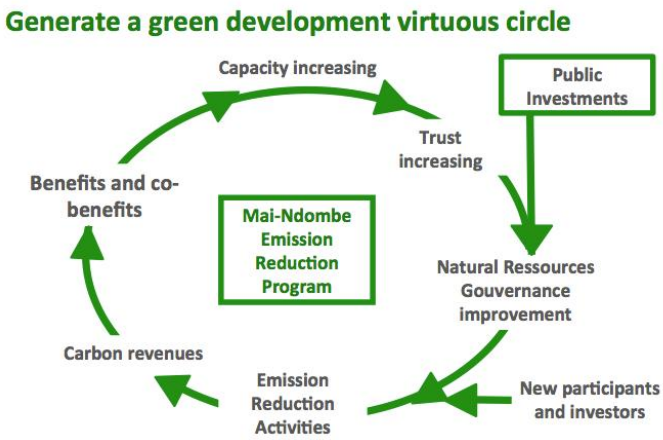
The green development model of this program will be adapted to the strategic vision and to the dynamics at work in Mai-Ndombe. In particular, the province has the potential to offer a sustainable supply of fuelwood, lumbar and agricultural products for the megalopolis of Kinshasa while at the same time increasing the incomes of local populations and maintaining significant forest cover.

The program strategy will thus be geographically adapted and will lead to a land-use planning process centered around the sustainable development of natural resources. This will involve (i) offsetting the demand for unsustainable wood products from the province-city of Kinshasa with reforestation and regeneration activities in the savannas and along the river, in particular in the district of Plateau, (ii) orientating agricultural practices in the forests towards practices that are less land-consuming than fallow-slash and burn farming, such as perennial crops or agroforestry (iii) incentivizing the conservation and sustainable management of the forests.



Map 4: Location scenario of key program activities (Design: E. Marino/WWF)

In order to achieve the objectives of the program (See Table 1) and to trigger the transformational effects necessary to accomplish such a transition, the program will adopt the approaches described in below. The program will support the consolidation of a governance framework for natural resources management in order to secure investment and deploy innovative and sustainable economic activities.

APPROACHES	
	➢ A multi-sectoral strategy combining direct investments and enabling activities. ➢ Implementation of the program through local governance authorities and councils at village and territory level in order to integrate REDD+ into local development policies. ➢ A program of performance incentives designed to encourage sustainable practices among communities and the private sector, in particular (i) large-scale reforestation and protection of the savannas (ii) conservation and sustainable management of the forests. ➢ An innovative financing framework. Public financing creates enabling conditions for the roll out of emission reduction activities. These activities generate carbon and non-carbon revenues which help to incentivize the engagement of new stakeholders and investors.

EXPECTED TRANSFORMATIONAL EFFECTS
1. Thanks to the improvements in governance promoted by the program, the local and Provincial Authorities will take account of deforestation in their investment plans and in their political decisions relating to land use. In addition, land tenure conflicts will be more easily arbitrated by the consultation mechanisms and the land use participatory approach. 2. It will be in the interests of communities and entrepreneurs to adopt the rationale of a low level of deforestation defined by the agreed sustainable development plans (SDP) drawn up in a participatory manner. In fact, this rationale will produce direct revenues (investments in cultivation techniques and choices) and will make payments conditional upon performance. 3. The farmers will benefit from support, enabling them to make long-term efficiency improvements to their agricultural practices, to orientate their productive activities toward the savannas and thus to accept more readily the restrictions that will be imposed upon them regarding use of the forests. 4. The formalization of the commodity sectors (charcoal, wood, perennial crops etc.) will offer improved control of their legality and their impact on forest cover while at the same time guaranteeing populations and farmers an outlet for their products at stable prices.

Figure 1: Approaches and transformational effects expected of the Mai-Ndombe ER Program

APPROACHES AND STRUCTURE OF THE PROGRAM

The program will translate this vision into a combination of enabling and sectoral activities in accordance with the 7 pillars of the national REDD+ strategy framework (See table below).

"Sectoral" activities are defined by the national REDD+ strategy framework as types of activity aiming to address the direct causes of deforestation and to generate measurable and verifiable emission reductions.

- In the case of the program, they seek in particular to reduce poverty and to make up for the shortfall in startup funding, incentives and knowledge transfer in order to develop agricultural, energetic and forestry alternative activities. (Removing the barriers a. and b. above).
- The sectoral activities considered to be priority activities and the most relevant in terms of addressing the drivers of deforestation and degradation are proposed by the program. Even though other activities may be introduced over the course of the program, this list provides a means of mobilizing financing and expertise within a clearly defined framework.
- The sectoral activities will be realized through direct investment, through payment by performance (proxy or carbon) and will be implemented by operators, be they communities, enterprises, associations or farmer organizations. (See section 6.1 below)

“Enabling” activities are activities that aim to create conditions favorable to the implementation of sectoral options, but which also offer a means of addressing certain underlying causes of deforestation and contribute to the sustainability of sectoral activities. They do not generate emission reductions or *a priori* non-measurable emission reductions (except on the basis of estimates relying on assumptions which must be clearly established and argued).

- Under the program, these activities will seek (i) to create a participatory framework for the management of natural resources focus on the definition and implementation of the Sustainable Development Plan (SDP) in order to remove land tenure insecurity and to improve governance as well as political and administrative coordination; (ii) to build the capacities of the decentralized services to enforce regulations; (iii) to facilitate the development of the relevant economic sectors by supporting operators in the agricultural and wood sectors and (iv) to apply the national family planning strategy in the Mai-Ndombe province (removing barriers c, d, e and f).
- The enabling activities will be realized through public investment and implemented by local executing agencies, NGOs and decentralized State services.

Table 5 Program structure and key activities

Pillars	Sectoral activities	Enabling activities
Agriculture	AS1. Agroforestry and improvement of cultivation techniques AS2. Perennial crops development in non-forest areas (coffee, cocoa, palm oil and rubber)	AH1. Strengthening agricultural value chains
Energy	ES1. Assisted natural regeneration for charcoal production. ES2. Afforestation/Reforestation for charcoal production	EH1. Formalization and strengthening of the fuelwood sector
Forest	FS1. Reduced impact logging FS2. Conservation of local community forests FS3. Conservation concession FS4. Afforestation/Reforestation for lumber production	FH1. Strengthening forest and wildlife law enforcement FH2.Legal compliance of industrial logging operations FH3. Development of community forestry. FH4. Support management of protected areas
Enabling *Governance, Population, Land-use planning and Land tenure*	H1. Capacity-building of decentralized State services H2. Multi-level capacity-building and Sustainable Development Plans design H3. Implementation of collective and strategic facilities H4. Family planning	

ENABLING PILLARS

In order to successfully roll out the key deforestation reduction activities and also to address the underlying causes of deforestation, the program will finance enabling strategies in terms of governance, land-use planning, land tenure and family planning,. These activities will allow to test key reforms of the DRC in these sectors and inform the development of a provincial plan for the use of land and resources. The activities presented below constitute a combined multi-level support for populations and State services in order to create the necessary conditions for a transition towards sustainable development. The aim of the actions undertaken here is to strengthen significantly the institutions and the governance of natural resources in Mai-Ndombe. Great importance in terms of financing and monitoring and evaluation will be attached to these activities in order to guarantee the sustainability of the program.

- H1. Capacity-building of decentralized State services. This activity includes: i) participation of government services (Environment, Agriculture, Interior, Land Registry), in the provincial and local

Steering Committee and in the monitoring and evaluation of the program ii) strengthening of the regulation of logging and charcoal operations, iii) selection, motivation and training of the agents involved in the project activities and in particular the activities set out below involving support for land-use planning.

- H2. Multi-level capacity-building and Sustainable Development Plans design. The aim of this activity is to strengthen the associative structures at village community level (through the Local Development Committees) and decentralized territorial entity level (through the Agricultural Rural and Management Councils (CARG) or Rural Management Councils (CART[15]). Sustainable Development Plans (SDPs) for Natural Resources will be established or updated in order to formulate a sustainable vision of the use of resources and material needs at each level of administrative and community organization. This support for delimiting customary *terroirs*[16] will also occur within and around the forest concessions, thereby supporting the process - currently under development - of forest concession management plans. This activity will involve a certain number of steps: awareness raising, community structuring, participatory mapping and establishment of SDP at the various implementation levels. These steps are detailed in figure below. The Sustainable Development Plans developed at the various levels will then be:
    i. Approved by the Territory Administrator and by the land affairs services, thereby ensuring the security of the process and the future investments (See Section 4.4);
    ii. Compiled at provincial level and included in the definition of a provincial plan that will prioritize future activities and investments.
    iii. Used as the basis for the signature of contracts for the implementation of the plans, in particular on the basis of actions and projects proposed by local stakeholders and other external project holders. These contracts will incorporate all the planned support by Territory, Sector, Chiefdom and LDC.
- H3. Implementation of collective and strategic facilities programmed in the plans, on the basis of the preliminary programming done in the Territory workshops during missions to draft the Plateau and Mai-Ndombe investment programs[17] The main strategic roads and bridges in the Provinces will be maintained. Processing and storage equipment for agricultural products, managed by cooperatives and private operators, will be put in place in order to reduce the value chain costs and to secure them.
- H4. Family planning. This activity seeks to achieve the Family Planning objectives set out in the National Strategic Plan for Family Planning (Ministry of Public Health, 2013). It will be conducted in close synergy with the Ministry of Public Health and plans to reach 20% of women of childbearing age (awareness raising among men and women, supply of contraceptives, monitoring and evaluation). A detailed strategy will be developed as soon as the program starts.

[15] CART members are: representatives of the Territory Administration, including the Administrator, President of the CART, the Technical Departments of Agriculture, Environment, Land Registry, the law enforcement agencies, all Sector and Chiefdom chiefs, representatives of the customary Chiefdoms and of the Land and Group Chiefs, of the Indigenous Peoples, of the Sector CARTs, women's associations, farmers, fishermen, the international and local NGOs operating on the project in the zone and representatives of church organizations. See section 6.1.

[16] A *terroir* is defined as a land area under the customary management of 1 Land Chief

[17] PAB/ISCO/EU projects and BioCFplus mission in the district of Mai-Ndombe.

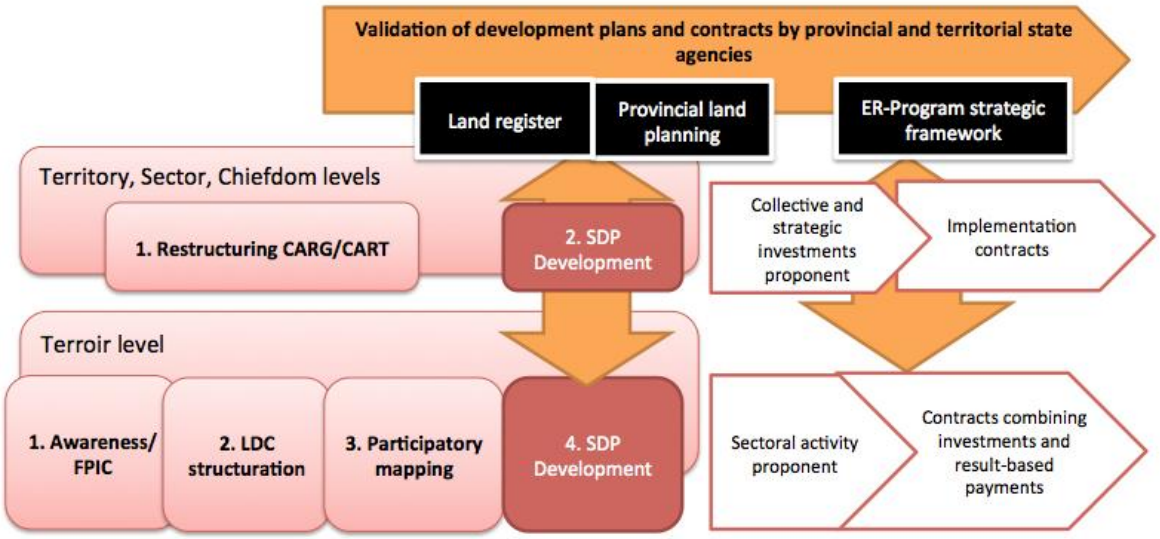


Figure 2: Participatory land-use planning and investment securing process

AGRICULTURAL PILLAR

A. Sectoral strategy

Slash-and-burn farming is the main cause of deforestation, as explained in Section 4.1. In order to address this important driver, the program strategy is to develop agriculture in the savanna and to make agriculture in forest more sustainable. This strategy will allow (i) to generate higher incomes for households and small farmers and (ii) to reduce the surface area cultivated under slash and burn practices and to reduce the associated deforestation. These objectives will be pursued by a variety of means, such as: i) diverse forms of training (initial, field school etc.), ii) Up-front finance and supply of inputs, and iii) result-based payments. Support in value chain downstream will be a decisive factor in guaranteeing stable incomes for the various households and farmers involved. To achieve this, the program will seek to work with private operators and establish co-financing arrangements with them. The program will also establish partnership with institutional or private organization interested in supporting sustainable landscape production initiative as Tropical Forest Alliance, Verified Carbon Standard and Global Canopy program.

B. Medium-term vision and sustainability

Through a combination of investment and result-based payments, the program will encourage households and small farmers to cultivate the savannas rather than the forests and to reduce the number of fields in forest areas. The non-carbon revenues[18] generated by agricultural diversification will be an incentive to maintain these sustainable agricultural practices over the medium- to long-term.

[18] The average for agroforestry and perennial crops is approximately $700/ha/year.

Investment in value chain facilities will help to attract professional operators who 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. This facilities and small factory that will be settled overtime to transform agricultural products will be a key strategy of poverty reduction and job creation.

C. Key sectoral activities

AS1. Agroforestry and improvement of cultivation techniques

Description	The program will develop small-scale agroforesty models that will help to ensure food security for households while at the same time generating additional income from the sale of agricultural and wood products. The program will put incentives in place to provide incomes for households before trees are exploited. The program will promote agroforestry systems that offer a good mix of short-cycle crops with real potential for penetration into urban markets, in combination with energy trees such as acacia, fruit trees, moringa and other legumes and caterpillar bearing trees. The trees planted might be acacia for energy or fruit trees (mango, avocado, safou etc.). The combination of short-cycle crops and reforestation will allow households and farmers to generate additional income in the short term until the trees start to generate revenues. The development of agroforestry systems will go hand-in-hand with improvements in cultivation techniques for short-cycle crops (cassava, maize etc.). The main improvement involves a continuation of the dissemination of improved varieties, foremost among these being cassava as this has a potential for sustainable improvement of 30 to 40% per year. The distance of cultivated parcels from all-weather roads and navigable waterways and existing knowledge will be taken into account in the choice of agroforestry systems. This activity will often be associated with the protection of savannas in order to protect the agroforestry parcels from fires while at the same time reconstituting the forest in savanna areas (See ES1.). The program will fund nurseries to supply improved seeds and performance incentives for the establishment and maintenance of the parcels.
Key results targeted after 5 years	✓ 12,000 ha of agroforestry ✓ 50% of vegetation material renewed ✓ $3,000 in non-carbon revenues generated per ha ($10,000 after 10 years)
Operators/beneficiaries	Households and small farmers
Potential partners	ICRAF, GI-AGRO, CTB, HPP, local NGOs

AS2: Perennial crops development in non-forest areas (coffee, cocoa, palm oil and rubber)

Description	The intensive development of crops in savanna areas is only possible in the district of Plateau and certain territories of Mai-Ndombe where there is a sufficient surface area of savanna. It is therefore necessary to develop perennial crops in the agricultural complex in order (i) to increase the incomes of households and farmers and (ii) to reduce the labor available for slash and burn farming and hence reduce the cultivated surface area[19] The perennial crops will be developed primarily in the district of Mai-

[19] Proposal for a REDD+ integrated project for Mai-Ndombe- BioCarbonFundplus – April 2015 - Rodriguez, Kashimba, Ipanga

	Ndombe by focusing on the rehabilitation of former coffee and cocoa plantations. In the savanna, the program will develop (i) palm oil plantations in combination with agroforestry which will help to generate substantial incomes for households through the sale of palm oil, which is much in demand locally; and (ii) rubber plantations which will help to generate substantial revenues for households from latex, wood and sequestered carbon. Combinations of subsistence crops and short-cycle income crops (see AS1) will be prioritized in association with perennial crops (plantain banana, for example). The program will co-finance the inputs and a proportion of labor costs for establishment and maintenance during 2 years.
Key results targeted after 5 years	✓ 6,000 ha of perennial crops in savannas ✓ 6,000 ha of perennial crops in degraded lands ✓ $1,500 in non-carbon revenues generated per ha ($5,500 after 10 years)
Operators/beneficiaries	Households and small farmers. One objective will be to create a professional class of small farmers who will be organized into producer associations by type of crop.
Potential partners	• Administration: MINAGRI Provincial Ministry of Agriculture • Technical and financial partners: The NGO TRIAS, CTB and IFAD • Private sector: Café Africa, Forest Carbon Group/Forest Finance

Key enabling activities

AH1. Strengthening agricultural value chains

Description	The sustainable development of perennial crops can only be achieved with the simultaneous emergence of organized and professional channels. To achieve this, the program will draw on and strengthen the existing channels and stakeholders (the company Congo Forêt (rubber), the NGO Trias (Cacao)) but will also seek to organize the channels and develop new partnerships in order to ensure constant demand, a prerequisite for the farmers to really re-engage in this sector. The program will therefore seek (i) to attract experienced buyers, (ii) to construct or repair storage facilities and processing equipment, (iii) to create buying agencies at strategic points, (iv) to support the development of product certifications and in particular to guarantee that the development of perennial crops is not exacerbating deforestation.
Key results targeted after 5 years	Professional operators are in place through all perennial crops value-chain, contributing to the maintenance of price stability, high product quality and compliance with strict specifications relating to the reduction of deforestation. (Zero Deforestation production standard)
Operators/beneficiaries	Professional operators: i) cooperatives and associations of planters, ii) large private operators already active in the zone and iii) specialist private companies already operating in the DRC or elsewhere.
Potential partners	• Administration: MINAGRI. Provincial Ministry of Agriculture • Technical and financial partners: The NGO TRIAS, CTB and IFAD • Private sector: Café Africa, Forest Carbon Group/Forest Finance

ENERGY PILLAR

A. Sectoral strategy

In order to counter the ever-increasing demand in Kinshasa for fuelwood and the undeniable attraction charcoal production holds for the populations in the area, the energy strategy of the program will primarily consist in supporting reforestation and regeneration for energy purposes in order to rapidly grow a sustainable fuelwood offer and to reduce pressure on forest spaces (this also constitutes a key leakage reduction strategy).

B. Medium-term vision and sustainability

After an initial production cycle, the communities and private stakeholders will draw significant revenues from their charcoal production and will be encouraged to maintain this activity in combination with agriculture. Furthermore, the formalization of the sector will help to disseminate good practices and standards among the various stakeholders. In the medium term, a "sustainable charcoal" value-chain will be formed and supported either by a favorable tax regime or by promoting the sustainable origin of their product among consumers in Kinshasa. As for non-sustainable charcoal, this will be taxed progressively, supporting the transition toward sustainable charcoal production across the province. The revenues from these taxes will be used to consolidate funds dedicated to reforestation and ensure the long-term sustainability of the system.

C. Key sectoral activities

ES1. Assisted natural regeneration for charcoal production.

Description	This activity consists in establishing and maintaining fire breaks in order to encourage the regeneration of forestry-dedicated savanna and thus help to (i) increase carbon stocks, (ii) develop a sustainable charcoal offer in the short term and (iii) to create a cost-effective leakage mitigation mechanism linked to fuelwood. Incentives per hectare will be proposed for establishment and maintenance. In addition to protecting neighboring forests from the spread of savanna fires, the activity will offer a means of providing a sustainable supply of charcoal. The regeneration zones will be incorporated into the local natural resource management plans and the program will focus this activity on the district of Plateau, in particular along the Rivers Congo and Kasai in order to facilitate the transportation of the charcoal produced. After charcoal production of one parcel, the land can be used for farming, thus reducing pressure on the neighboring forests.
Key results targeted after 5 years	✓ 55,000 ha of Assisted Natural Regeneration dedicated to fuelwood ✓ $700 in non-carbon revenues generated per ha ($2,200 after 10 years) ✓ 900,000 tons of charcoal produced over 10 years (replacement of approximately 40% of the charcoal offer in Mai-Ndombe)
Operators/beneficiaries	LDCs, households, small farmers, specialist NGOs or private operators
Potential partners	Hanns Seidel Foundation, CIRAD

ES2. Afforestation/Reforestation for charcoal production

Description	Energy plantations will be planted in the large grassy savannas (requiring no stump removal) close to roads in the vicinity of Kinshasa, in particular in the south of the territory of Kwamouth.

	This activity can be conducted with inter cropping for the first 2 to 4 years in order to generate revenues. After 7 years, the trees can be used to make charcoal. The program will co-finance professional operators (private enterprises, cooperatives) up to 50 to 60% of total startup and running/management costs, which will vary between $800 and $1,000 per hectare according to site and type of sylviculture. Co-financing will be conditional upon performance, in accordance with modalities which are yet to be defined.
Key results targeted after 5 years	✓ 6,000 ha of industrial agroforestry reforestation. ✓ $1,400 in non-carbon revenues generated per ha ($3,000 after 10 years) ✓ 100,000 tons of charcoal produced over 10 years (replacement of approximately 4% of the charcoal offer from Mai-Ndombe)
Operators/beneficiaries	Professional operators: i) cooperatives or associations of planters, ii) specialist private companies already operating in the DRC or elsewhere. ➢ *Identified operator: Novacel, a specialist agroforestry company, in association with the Nsia Mala Mala cooperative currently being set up in South-Kwamouth*
Potential partners	Hanns Seidel Foundation, European Forest Institute, `New Generation' Platform, Mondi

D. Key enabling activities

EH1. Formalization and strengthening of the fuelwood sector

Description	This sector support activity will be structured around the following focuses: i. Improving the efficiency of fuelwood production and reducing its impact on deforestation by building technical and administrative capacities, putting monitoring tools in place. In synergy with the drafting of simple management plans at village level, activities to support charcoal makers and other sector stakeholders will seek to disseminate good charcoal production practices and sustainable sources of supply. Synergies can be found with the development of improved cookstoves in Kinshasa (planned in component 2b of the FIP), in particular for adapting the type of charcoal to the cookstoves distributed. ii. Developing a network for the transportation of the fuelwood thus produced in order to facilitate the distribution and marketing of this product; iii. Contributing to the formalization of the fuelwood sector in the province of Mai-Ndombe through the introduction of a) an institutional framework regulating the production, transportation, distribution and sale of charcoal and b) fiscal measures encouraging sustainable practices and discouraging practices that are harmful to the environment.
Key results targeted after 5 years	✓ A legal framework and technical standards for sustainable charcoal are defined. ✓ 5 to 10 cooperatives of producers/carriers are created;
Operators/beneficiaries	Professional operators: i) cooperatives or associations of producers, ii) specialist private companies already operating in the DRC or elsewhere.
Potential partners	The SNV, which is working on the formalization of the sector and improved charcoal production in the province of Kinshasa.

FOREST PILLAR

A. Sectoral strategy

The strategy of the program in the forest sector is translated into two complementary axes of production and conservation.

First, in order to reduce deforestation and degradation due to industrial and artisanal logging while at the same time satisfying demand for wood products in the domestic and international markets, the program will support: (i) industrial forest companies, to reduce their impact on the forest and to comply with national regulation and certification requirements; (ii) professional and community organizations, to reforest local species in order to offset at a medium-run the local and Kinshasa demand for wood; (iii) the State services, in reinforcing the law. The aim of this combination of performance-based incentives, co-financing and strengthening of controls will be to formalize and move the forest sector towards sustainable management standards.

Then, in order to promote the conservation of forest carbon stocks, the program will support (i) the creation and operation of conservation concessions, (ii) the conservation of local community forests and (iii) the management of protected areas.

The program offers the opportunity for forest companies to be compensated for their effort in reduced impact logging or extending conservation area but this opportunity is limited to concession which are already advanced in their forest management process. In parallel, forest control by the state will be reinforced and sanction will be apply for concession which are not progressing toward legal requirements. Transparency and monitoring will be the key of this strategy to bring the forest sector on track to Sustainable Forest Management.

B. Medium-term vision and sustainability

- The first activities of reduced-impact logging with pioneers forest companies will help to demonstrate the effectiveness of this type of management and will gradually cover all concessions. This gradual dissemination of sustainable practices will bring significant opportunities for the logging sector; first economically, by rewarding low-impact practices, but also commercially as participation in the program will help to foster greater confidence among commercial export partners especially through certification.
- Conservation concessions development is an intermediary strategy to give values to forest and provide local development in a context of increasing forest destruction. Conservation concession will be at a later stage (when the economical and regulative context will be improved) subject to other economical vocation as sustainable forestry, NTPF activities, ecotourism.
- The resources made available to the State for controlling the legality of wood transported and for controlling compliance with management plans and standards will contribute to a substantial reduction in illegal and semi-industrial logging, and will help to formalize the small-scale sector. The taxes and fines collected through the control system will in part be re-channeled towards sector formalization and reforestation for wood production.
- The program will gradually implement a payment system for environmental purposes, intended for both conservation concessions and community forests. This system will be financed at a

medium-run by a provincial or national revolving fund, built up with carbon revenues or some other fiscal arrangement at national level.

C. Key sectoral activities

FS1. Reduced impact logging

Description	The objective of this activity is to reduce the impact of logging by the following measures: reduction of the length and width of the primary and secondary roads, improved planning of extraction paths, extansion of conservation areas and reduction of storage areas, increased duration of rotation and of minimum felling diameters etc. By providing monetary incentives to reduce the emissions generated, reduced-impact logging practices remains profitable and attractive for the private sector. The forest concession holders will thus be subject to a carbon performance-based regime linked to a specific reference level calculated on the basis of their management plans (or development plan where applicable). This support from the program will be conditional to the progress of the forest companies toward certification scheme (FSC or others) and this to ensure sustainability of the system if the Carbon Fund payments are not available anymore after 2021.
Key results targeted after 5 years	✓ 50% of the concessions of Mai-Ndombe engaged in reduced-impact logging (More than 100 000 ha logged with reduced-impact logging standards) ✓ 30% of concessions of Mai-Ndombe engaged in a certification scheme
Operators/beneficiaries	Industrial timber companies - SODEFOR, SIFORCO and Maison NBK have already declared their interest in participating in this activity.
Potential partners	FRM, GFA

FS2. Conservation of local community forests

Description	This activity consists in providing direct incentives for the conservation of local community forests in line with the local sustainable development plan developed by communities in a participatory manner. This activity will be conducted in synergy with the other alternative activities in the savanna and those involving agricultural intensification targeting village land parcels. It will offer an incentive to rights holders to improve their management of the allocation of forest parcels for charcoaling or non-sustainable agriculture in favor of conservation of community forests. These direct revenues will supplement household incomes and finance collective investments. Payments will be performance-based in accordance with modalities that are still in detailed design and that will be tested during the first years of the program. A portion of these forests will be formalized into local community forests, thereby enabling the implementation of the recent decree. Controlled logging will therefore be tested and then extended to other community concessions (see FH3).
Key results targeted after 5 years	✓ More than 500 000 ha of local community forests under conservation
Operators/beneficiaries	LDCs and/or CARGs
Potential partners	Local civil society

FS2. Conservation concession

Description	By offering carbon incentives, the conversion of logging concessions into conservation concessions is rendered profitable and thus attractive to the private sector. The program will reward the carbon performance of existing conservation concessions and will facilitate the creation of new conservation concessions. The concession holders will develop activities with the communities, who must ideally incorporate the various key activities of the program into their management plan (agroforestry, perennial crops, reforestation, family planning etc.). This support from the program will be conditionnal to the progress of the forest companies toward certification scheme (FSC or others) and this to ensure sustainability of the system if the Carbon Fund payments are not available anymore after 2021.
Key results targeted after 5 years	✓ 3 conservation concession (Around 500,000 ha)
Operators/beneficiaries	Conservation companies (WWC) Industrial timber companies (SODEFOR, SIFORCO and Maison NBK)
Potential partners	PERMIAN Global

FS4. Afforestation/Reforestation for lumber production

Description	The program will facilitate and assist private operators in the establishment and management of industrial lumber plantations for the local and regional lumber market (construction, manufactured products etc.). This activity will participate in carbon sequestration but will also help to secure sustainable sources of lumber supplies for industry in Kinshasa and the sub-region. In the medium term, local timber processing activities will contribute to increase local employment and reduce poverty. The program will co-finance professional operators (private enterprises, cooperatives) up to 50 to 60% of total startup and running/management costs, which will vary between $800 and $1,000 per hectare according to site and type of sylviculture. Co-financing will be conditional upon performance, in accordance to modalities which are yet to be defined. The program will encourage the development of agroforestry system in order to diversify revenues streams and contribute to increase food security. The program is currently in discussion with the company SOCALCO, leader in the matches production sector based in Kinshasa, in order to offset their unsustainable wood sourcing by establishing agroforestry system.
Key results targeted after 5 years	✓ 6,000 ha of industrial reforestation
Operators/beneficiaries	Professional operators: i) cooperatives or associations of planters, ii) specialist private companies already operating in the DRC or elsewhere. ➢ *Identified operator: Company SOCALCO (Dewji International Group) has expressed its interest in this activity*
Potential partners	ICRAF, New Generation Platform, Mondi, Moringa Fund

D. Key enabling activities

FH1. Strengthening forest and wildlife law enforcement

Description	The objective of this activity will be to strengthen forest and wildlife law enforcement in the Mai-Ndombe program zone, in particular: (i) control of the logging products derived from small-scale and industrial logging , (ii) control and taxation of charcoal and (iii) control of poaching and animal traffic; To achieve this, it will rely on the decentralized service of the Ministry of Environment and on the Department of Internal Control and Audit (DCVI) within that Ministry. This activity will involve strengthening these services to give them the capacility to carry out the tasks concerned. This will be carried out (i) at territory level to strengthen the teams responsible for controlling and sanctioning industrial and small-scale operations, as well as poaching; and (ii) at key crossing points (Mongata, Kinsele, Mushie and Kwamouth) in order to strengthen the control system, by providing it with the means to detect infringements and apply the regulations on contravening products, and also to determine clear statistics on the exploitation and trading of forest resources in the province of Mai-Ndombe. The Program management unit will supervise the activity and will draw on independent mechanisms (civil society, independent observers) responsible for verifying the effectiveness of the check points and the correct application of management measures. Serious consideration will be given to the option of channeling the revenues generated from the various taxes to reforestation for energy and wood production purposes. As part of these activities, the AGEDUFOR project will be able to train DCVI officials. Other enabling activities could be envisaged in order to improve the training of MEDD and provincial departmental personnel on the performance of their tasks of supervising, managing and controlling forest activities.
Key results targeted after 5 years	✓ 4 reinforced check points at all the crossing points leading to Kinshasa ✓ More than thirty agents trained and reinforced in terms of resources and equipment.
Operators/beneficiaries	State Services (environment territorial units, DCVI etc.)
Potential partners	AGEDUFOR project (AFD)

FH2. Legal compliance of industrial logging operations

Description	The legal compliance of forest concessions and their integration into the management planning process often comes up against the problem of financing the collection of the basic data required for the preparation of the various management planning documents required. At present, only two concessions (held by the same company) have filed their Forest Management Plan. The filing of a further 2 Forest Management Plans is anticipated by the end of 2015. A large number of concessions, therefore, are or will be late in this management process. Support in the form of technical assistance and financing will be necessary in order to finalize this management planning process. Contracts with concession holders and consultancies specialized in forest management planning (or with the management planning units of companies if they are operational)

	to cover a part of the management planning costs (cost of the inventory borne by the holders). Initial support in terms of forest management is also planned. It concerns the production of the first management plan and the first annual operations plan, as well as technical assistance for the monitoring of forest production and social provisions. This activity will be developed in close interaction with the AGEDUFOR project that will provide training and technical support to forest holders in their forest management planning process.
Key results targeted after 5 years	• 75% of forest concessions submitted their Forest Management Plan.
Operators/beneficiaries	Industrial Timber Companies
Potential partners	MEDD, AGEDUFOR, FRM

FH3. Development of community forestry.

Description	This activity will support the creation and management of forestry concessions for local communities at a sufficiently large scale (consortia or clusters of adjacent community concessions, for example) and these would be managed and exploited in collaboration with artisanal loggers, themselves more effectively structured and supervised. Exploitation contracts will then be negotiated with the communities holding the concessions, including, among other things, an equitable benefit-sharing mechanism and procedures for the monitoring and control of the operation. An important precondition for the success of this activity is the structuring and strengthening of local communities and artisanal loggers who will participate in the initiative. This activity will draw on the experiences of community forestry in the DRC, in particular the GIZ project in Maniema.
Key results targeted after 5 years	✓ 3 community forest concessions under sustainable management (50,000 ha each on average) – Representing a volume of 50 000m3 per year and 20% of the current importation of artisanal wood from Mai-Ndombe[20]
Operators/beneficiaries	LDCs/CARGs and associations of artisanal-loggers
Potential partners	GIZ, CIRAD

FH4. Support management of protected areas

Description	This activity will support the management of protected areas in the zone, in order to provide equipment and human and financial resources to the manager of the reserves concerned, but also to involve and raise awareness among communities with regard to protection activities. This activity will be conducted in close synergy with the activities that support communities in the development of local land-use plans and plans for investment in the agricultural sector.

[20] Lescuyer G, Cerutti P.O, Tshimpanga P, Biloko F, Adebu-Abdala B, Tsanga R, Yembe-Yembe, R.I and Essiane- Mendoula E. 2014. The domestic small-scale sawing market in the Democratic Republic of Congo: State of play, opportunities, challenges. Occasional Paper 110. CIFOR, Bogor, Indonesia.

Key results targeted after 5 years	✓ 4 units of eco-guards trained and reinforced in terms of resources and equipment.
Operators/beneficiaries	Support for the management of protected areas will be delivered by the WWF under CAFEC funding.
Potential partners	ICCN

PAYMENT FOR ENVIRONMENTAL SERVICES PROGRAM AND LINK BETWEEN INVESTMENT AND CARBON FINANCE

The financing of the program requires significant up-front investments in order to launch the enabling activities that are essential to the success of the program, but also to invest in sectoral activities until these activities start to generate carbon and non-carbon benefits.

The sectoral activities presented above are all directly linked to the emission reductions generated. Most of this activities will be included in a Payment for Environmental Services Contract with the operators and communities. These contracts will be paid on the basis of carbon performance or according to simplified indicators approximating the carbon performance (proxy indicators).

At the outset of the program, contracts will be signed with certain operators and communities already committed and structured under existing pilot initiatives. These contracts will be honored in the first few years through the initial investments, such as those of the Forest Investment Program, and thereafter by the redistribution of REDD+ revenues when carbon emissions are measured and audited and Carbon Fund payments can be accessed. For the various key activities, the table below presents the targeted operators and the basis for payments. Details of the standard contracts are given in section 15.1.

Even though the present structure of the strategy divides the activities into enabling and sectoral pillars, the strategy for intervention in local communities will be fully integrated; (i) the communities will be supported in the preparation of a participatory mapping and a local development of natural resources management plan; (ii) this step will form the basis for the definition of the suitable sectoral activities (agroforestry, perennial crops and assisted natural regeneration) at the village level; (iv) the sectoral activities will be deployed through contracts combining investment and result-based payments; (v) the results-based contracts will provide a guarantee that the communities are indeed reducing deforestation on their land (the investments will be linked in part to observance of the land management plan).

Table 6 Targeted operators and basis for payments for each key activity

Carbon stratum	Key activities	Targeted operators	Basis for payments
UNDEF/ UNDEG	AS1. Agroforestry and improvement of cultivation techniques	LDCs, households and small farmers	Investments and performance-based incentives during the first years
UNDEF/ UNDEG	AS2. Perennial crops development in non-forest areas (coffee, cocoa, palm oil and rubber)	LDCs, households and small farmers	

A/R	ES1. Assisted natural regeneration for charcoal production.	LDCs, households and small farmers	
A/R	ES2. Afforestation/Reforestation for charcoal production	Professional organizations	Up to 50% co-financing with a private stakeholder Paid in part on performance/ha
PDEG	FS1. Reduced impact logging	Professional organizations	Carbon performance-based payment
UNDEF/ UNDEG	FS2. Conservation of local community forests	LDC	Payment by results on the basis of contracts with the LDCs (to be defined)
PDEG	FS3. Conservation concessions.	Professional organizations	Carbon performance-based payment
A/R	FS4. Afforestation/Reforestation for lumber production	Professional organizations	Up to 50% co-financing with a private stakeholder Paid in part on performance/ha

STARTUP STRATEGY

In its design, the program identified a certain number of priorities while taking account of the need to address all the drivers of deforestation and forest degradation in a coordinated way. The various funding have been allocated in order to assign sufficient resources to packages of activities that generate pilot successes that will encourage the various stakeholders to adhere to the principles and strategic framework of the program. The various implementation risks[21] and potential benefits have been taken into account throughout the design phase and allocation of the associated budgets. The program will therefore seek to respect the following startup principles:

- The program will prioritize its efforts and investments in the zones where initiatives are already present and/or where there is a high risk of forest cover reduction; along the major roads and waterways in particular.
- In order to guarantee that perennial crops are not developed to the detriment of the populations and forests, an in-depth study is under way to identify the most suitable zones for the development of perennial crops.[22].
- In late 2015/early 2016, the program will roll out a breaking-in phase involving training and demonstrations of referential agricultural techniques together with the most effective approaches of engagement, mapping and local governance strengthening. To accomplish this, significant resources and local monitoring and evaluation will be deployed in the first pilot terroirs, which will receive support and investments in order to disseminate lessons learned, to train future trainer and to exponentially roll-out the program activities.

[21] The analysis of the risk of non-permanence and of leakages is detailed in Sections 10 and 11

[22] Siting-Tool developed by the SNV

- Iteratively, the program will ensure (through internal quality controls) that the level and quality of the upstream enabling activities are sufficient to achieve the objectives of the downstream sectoral mitigation activities.
- From the outset, the program will place emphasis on strengthening forest control in order to put a significant brake on illegal logging operations, thus increasing confidence among the various stakeholders and guaranteeing that the efforts of some are not in vain due to the illegal actions of others.
- From the outset, the sectoral activities will aim to generate revenues for the populations, thereby increasing confidence and broadening the dissemination of these techniques. With this aim, the program has already established partnerships with the academic and research world in order to refine the various agroforestry and agro-ecological models that are adapted to environmental conditions and to local and regional market opportunities.
- The program will ensure the availability of sufficient resources and appropriate conditions to build the capacities of the various stakeholders, from the communities to the national and provincial authorities, in order to guarantee their participation, transparency and the effectiveness of the program activities.

4.4 EVALUATION OF LAND TENURE SYSTEMS AND ACCESS TO RESOURCES IN THE PROGRAM ZONE

LAND TENURE IN THE ACCOUNTING AREA

A number of studies exist on land tenure and access to resources in DRC, with a particular focus on REDD+.[23] The program zone, the province of Mai-Ndombe, in particular, was closely assessed with respect to land tenure aspects as part of the project for improved management of forest landscapes (PIMFL) funded by the FIP. Furthermore, independent assessments were conducted by the various REDD+ initiatives implemented in the program zone. The legal assessments were complemented with statistical samples (district of Mai-Ndombe; sample of 400 households), collected in the context of the BioCarbon Fund+ mission of November 2014, and on-the-ground surveys made by the Provincial Ministry of Agriculture (Bandundu) (2011) in the 4 territories of Plateau District.

SETTING THE SCENE: LEGAL TITLE AND USAGE

The Congolese land tenure regime has evolved on the basis of two constitutional guarantees: a public (state) guarantee of permanent sovereignty over the country's lands, waters and forests (recognized under the current constitution, which dates from 2006, in article 9), on the one hand, and the private property guarantee, which includes individual property as well as collective property, established in accordance with statutory law or custom (article 34 of the 2006 Constitution), on the other hand.

[23] Mpoyi/Sakata/Longbango/Kabue, REDD+ en RDC, Cadre juridique et institutionnel de mise en oeuvre de la REDD+ en RDC (GLOBE International 2013); Mpoyi/Nyamwoga/Kalasi/Mulenda, Etude sur le partage des revenus issus de la REDD+.

Within these constitutional guarantees, Congolese law defines and recognizes different property titles over movable and immovable objects as well as distinct resource tenure regimes. Article 1 of the Congolese Property Law ("Regime général des biens, régime foncier et immoblier et régime des suretés" of 1973, hereinafter "Régime foncier" or "RF") lists the different types of rights in rem ("droits réels"), see below.

Land is considered a genuine immovable object (article 6 RF). "Trees and all plants" are considered components and, thus, are an integrated part of immovable objects, as long as they are not removed from the land; so are fruits and harvests (article 7 RF). Ownership of an object, whether movable or immovable, gives the right to all its physical components (article 21 RF).

The Forestry Code of 2002 specifies that the forests are the property of the state (article 7 Forestry Code) and may be exploited and used only in conformity with the Forestry Code and its implementing legislation. Laying out different tenure regimes, the Forestry Code explicitly recognizes customary holdings (article 36) and gives local communities, organized in families or clans (article 1 (17)), dedicated rights of use, exploitation and self-governance (articles 111 and 112).

The rights of use and exploitation are defined in the Code, with article 45 explicitly banning non-authorized exploitation and, generally, "overexploitation". Management plans must be in place for any form of forest exploitation (article 71). Whoever intends – within the limits of the concession or right holding, whether it relates to mining, agriculture, urban developments, tourism or other – to deforest any lot of land, needs a "deforestation permit" (permis de déboisement). The Forest Code includes a number of provisions to set incentives for reforestation, among them the authorization to individuals and local communities to harvest the forest products from the reforested zones (article 80).

Other statutes – including the Decree on Urban Planning of 1957, the Mining Code of 2002, the Agricultural Code of 2011, and more recently the Law on Nature Protection of 2014 – define and shape specific land- and/or resource-related titles and practices and have a bearing on the implementation of a number of envisaged REDD+ activities. Section 4.5 presents an overview of key statutes and implementing provisions, as relevant for the program zone. The table is to be read with the caveat that many of the laws and statutes on land and land-use have a long history and often tend to remain in force in parallel, at least formally, with new regimes, which are evolving at an ever-growing pace; the result is a legal body that is not always synchronized and complementary to each other and that includes regulatory overlaps (c.f. the different land registries: cadastre foncier, cadastre minier, cadastre agricole, cadastre forestier), and even contradictions. For the legal practitioner, it is all the more important to focus on process and broad stakeholder representation, in order to ascertain tenure, land use and access rights as well as other holdings over land (on this see chapter 5.1 and Annex 7 below).

Main land holding types in the program zone

The program zone includes both formalized and informal land-holdings and resource rights. On the side of formalized holdings, a range of different concessions are in place for land in the assessment area. Congolese law distinguishes short-term and long-term (emphyteutic) concessions. Short-term concessions include 5-year long small-scale farming concessions (50-500 ha) for extensive livestock farming (agriculture) and small-scale logging concessions for up to 50 ha (forestry); long-term concessions – for leases of 25 years, with the possibility for DRC nationals to transfer to a perpetual lease (see on rights in rem below) – are given out for both forestry activities (mainly industrial logging, but also conservation) as well as agricultural activities (livestock farming, agroforestry, sylviculture, etc.).

Generally, the level of public and legal recognition differ for short-term and long-term concessions. While short-term concessions are usually not inscribed in the public land registry (even though loose demarcation, in particular with respect to farming concessions through the Ministry of Agriculture, may

occur) and while they often transcend the sphere of formalized and informal law with customary institutions, notably the clan chief assuming an important role, long-term and perpetual concessions require full documentation in the land registry.

On the side of informal, or customary law, land access rights and rights of resource usage focus on communities are arranged mostly around clan structures in both local and indigenous communities. The surface area of available forest land, i.e. flood-proof forests outside concessions, represents approximately half of the forests in the province (including the man-made forests of the "rural complex").

Historically, clan members enjoyed unrestricted access to primary forest land as well as its resources, with the clan chiefs assuming the role as supervisor and arbiter who allocates and demarcates land in case of dispute. While the concept persists to this day, it is increasingly contested at numerous levels, including horizontally among clans and clan chiefs; vertically between the government (which reserves the right to make formal allocations, including for the sake of protection) and the clans; in succession from one chief to another; and generally as a consequence of widespread pressure on, and competition for, land (see below). Today, substantial areas of the land not under formal concession is illegally exploited for wood and charcoal production.

LAND TENURE AND CARBON RIGHTS

Carbon rights are not explicitly referenced in the country's legislation,[24] except recently in the context of administrative procedural law laid down in Ministerial Regulation No 4 of 2012 (see below).[25]

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

Right to emission reductions (obligatio)

This right has its legal basis in Congolese contract law, namely article 25 and article 280 of the Code civil ("Des contrats et obligations conventionnelles" of 1888). The government – represented for the purpose of the (first) ERPA under the FCPF by the Ministry for the Environment, Nature Conservation and Tourism – assumes this legally valid obligatio upon execution and is bound under the Congolese Code civil or any other private law regime applicable to the ERPA. The government will, for itself, agree with a range of REDD+ stakeholders similar terms to secure that carbon asset generation is centralized in one actor (e.g. the central government) and that the stakeholders concerned will abstain from marketing the REDD+ activities to third parties.

[24] Mpoyi, A. / Sakata, G. / Longbango, A. / Kabue, G., REDD+ en RDC. Cadre juridique et institutionnel de mise en oeuvre de la REDD+ en RDC, GLOBE International 2013.

[25] Arrêté Ministériel No 004/CAB/MIN/ECN-T/012 du 12 fevrier 2012 fixant la procedure d'homologation des projets REDD+. In a separate context, i.e. the recently adopted Nature Conservation Law (*Loi No 14/003 du 11 fevrier 2014 relative a la conservation de la nature*), a legislative reference to the "potential value of forest carbon stocks" and the need for its consideration by the government under both the national conservation strategy and the national forest program can be found (Article 8), but the provision does not state any legal particularities.

Right to emission reductions (ius in rem)

A right in rem, in order to be recognized under Congolese law, would need to fulfill the requirements of rights in rem ("droits reels") as defined by Congolese property law (article 1 RF), namely:

- Ownership or dominium ("propriété");
- Permanent concession ("concession perpetuelle");
- Long-term lease ("droit d'emphytéose");
- Heritable building right ("droit de superficie");
- Usufruct ("usufruit");
- Servitude ("droit d'usage et d'habitation" and "servitude foncière"));
- Pledge ("gage");
- Privilege ("privilege"); and
- Mortgage ("hypothèque").
- Forestry concessions (defined as 'right in rem sui generis').

These rights share as common feature that they represent an inherent claim to a particular object (whether movable or immovable) and that they give an absolute or restricted right of use. From the point of view of Congolese law, emission reductions are neither considered an object – they lack the physical form – nor a forest product[26] nor do they indicate a particular form of usage. Rather, they represent the result of an effort and an achievement. They may be the result of a concrete set of land and area-related actions (e.g. reforestation of a particular stretch of land) or they may be created through activities further removed from particular lots of land such as the introduction of certain policy measures with an impact on country- or jurisdiction-wide deforestation.

It follows that Congolese law 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 issued into a registry. While case law is yet missing, it is expected that Congolese courts 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 Congolese 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 e.g. concession holders (and/or of a deforestation permit under Article 53 Forestry Code) to perform logging in accordance with the terms of the concession or permit, or the right of indigenous communities to use the forest environment as recognized by Congolese formalized and non-formalized law.

Also, Congolese law recognizes the principles of unjust enrichment and similar institutes (such as "gestion d'affaires"). 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.

Administrative conservation permits and agreements (public law)

Of fairly recent origin, Congolese law today recognizes the right for any or legal person established in the Democratic Republic of the Congo to engage in REDD+ activities as a 'project proponent' ("porteur

[26] For a definition see art. 1 (2) Forestry Code: All listed products are tangible objects.

du projet"). Ministerial Regulation No 4/201227, currently under revision, allows for the conclusion of partnership contracts ("contrats de partenariat") between the government (represented by the Ministry of Environment), which – together with the adoption of an accord between the project proponent and local and indigenous communities – is deemed a pre-condition for the right of the project proponent to commercialize REDD+ carbon credits. It is noted that the Regulation distinguishes "emission reductions" and "carbon credits", the latter implying a validation process under an international standard. It is also noted that the Regulation is confined to procedural matters; it does not create particular 'carbon rights', and it does not provide a legal basis for implementation.

Another legal act of relevance, in this context, is Decree 11/27 of 20 May 2011[28] on the issuance of forest conservation concessions. Forest conservation concessions are given out by the Ministry of Environment; they confer on the concession holder the "right to utilize the forest for the *valorization* of environmental services, at the exclusion of all extractive activities" (Article 3, italics added). "Environmental services" are defined as "the sum of activities giving rise to goods or services that serve to measure, avoid, limit, reduce to a minimum, or correct any encroachment on the environment" (ibid.). Whether REDD+ and the participation in REDD+ activities are covered by Decree 11/27 has not yet been finally established, and no case law is available. Following a conservative approach, the REDD+ program will assume that forest conservation concessions do include the right to engage in REDD+ and confer an exclusive right to valorize emission reductions and receive REDD+ credits for the area under concession. The matter will be adequately addressed through contract between MECNDD and the concession holder (see below Section 18).

LEGAL APPROACHES TO REDD+ IMPLEMENTATION

The general approach of REDD+ implementation in the assessment area and elsewhere will be based on voluntary participation of stakeholders, rather than on command-and-control-driven measures. This said, the enforcement of existing rules of protection and limitation of use will be part of the country's REDD+ policy (and a key contribution of government entities). This includes strict application of the perpetual protection status. Illegally deforested land must not be legalized ex-post through the granting of formalized titles. In its role as sovereign owner of the land and the resources, the government will also provide for long-term planning, and it will work towards a more restrictive and sustainable use of future logging and other exploitative concessions.

Beyond enforcement and long-term planning, the relevant legal instrument of implementation will consist in bilateral and multilateral contracts between the government, a REDD+ program holder (such as the province of Mai-Ndombe) or a project holder, on the one hand, and the various stakeholders – concession holders, local communities, Indigenous Peoples, village association, not-for-profit organizations, etc. – on the other hand. The contracts will specify options for participation, targets, activities and follow-up, valorization priorities, if any (see before, sub-chapter above), as well as rules for benefit-sharing. The contracts will also include an exclusivity and no-compete clause concerning the REDD+ activities and their exclusive eligibility under the national REDD+ program (or the REDD+ project in question); this clause will strictly adhere to the rules on "double-counting", which are an integral part of the national REDD+ program, in general, and the contractual obligations under any ERPA, in particular.

[27] See above footnote

[28] Accessible at http://www.leganet.cd/Legislation/Droit%20economique/Code%20Forestier/D.011.27.50.05.2011.htm.

The table below lists the main tenure/usage types (with relevant stakeholders), the plans/instruments envisaged for them as part of REDD+ implementation and relative to rights on Emission Reduction.

Table 7 Type of land tenure, users and relevant legal instruments to engage stakeholders

Zone type		Area Mha	Users	Relevant tenure regime	Legal instruments envisaged to engage actors (see	Remarks regarding rights on Emission
Converted logging titles[29]	Production series	1.52	Logging companies	Forestry concessions in permanent production forests (Forestry Code)	Carbon related contracts	Transfer of title
	Protection and conservation	1.15	Logging companies, local population	Forestry concessions in permanent production forests (Forestry Code)	Implementation contracts (proxy-based)	Exclusivity and no-compete clause
	Rural development zone	0.89	Local population	Protected forest (Forestry Code) under customary regime	Implementation contracts (proxy-based)	Exclusivity and no-compete clause
Classified forests		2.04	State (ICCN, implementing agency), Local	Forest within the public domain under various status of protected areas	Implementation contracts (proxy-based)	Exclusivity and no-compete clause
Conservation concession		0.32	Conservation concession holders, Local population	Forestry concessions in permanent production forests (Forestry Code)	Carbon related contracts	Transfer of title
Zones under customary regime	Afforested	4.34	Local population Small-scale loggers	Protected forest (Forestry Code) under customary regime	Implementation contracts (proxy-based)	Exclusivity and no-compete clause
	Non-afforested	2.58	Local population	Customary regime	Implementation contracts (proxy-based)	Exclusivity and no-compete clause
Emphyteutic concessions and farm leases		0.80	Farmers; livestock rearers and neighboring	Land Tenure Code	Implementation contracts (proxy-based) or Carbon-	Exclusivity and no-compete clause or transfer
Mining sites and infrastructure		Less than 0.01	State and mining concession holders	Mining Code, Public domain for infrastructures	No specific instruments	Exclusivity and no-compete clause

CHALLENGES

Challenges are mostly foreseen with respect to the contractual integration of customary land holders. This does not concern so much the contractual negotiation process at both the level of clan chiefs as well as the level of local and indigenous communities as a whole, which are addressed in dedicated stakeholder consultations (see below section 5). Rather it concerns the long-term effectiveness of any contracts concluded.

In the savanna zones, wandering livestock is a recurrent problem, during the dry season in particular when they turn to cultivated or forest land. The absence of the clear delimitation of clan land as concessions and the interpersonal and discretionary nature of the agreements granted by the land chief are potential factors for conflict. These arise in particular when there is a succession (a change of lineage in the chiefdom entails a renegotiation, from "admission" to the amount of the annual charge) or when

[29] Estimates of the areas of forest concessions on the basis of existing management plans (FRMi, 2015)

there is competition for access to resources. This situation requires perpetual awareness and compliance checks of the partnership contracts concluded.

The boundaries of clan land parcels create conflict between chiefs, and the clan right of use (agriculture, fishing, hunting, mining) becomes conflictive when a clan member exercises this right over land in conflict with "clan ownership". On the urban fringes, "newcomers" (migrants) who arrive in excessive or increased numbers, experience discrimination through the clan land practices, or question the admission conditions and charges they are obliged to pay. The response to this situation is to lead integrated contract awareness campaigns with participation of land users at all levels (beyond representatives and clan chiefs), to uphold the law including towards clan members, and to offer migrants paths for future participation.

Conflicts between local communities and concession holders break out in particular when cultivated gallery forests become inaccessible to farmers because they are enclosed within savanna lands held under concession, when land becomes scarce in the clan because of the size of the allocations made by the land chief, or when concession holders lack flexibility in the enforcement of their right to prohibit agriculture inside the concession. The integrated REDD+ approach, which works along a wide number of horizontal agreements, is expected to alleviate this situation.

Access to land tenure in the program zone is most problematic on the urban fringes and in the territory of Yumbi where human density, the scarcity of forests and the widespread grabbing of savanna land by livestock farms create a structural deficit of cultivable land and threaten food security at the same time. This cannot fail to produce periodic conflicts, especially when wandering herds are thrown into the mix. In response, investments in the land (perennial crops, improved fallows, assisted natural regeneration on the savannas) must be adequately secured, including through simple management plans as trialed by the Makala project for the improvement of fallows and the enhanced use of formalization instruments such as registration certificates.

4.5 ANALYSIS OF THE LAWS, STATUTES AND OTHER REGULATORY FRAMEWORKS

For a specific analysis of private and public law implications for the program zone, see above 4.4. Below we summarize the main laws of relevance for the land tenure regime.

Table 8 Laws of relevance for the land tenure regime

Statutory Base Regime	Relevant Implementing Acts	Land Tenure Relevance	Relevance for the Program area
1959 Urban Planning Code		The decree lays down the procedure for preparing local management plans	More stringent implementation will allow for more stable long-term plans for the use of local natural resources
1973 General Property Law / Land Tenure Code (Law No. 73-021) *Loi n° 73-021 du 20 juillet 1973 portant régime général des biens, régime foncier et immobilier et régime des sûretés, telle*	Ordinance 086 (April 10, 1986) modifying Ordinance 74-148 (July 2, 1974) implementing Law 73-021	It asserts state ownership of all land, subject to rights of use granted under state concessions (in perpetuity and inheritable for Congolese nationals). The law permits customary law to govern user rights to unallocated land in rural areas but the regulation expected under art. 389 was never adopted (see, however, for similar provisions, the Forest Code, belwo). Foreign individual or	The Program Zone holds wide catlle ranching concessions. Most of the remaining land is not under formal concession. Some customary "titles" for small extensive ranching are recognized by the Agriculture Dpmt only.

que modifiée et complétée par la loi n° 80-008 du 18 juillet 1980		foreign legal entity can hold concession rights on farmlands only for a renewable period up to 25 years. It covers agriculture, ranching, and plantations, including sylviculture. Natural and planted belongs to the concession holder. Unproductive concessions may be cancelled off. Outside concessions, customary law governs where clans held the land collectively and a "chef de terre" regulates access of communal land to non community members.	Land dedicated to large-scale (industrial) reforestation projects for charcoal production (ES2) or production of lumber (FS4) are secured under concessions titles for 25 years. .
1977 Expropriation Law (Law No. 77-001)		The state can expropriate land under concession and held by local communities as it deems necessary for public use or in the public interest, subject to payment of compensation.	No expropriation is envisaged.
2002 Mining Code *Loi n°007/2002 du 11 juillet 2002 portant code minier*		Under the Mining Code, rights to mineral deposits are separate and distinct from rights to land, and holders of surface rights cannot claim ownership of mineral deposits. Defines a range of concession types (exploration and production) for quarry and minerals."	Only one concession title is identified in the Moabi Platform (source flexicadastre) in the ERPD Program Zone
2002 Forestry Code *Loi n°011/2002 du 29 août 2002 portant Code Forestier*	Ministerial order 024 (August 7, 2008) regulates transferability of forestry concessions Decree 08/09 (April 8, 2008) modified by Decree 011/25 (May 20, 2011) sets non competitive allocation process for selling ES, ecotourism, conservation and bioprospection Decree 011/27 (May 20, 2011) entitles to sell environmental services Decree 14/018 (August 2, 2014) related to allocation of community concessions (up to 50.000 ha of ""local community forests"") Ministerial order 024 (August 7, 2008) laying down examination procedure of claims preceding granting or adjudication of forest concessions Ministerial order 028 (August 11, 2008) laying down templates for both contracts and specifications regarding logging concessions Ministerial order 023 (January 7, 2010) laying down template of the agreement to be annexed to the logging concesion contract Ministerial order 035 (October 5, 2006) regulating felling and harvesting permits with templates annexed to the Ministerial order 105 (June 17, 2009). The Ministerial order 050 (September 23, 2015) allows creation of a 500 ha artisanal	The Code recognized (a) classified forests (public domain), (2) permanent production forests (under long-term concessions), (3) protected forest (less restrictions of community rights). It defines a range of of concession types and other legal forms of usage, namely forestry concessions for a wide range of activities (including logging and conservation), community concessions, and artisanal logging permits and commercial firewood licence. It also recognises customary land holdings (individual or collective property of trees around and within villages et and fields) and as well as use rights. Allocation of concession and artisanal logging permits are supposed to be based on the formal agreement of communities (including benefit sharing schemes). The Code also sets incentives for resforestation activities such as the property of natural or planted forest for land concession holders and beyond the property of benefits of forest products for anyone planting trees.	The Assessment Area holds 17 forestry concessions, among which one is dedicated to conservation, the others to industrial logging (all already signed benefit sharings agreements with communities). A number of new conservation concessions will be created by conversion of existing logging concessions (FS3) and some logging concessions will generate ERC through RIL (FS1). An undefine number of artisanal logging permits have been delivered. Most of the remaining forestland is not under formal concession and exploited largely illegaly for wood of charcoal production. The program will support the creation of community concessions for the development of small-scale logging under community control.

	concession title under supervision of local bodies Ministerial order 026 (August 7, 2008) regulating forest reconstitution activities Decree 09/24 (May 21, 2009) creating a National Forestry Fund to support public-financed reforestation activities (including 10% of public revenues from environmental services sells as REDD credits)		
2011 Agricultural Code *Loi n°11/022 du 24 décembre 2011 portant principes fondamentaux relatifs à l'agriculture*	No implementing acts yet	It provides an agricultural provincial consultative body to be implanted at ETD level, in charge of land dispute settlement ; identification of agricultural lands; creation of a land register responsible for proposing land to be conceded and monitor that development standards are met; recognition of local individual of or collective use rights but not title securing them; articles 16 and 82 impose that foreign investor cannot hold more that 50% shares.	Application text will set the procedure of identification of lands suitable for agricultural expansion (governor's competence) et land dispute resolution.
2012 Environment Code *Loi n°11/009 du 09 juillet 2011 portant principes fondamentaux relatifs à la protection de l'environnement*		Formulates the obligation for all government levels -- central, provincial and decentralized territorial entities -- as well all natural and legal persons to protect the environment. Instals participation rights for everyone as well as access to information rights. Enshrines principles of precaution, transparency, impact assessment. Creates an Environment Fund for conservation and research purposes. The Fund has responsibility for, among others, the remuneration of "environmental services	The Environment Fund may be used in the future as financial facility for the management of payments and investments.
2014 Conservation Code *Loi n°14/003 du 11 février 2014 relative à la conservation de la nature*		It provides obligation of impact assessment studies, consultation of communities and indemnisation in case of resetlement. State, province or local bodies (ETD) may concede a protected area for 25 years	Not yet applied to the program zone.

4.6 ANTICIPATED LIFETIME OF THE ER PROGRAM

The ER Program will be integrated into the plan to implement REDD+ in the province of Mai-Ndombe and in DRC.

The program will start in 2016 and in spite of the limited lifetime of the ERPA with the Carbon Fund (2016-2021), the program will be implemented with a long-term perspective of 20 years and with a cost-effectiveness objective (carbon and other revenues) extending beyond the ERPA with the FCPF Carbon Fund. The financial calculation, showned in Annex 1, has been designed for 10 years.

5. STAKEHOLDER CONSULTATION AND PARTICIPATION

5.1 DESCRIPTION OF THE STAKEHOLDER CONSULTATION PROCESS

INFORMATION AND CONSULTATION DURING THE DESIGN PHASE

Consultation and information in the design phase of the Mai Ndombe ER Program has taken place at multiple levels. There has been very active consultation with the various stakeholders based in Kinshasa in the context of the REDD+ readiness phase, which has mobilized a large number of organizations on a variety of themes through numerous working groups. Furthermore, significant efforts have been made since the submission of the ER-PIN to inform and consult with local stakeholders in Mai Ndombe (Indigenous Peoples, local communities, civil society and local administration) through meetings in every territory and training workshops in the capital of the former and new province (Bandundu Ville and Inongo). Annex 6 summarizes the various consultations and workshops held in the province and in Kinshasa in connection with the ER Program.

The design phase was based on various levels and frameworks of participation and consultation:

a. The Technical Secretariat, which includes the main program partners, met regularly in order to coordinate and discuss progress of activities. It was formed already in the development phase of the ER-PIN based on a Memorandum of Understanding and is composed of: CN-REDD/MEDD, the provincial government of Mai-Ndombe, civil society (through the GTCR), the WWF-DRC and WWC/ERA;

b. The various stakeholders participating in ER Program design were organized into five working groups: (I) Communication, (ii) Benefit sharing, (iii) Intervention strategy, (iv) Safeguards and (v) reference level/MRV. The working groups provided input to the program design and coordinated the actions of the various partners. They have been meeting on a number of occasions since September 2014 (at least three times each).

c. In order to ensure the close involvement of local communities and Indigenous Peoples, representatives from the 19 sectors and 8 territories of the Province were appointed with the facilitation of civil society organizations coordinated by the NGO OCEAN. The representatives designation has been guided by the following criteria: (i) residing in the village (ii) engaged in development actions in the area, (iii) moral integrity, (iv) restitution capacity. Theses representatives have been then elected during meetings who took place in chief-place. A Proces Verbal has been established after the vote and has been signed by the land Administrator of each entity. A series of workshops and missions took place to consult with these representatives and take their considerations into consideration in the program design.

d. An extended cooperation convention was signed by most of the partners represented in the working groups, the designated representatives of the local communities and Indigenous Peoples, the administration as well as the provincial and national civil society. This convention has been shared and updated during more than 6 months in order to include the different inputs of all the stakeholders. The convention has been then presented during a launching workshop in Bandundu and is still open for signing and will serve as the basis for annexes describing the precise terms of reference for collaboration between the program and the various partners.

It is important to highlight the following issues with regard to the information and consultation process during the design of the Mai Ndombe ER Program.

a. The design of the program has built upon studies and programs developed at national level, including the National REDD+ Strategy Framework, the Strategic Environmental and Social Assessment (SESA) and the FIP, which were subject to a wide-ranging and inclusive consultation process (See Self-assessment of the REDD+ Readiness Package in the Democratic Republic of Congo on the FCPF website).

b. The DRC's experience acquired over these years of preparation for REDD+ has demonstrated the significant risks of communication on a massive scale regarding a mechanism that is still in development and with major uncertainties with regard to funding. Many misinterpretations, misunderstandings and frustrations have been reported to the CN-REDD by most of the stakeholders: administrations, private sector, civil society and communities. In the case of the Mai Ndombe ER Program, where uncertainty remains as to its acceptance by the Carbon Fund, it is especially risky to generate too high expectations.

c. Finally, it should be stressed that the involvement of local communities and Indigenous Peoples is an integral part of the first steps of program implementation. All the sectoral activities will be initiated through the establishment of local sustainable development plans designed at village level and validated by sector/chiefdoms, territories and subsequently the province. This FPIC process is fully integrated into the project's activities and communities will have full discretion as to whether or not to participate. These steps of consultation will be crucial to the success of the program and respect the rights of communities and Indigenous Peoples.

Further consultations on the design of the ER Program have been taking place on the basis of this document. The table below summarizes the main stages up to the validation of the final ERPD, which will be submitted to the Carbon Fund around April 2016.

Table 9 Consultation and validation stages of the ERPD

Stages	Target groups	Dates	Objectives/comments
Sharing of the draft ERPD document by email	Secretariat and other key stakeholders (central and provincial administration, national and international NGOs, private sector)	July – September 2015	Comments on the draft ERPD open from July to September in order to enrich the final version
Organization of targeted consultations in the province	Representatives of the communities, Indigenous Peoples, local NGOs and other provincial stakeholders	September – October 2015	Disseminate and present the strategy, implementation arrangements, the benefit-sharing principles, operation of feedback and grievance redress mechanism, in order to compile comments for the final version

Organization of targeted consultations in Kinshasa	Administrations, civil society and private sector	September – October 2015	Organize thematic meetings to explain the options adopted in the draft ERPD, and enrich the final version
Validation workshops in Inongo and Kinshasa	All stakeholders	February 2016	Validate remaining issues following the TAP assessment and final validation of the document before submission to the Carbon Fund

INFORMATION AND CONSULTATION DURING THE IMPLEMENTATION PHASE

The program will dedicate resources at the disposal of the program management unit and the local executing agencies in order to ensure the dissemination of information to stakeholders as well as their regular consultation. The methodology for the deployment of the program activities is based on consultations at village level as part of the development of the land-use map and associated sustainable development plans. A major communication campaign will be launched upon the initiation of the activities (scheduled for early 2016). In particular, the program will rely on community radio and liaison workers identified and trained during the design phase.

Over the lifetime of the program, regular consultations will be carried out at decentralized territorial entity level and territory level in order to adjust the program activities and the investments of collective interest. The population will also have the opportunity to submit feedback or complaints as described in Section 14.

5.2 SUMMARY OF COMMENTS RECEIVED AND HOW THESE VIEWS HAVE BEEN TAKEN INTO ACCOUNT IN THE DESIGN AND IMPLEMENTATION OF THE ER PROGRAM.

In the course of the year 2015, the CN-REDD received a lot of feedback and comments reflecting the views of stakeholders vis-à-vis the Mai Ndombe ER Program. These comments were compiled in particular during the consultation and communication activities described in the table below. This section will be updated with the coming comments on the final draft ERPD. The table below summarizes the main comments received and how they have been incorporated into the design of the program, or how they will be incorporated in the coming months and during implementation.

Table 10 Summary of the comments received and how these views have been taken into account in the design and implementation of the ER Program

Main subject	Type of stakeholder	Comments - risks expressed	Incorporation
Institutional arrangements	Provincial government	The decentralized services deconcentrated from the State should be given a greater role in the control and monitoring and evaluation functions	➢ The role of the provincial government and the provincial steering committee has been strengthened, with real decision-making and control powers ➢ The functions of implementation monitoring and evaluation and of complaints management have been considered at decentralized service and ETD level
	Civil society,	Risk of conflict of interest for the program management unit (particularly	➢ The option to hire a third-party firm as program management

	government	if this is made up of project holders)	unit has been decided ➢ The risks are reduced by the requirement that the province, via the provincial steering committee, approves the contracts and payments to the various beneficiaries.
Sharing of REDD+ revenues	Civil society (REPALEF)	Indigenous peoples taken into account in revenue sharing	➢ The revenue sharing principles explicitly stipulate a share for indigenous populations because of their historical responsibility in the preservation of forest ecosystems.
	Private sector (WWC)	Honoring of agreements already signed with the government	➢ A negotiation is currently progressing in order to guarantee the long-term continuation of the WWC project while at the same time respecting the methodological framework of the Carbon Fund.
	Civil society, private sector	Need to re-invest in order to maintain the startup funding and to extend the activities to new stakeholders	➢ The share of revenues allocated to the State under existing and future agreements will be redirected to the program activities directly.
	Provincial government	The province must be provided with the resources to fulfill its governmental functions	➢ A share of the revenues will be channeled directly to the province's budget. In particular, this will place responsibility on the province for the performance of the program.
	All stakeholders	There is a high risk of land conflicts between stakeholders regarding distribution of benefits.	➢ The signature of sub-contracts under the REDD+ revenue sharing plan must be based on prior recognition of rights over land and resources (concession contract, natural resources management plan etc.)
Strategy and activities	All stakeholders	It is necessary to address small-scale logging which is a major driver of deforestation and degradation	➢ The program provided support activities for the small scale wood trade, as well as reinforcing monitoring by the environmental services.
	Central and Provincial Government	Participation of provincial and state services in the program strategy must be encouraged	➢ All program activities enabling the program will involve the relevant state services, in particular the environmental services for enforcement of controls.
	Civil society	The REDD+ activities with forest concession holders must be made conditional upon compliance with the legality of operating practices	➢ A study, funded by EFI and executed by FRM, is working on establishing a compliance standard for forest concessions (see in Annex)
	All Stakeholders	The program area is too large and actions taken are at risk of being too dispersed without any real impact on deforestation.	➢ The program will have a phased approach, starting with a focus on pilot areas in order to determine and distribute the lessons learned ➢ The program will focus on priority areas where the risk of deforestation is high.
Communicatio n	Civil society	People have very little understanding of the program and REDD+ in general (excessive local expectations)	➢ CN-REDD conducted missions and training sessions throughout 2015 to provide information about the program (particularly through the identification and training of community volunteers and radio stations)
	Government, Civil society	There are still disinformation campaigns by local politicians about REDD+ and the program	➢ We will have to present the program at all levels from September, including to local elected officials and leaders.
Safeguards	Civil society	Lack of ownership of the safeguard principles and tools by the population and government services in the province	➢ Extension of safeguards through several targeted training sessions and workshops, making it possible to define in a participatory way the monitoring indicators for relevant safeguards
	Civil society	Lack of capacity of the state to enforce safeguards	➢ In addition to monitoring measures, safeguards by decentralized services and implementing agencies, the program will rely on independent inspections and observations by civil society, collected using the technologies made available by the NGO Moabi (internet platform for collaborative mapping, smart phones, tablets and "open source" apps for tracking REDD+)
	Civil society	Making the safeguards binding by	➢ Respect of safeguards will determine firstly the generation of credits (approval standards). Each subcontract then includes

		linking them to payments	clauses that will link payments to social, environmental, and compliance standards.
Reference level and MRV	Partner	The emission factors calculated by the LiDAR technology are not representative of certain areas	➢ Organization of additional field data collection mission to refine the model by the end of 2015
	Donors, Civil society	Alignment with tools and methodologies used at national level for the calculation of reference levels and MRV	➢ Several coordination meetings organized to harmonize work at national and provincial level ➢ Involvement of DIAF in evaluating the accuracy of the data produced ➢ DIAF involvement planned in the implementation of MRV (consistent with SNSF)

6. OPERATIONAL AND FINANCIAL PLANNING

6.1 INSTITUTIONAL ARRANGEMENTS AND IMPLEMENTATION

NATIONAL SUPERVISORY

The Government of DRC will be the signatory of the Emission Reduction Payment Agreement (ERPA). It is the direct contact of the Carbon Fund Administrator and is legally responsible for the program's success. The ERPA with the Carbon Fund will be co-signed by MECNDD and provincial government of Mai-Ndombe

The Ministry of Environment, Nature Conservation and Sustainable Development is the ministry responsible for the REDD+ process and the main contact of the UNFCCC. It will play a national supervisory and regulatory role and will work closely with the Ministry of Finance in the governance framework of the National REDD+ Fund. The ministry will co-chair the National REDD+ Committee of the REDD+ process and co-manage the REDD+ Executive Secretariat.

This National REDD+ Committee has the function of national piloting of the REDD+ process and the National REDD+ Fund. It will be a decision-making body composed of multiple sectors, in particular the Ministry of Environment and the Ministry of Finance. (composition and mandate is under review). It will play a role at the sub national level by validating the technical and political directions taken by the program. As other REDD+ participatory bodies, the composition of this committee will include all the stakeholders and particularly civil society and Indigenous Peoples representatives. It will ensure in particular the alignment of the program with the National REDD+ Strategy framework, in compliance with the safeguards and can intervene, if necessary, in the management of complaints, appeals and decisions.

The REDD+ Executive Secretariat is a body responsible for the technical management of the National REDD+ Fund and the homologation procedure[30] (continuity of the current CN-REDD). It is in charge of preparing technically the decision-making process of the National REDD+ Committee and in particular; approbation, monitoring, evaluation and complaints managements of REDD+ projects and investments in the country. They will use for this tasks the national REDD+ registry (see section 19). This REDD+ Executive Secretariat will work closely with the Ministry of Environment and the Ministry of Finance but also with others ministries involved in the REDD+ Strategy. It will be the main agency responsible for the

[30] Homologation procedure: procedure to approve REDD+ project and transfer rights on Emission Reduction

emission reductions credits generated by the program and will be responsible for the national verification of carbon and safeguards monitoring reports, relying in particular on the various departments of MECNDD, such as DIAF and DDD. It will be responsible in particular for:

a. Registering, preparing approval and homologation of REDD+ projects and programs.

b. Checking the reports for monitoring of emissions reductions and monitoring of safeguards and co-benefits submitted by Program Management Unit(s) and project owners in order to certify that credits generated by projects/programs comply with national Standards and to provide technical advice to the National REDD+ Committee.

c. Ensuring the proper application of the environmental and social management framework and specific frameworks, as well as proper handling of complaints;

d. Managing information about projects and programs through the National REDD+ Registry, including information related to the generation and certification of emission reductions;

e. Informing the National REDD+ Committee, the UNFCCC and international partners in national and sub-national progress;

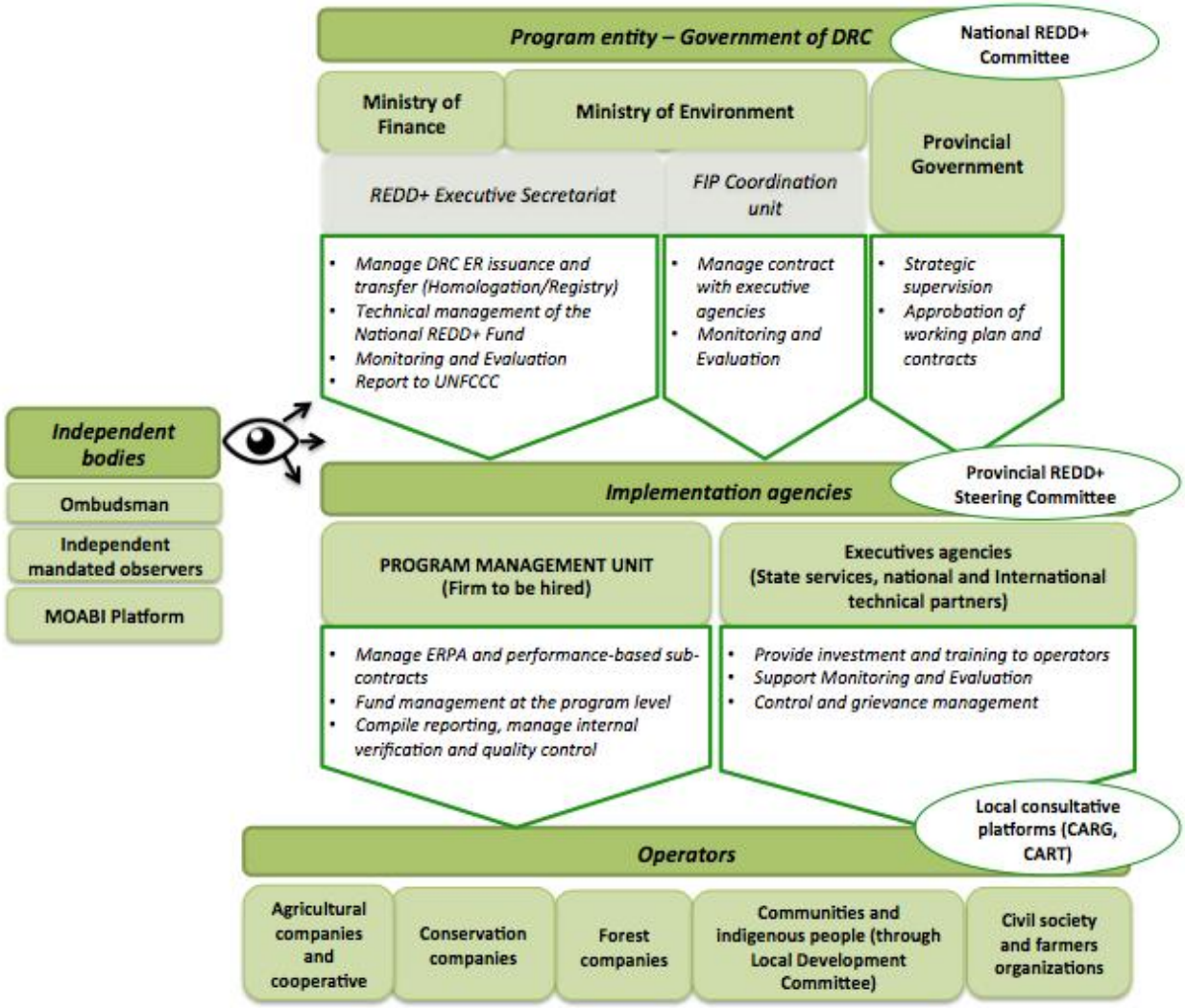


Figure 3: Implementation scheme for the Mai-Ndombe ER Program

PROVINCIAL MANAGEMENT

The provincial government of Mai-Ndombe as the main responsible of the program success. In order to fulfill this role of steering and policy coordination, the provincial government will be supported by a multi-party steering committee. He will also work closely with the Program Management Unit in charge of the technical and administrative tasks.

This Provincial REDD+ Steering Committee will be the one of the two major investment programs (FIP and additional program), it will be chaired by the Governor and include representatives of the provincial government departments involved in the program (including agriculture, forestry, energy, health, land use, land rights), the territorial administration, decentralized services, the REDD+ focal points, the different Executive Agencies of the program, the private project developers, civil society, local communities and indigenous peoples. Terms of reference for the Committee are being prepared. It will be responsible in particular for:

a. Coordinating the overall implementation of the program;
b. Providing policy and strategic direction to the program;
c. Approving subcontracts for implementation of the program with intermediaries and beneficiaries;
d. Approve work plans and program budgets;
e. Validate monitoring reports for emissions reduction and monitoring of safeguards and co-benefits.

The Program Management Unit will be responsible for the daily management of the program and will be based partly in the capital of the province of Mai-Ndombe (Inongo). It will be the executing agency of the program and will sign a service provider agreement with the State. It will be a firm or a consortium with multiple tracked and recognized skills in order to tackle the challenge of this innovative program.

It will act under the control of the provincial government and the Provincial REDD+ Steering Committee. The Program Management Unit's plans and budget will be validated at least once a year by the steering committee.

The aim is to have this function to be fully integrated to the provincial government in the medium term. It will work in close contact with local implementing agencies and project owners in the province. The terms of reference for this unit are proposed in the Annex 7. The main functions of the Program Management Unit include in particular:

a. Administrative and financial management (managing the interface with the Carbon Fund and the contracts and result-based payments with sub-projects and implementing partners)
b. Strategic and technical coordination (proposing strategic reinvestment plans, coordinating the technical partners, involving the administration and the governorate)
c. Carbon and non-carbon reporting (compiling monitoring data with the support of the implementing agencies, by performing quality control and producing carbon monitoring reports and safeguards)
d. Marketing of the program. (Dialogue and engagement of buyers of Emission Reduction and investors)

The terms of reference of the Program Management Unit will be presented in the coming months to institutions in Mai-Ndombe in particular to be ratified by the provincial assembly and/or the Provincial REDD+ Steering Committee.

IMPLEMENTATION

The implementation of the program on the ground involves multiple stakeholders operating at different levels depending on their abilities, their mandates, and their rights. It will involve the following categories of actors:

Operators	The program provides a strategic and procedural framework in which different stakeholders can register their actions in order to benefit from monetary or non-monetary benefits of the program. These stakeholders may be: • Private companies that have concession titles or other farm leases (forestry or conservation concessions, agricultural or farming concessions, reforestation company...). • Organizations or cooperatives of producers (fishermen, ranchers, farmers...) • Small scale Forestry Companies • Local communities and Indigenous Peoples through their local Development Committees • Decentralized technical services (agriculture, forestry, fisheries, etc.) • NGOs and Local Associations These various players may be involved in the program through several types of partnerships or contracts (see Section 16.1 for details of contracts). Depending on the types of contracts, project leaders and activities will therefore have responsibility for: a. Implementing the actions specified in the contracts or partnerships while respecting social and environmental safeguards. b. Prepare and submit monitoring reports to the Program management unit, which include monitoring carbon or proxy performance and monitoring of compliance with environmental and social safeguards.
Local Executing Agencies (LEA)	Local Executing Agencies are key intermediaries in the implementation of program activities. They act as project managers delegated by government and are contracted by the Program management unit or the FIP Coordination Unit. (WWF has already been selected to be LEA in Plateau District). They will work closely wih Decentralized State Services.They are responsible for: a. Establishing contracts with operators/beneficiaries (local communities, farmer's organizations and civil society, small farmers and entrepreneurs), but also with NGOs providing support for specialized services support (demarcation of territories, co-management of fisheries...). b. Directly implementing certain activities (investment, supply of equipment, etc.) c. Strengthening the capacity of stakeholders in monitoring and evaluation; d. Compiling monitoring and evaluation reports on sub-projects for which it is

	responsible; e. Supporting local governments and communities in the development of natural resource management plans and prioritization of investments; f. Facilitating payments in kind or expected payments arising from payment contracts for proxy results; g. Fulfilling the social and environmental screening grids for sub projects for which it is responsible;
Decentralized State Services	Decentralized and deconcentrated State services will be involved in the implementation of the program. They will be strongly reinforced in term of training and material support to ensure their active participation in the program. This different Services (interior, environment, agriculture, tenure) will be involved in (i) the vulgarization of agricultural/forest practices, (ii) the validation of the Sustainable Management Plan and activities boundaries of villages or operators, (iii) the verification of protected or reforested area. The environment services will be especially reinforced in order to strengthen forest and wildlife law control (through checkpoints and field-visits).
Other executing agencies	Some other organization will also be responsible for certain enabling components of the program. The Annex 8 lists the different execution agencies envisaged for in the program.

MONITORING AND EVALUATION ARRANGEMENTS

The monitoring and evaluation of the program will be structured mainly around the production of a dual progress report: (i) The monitoring report on the emission reductions that will trigger payments by the Carbon Fund and other emission reduction purchasers, but also being the basis for the performance-based payments as defined in the contracts with the operators (see Section 9); and (ii) The monitoring report on the safeguards and non-carbon benefits that will compile information on the impact studies and compliance with safeguard measures when necessary. This report will follow the progress of the program compared to the national social and environmental standards (see Section 14).

The responsibilities of the various entities within the monitoring and evaluation functions are included in the Annex 9. These will need to be refined and developed by the implementation of the program but this annex describes the articulation of roles in these key functions for monitoring and evaluation. The monitoring and evaluation will involve the following additional organizations:

DIAF	The Directorate of Inventory and Forest Management (DIAF) is responsible for the National System for Monitoring of Forestry through the IT platform Terra Congo. Several of its officers will be seconded to the Program management unit to support the achievement of provincial analyzes (see Section 9)
Local consultative platforms (CARG and CART)	This consultative platforms at territorial, sector and chiefdoms levels are defined and recognized by the Congolese government through his Ministry of Rural development as entity in charge of coordinating rural and agricultural development at the local level The program will broaden this existing mandate in order to give them a role in the overall

	management of natural resources. This platforms will then be in charge of monitoring the implementation of activities and in particular to control the execution of collective investments as defined in the SDPs. This platforms will also be at the forefront of conflict resolution in relation with natural resources management and REDD+ implementation. This consultative platforms will be composed of representatives of territorial administration, local State services of key sectors involved in the program (agriculture, environment, tenure, security, …), chiefs of sector and chiefdoms, representatives of customary land chiefs, representatives of LDCs and Indigenous Peoples, representatives of civil society and private sector involved in the area. The program planned and budgeted the total refoundation of this platforms in order to ensure representativeness of all stakeholders and also to provide them material and financial means for their functioning (Enabling pillar of the program).
Independent mandated observers (IMO)	The independent mandated observers (IMO) at provincial and national scale will aim (i) to verify the implementation of the safeguards by decentralized state services during their field mission, (ii) to study the management of complaint mechanisms by decentralized state services and the CARGs, (iii) to compile the information provided by local OSCs for players in deforestation and forest degradation; (iv) prepare thematic reports on each of these three topics (safeguards,deforestation, complaints process) and, if appropriate, make recommendations to strengthen the capacity of decentralized state services and (v) to improve REDD governance. Currently, the national NGO OGF (Forest Governance Observatory) is working on a methodology for independent monitoring for REDD+ based on its experience as an independent observer of the FLEG process. To track compliance with SSE and the forestry act, as well as with its implementing measures in an independent manner, OGF will use the combined OIFLEG-OIREDD methodology developed thanks to the Open-Maï Ndombe project with the participation of local communities.
MOABI	The aim of the NGO Moabi is to strengthen governance and transparency in the REDD+ process. To achieve this goal, the NGO Moabi has designed an independent platform for collaborative mapping. This aims to share and enhance the spatial data relating to REDD+ in RDC, such as (i) information on the drivers and players in deforestation and forest degradation, or (ii) independent monitoring of the implementation of REDD+. This tool is particularly appropriate for ensuring transparency in the REDD process that will allow civil society to publicly release the realities of the territory. In addition, this platform can also be used by REDD+ independent observers appointed by the central government or the provincial government. To ensure this independent monitoring and to facilitate transparency in the REDD+ process, the NGO Moabi will equip environmental OSCs and IMOs with data collection tools (smart phones and/or tablets). The staff of the NGO will offer a training program on the use of these tools and on REDD+ monitoring.
Independent Auditors and Verifiers	The monitoring reports issued by the Program management unit and forwarded to the Carbon Fund Administrator through the program entity will be subject to audit as stated in the general terms and conditions of the ERPA. Auditors appointed by the Administrator of the Carbon Fund may conduct this audit. However, given that the program also plans on a validation by the VCS JNR standard (Verified Carbon Standard, Jurisdictional and Nested Approach), we can expect the audits in the VCS framework to be recognized by the Administrator of the Carbon Fund.

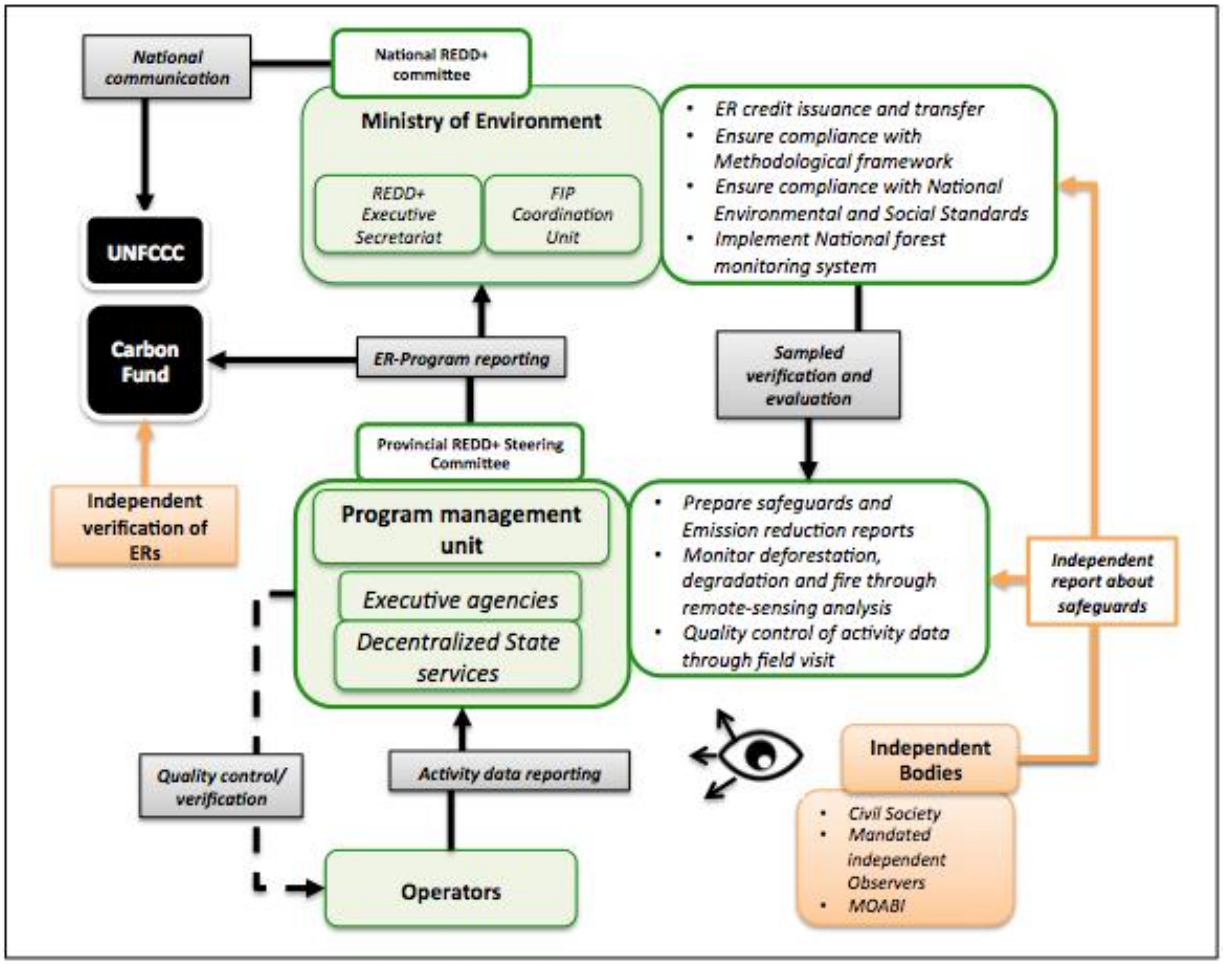


Figure 4: Role and responsibilities for monitoring and reporting of carbon and non-carbon performance

FINANCIAL ARRANGEMENTS

Two main types of financial flows will be coordinated under the program, first of all the various investments whether public (FIP, CAFI, CAFEC) or private (investment fund, entrepreneurs), then, from the time of the first emission reduction credit verification, Carbon Fund payments. The figure below specifies the circuits of these financial flows.

The various start-up investments will be channeled directly to the executing agencies and operators, particularly in the context of agreements already passed (WWF project manager of the CAFEC and PIREDD FIP Plateau project) or future agreements.

The Carbon Fund payments could be paid directly into the National REDD+ Fund. This Fund is intended to channel result-based payments from institutional buyers, as well any donations to support enabling and sectoral investments of the REDD+ National Investment Plan of DRC. The Fund could then allocate share of the ERPA payments to the Program management unit and others entities who have the sufficient financial capacity.

However, if this fund is not made operational effectively, payments by the Carbon Fund may be allocated directly to the Program management unit responsible for the financial management of the program and the implementation of the benefit sharing plan.

During the negotiation of the ERPA, the option of directly allocating portions of the Carbon Fund payments to the central and provincial government, or even directly to some private operators will be examined based on their capacity to manage funding. The Program management unit will anyway have the responsibility to distribute funds to a large part of stakeholders implementing mitigation activities (communities, NGOs, small companies).

The Program management unit redistributes the funds based on benefit sharing principles and the subcontracts entered into force with operators. The Program management unit executes payments in accordance with the payment orders attached to the Emission Reduction monitoring report and makes investments in accordance with plans validated by the provincial steering committee. Annex 10 describes in more detail the financial procedures in relation to monitoring and evaluation.

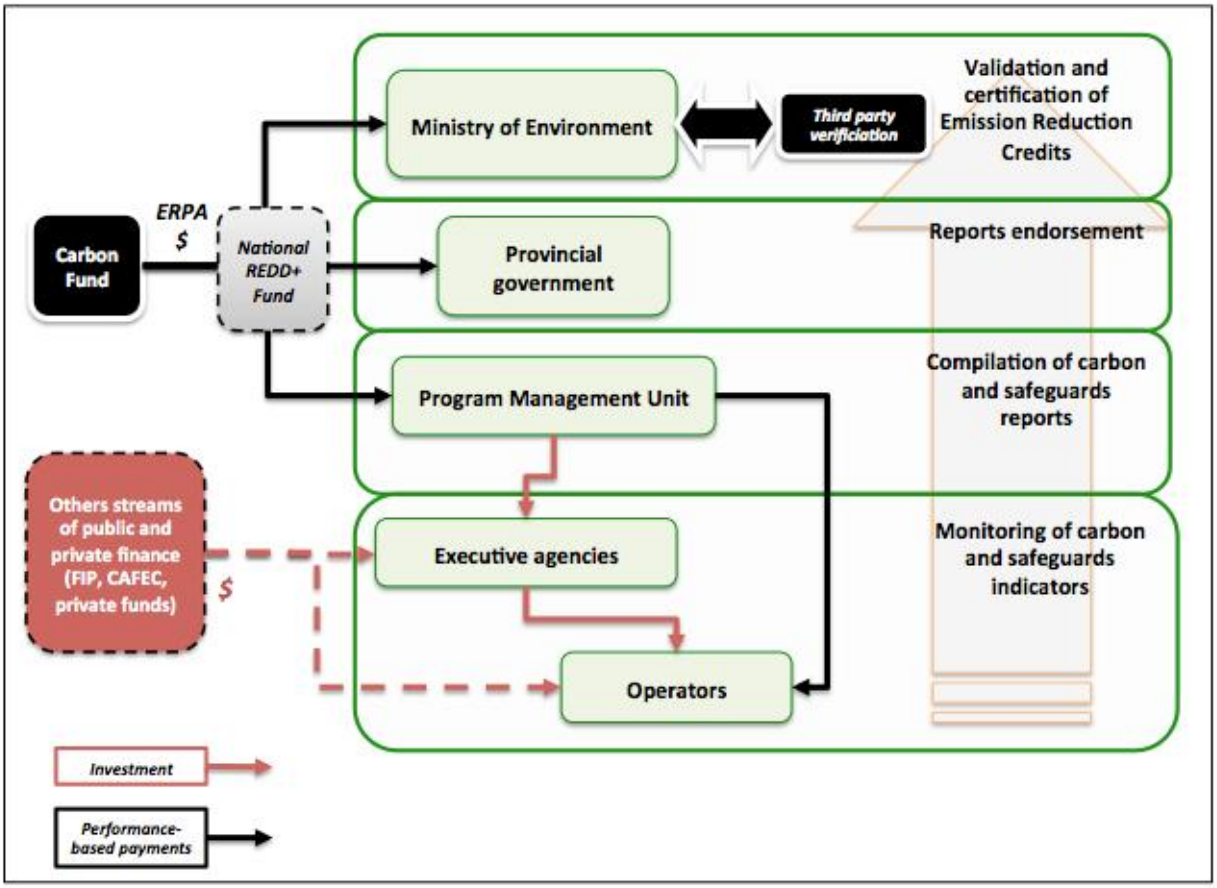


Figure 5: Simplified Financial Arrangements of the Program

6.2 ER PROGRAM BUDGET

Program startup will primarily rely on available sources of funding. For this, the design phase has aligned various funding mechanisms that will be mobilized in order to implement this strategy.

The main funding sources incorporated into the design of the program's financial plan are:

a. Secured funding, in particular from the Forest Investment Program, CAFEC (USAID), the KFW and International Climate initiative. It should be noted that component 2a of the FIP is a co-financing program directed towards the private sector, concerning agroforestry plantations in the savanna.

b. Private sector financing planned within the context of the program (conservation concessions, industrial timber concessions and industrial-scale reforestation).

c. An additional funding proposal has been made to extend and strengthen the FIP investments. Called PIREDD Mai-Ndombe (REDD+ Integrated Program), this project is included in the DRC REDD+ investment plan and is currently proposed to be financed through Central African Forest Initiative (CAFI)

Table 11 Current state of ER Program Up-front Finance

Type of fund	Fund sources	M$ USD
Secured Grant funding	FIP PIREDD-Plateau	14
	CAFEC USAID on Salonga and Lac Tumba Landscape	2
	KFW for Protected Area management on Salonga national park	0,6
	Project Carbon Map and Model financed by KFW	0,4
	Funding from FIP project supporting private sector in DRC (component 2a)	2
Private funds secured	WWC	10
Private funds expected	Other potential investors *(current status of interest)*	9,5
Grant to be financed (CAFI)	PIREDD Mai-Ndombe	30
	Advance payment FCPF	6,5
	Total	75

The advance obtained from the Carbon Fund - 10% of the total amount of sales of emission reduction credits through the ERPA - will cover the various initial administrative, management and monitoring and evaluation costs, and also the startup of the additional key activities. The Table below shows the key activities funded by the Carbon Fund advance. These activities were chosen on the basis of an analysis of the strategic gaps in the program and to comprehensively address all the drivers and underlying causes. (In particular small-scale logging for lumbar and fuelwood).

This intervention strategy and the key activities defined above will be used as a framework to align the various sources of funding and to manage the re-investment of part of the emission reduction revenues. Annex 11 gives a comprehensive overview of the breakdown of the startup funding according to the various key activities.

Table 12 Key activities funded by the Carbon Fund advance

Key activities	Amount (US $)	Comments
ES2. Afforestation/Reforestation for charcoal production	1 000 000	*Private sector co-financing*
FS4. Afforestation/Reforestation for lumber production	1 000 000	*Private sector co-financing*
FH1. Strengthening forest and wildlife law enforcement	1 500 000	*80% of the activity*
FH2. Legal compliance of industrial logging operations	1 500 000	*100% of the activity*
FH3. Development of community forestry.	1 500 000	*100% of the activity*
Total	6,500,000	

The financial plan for the ER program presented in Annex 1 is mainly supported by secured financing on the advance on the Carbon Fund and the assumption that the proposed additional funding that has been made to extend and enhance FIP investment will be financed. Assumptions are also made about the contribution of the private sector on the basis of interests expressed by different partners.

This financial plan over 10 years also simulates reinvestment of a portion of revenues issued from Emission Reduction Credits in the key activities of the program (see Section 15 on benefit-sharing). All key activities identified in Section 4.3 could also be developed on a larger scale in case of additional up-front funding.

7. INTRODUCTION TO THE CARBON ACCOUNTING SECTIONS

This section has been added to the original Emission Reduction Program Document (ERPD) structure to support the reader's understanding of the following carbon accounting framework. This introduction provides an overview on the choices made, and rationale behind the decisions taken by the ER Program and its partners with regard to carbon accounting. This section specifically aims to:

a) Provide an overview of the structure of the ERPD carbon accounting;
b) Offer additional key information explaining the rationale behind certain carbon accounting decisions (e.g. stratification of the REL, use of specific methodologies etc.);
c) Provide additional information to satisfy criteria and indicators in the Carbon Fund Methodological Framework (MF), which are not specifically requested by the ERPD template.

This additional information serves to increase the understanding of the ERPD carbon accounting section. Nevertheless, readers should be aware that the carbon accounting section of the ERPD is a technical document that shows, describes and where necessary explains methodologies and data used for the purpose of carbon accounting, so that methods and data may be verified by third parties. It is not a document whose aim it is to provide an education for or a deep understanding of technical carbon accounting issues. Furthermore, because the structure of this ERPD follows the Carbon Fund MF template (and its specific technical requirements), it is not necessarily easily interpreted by the casual reader.

7.1 STRUCTURE OF THE ERPD

The carbon accounting section of the ERPD is structured as follows:

Section 8 provides information on the sources and sinks, carbon pools (by stratum) and GHGs selected by the Emission Reduction Program.

Section 9 provides information on the reference emission level. Please note that due to the amount of parameters involved in the REL calculation (>50 parameters), detailed parameters tables for emission factors and activity data have been put in Annexes.

This section comprises information on:

1. The reference period
2. The Forest definition
3. Unplanned deforestation and degradation: the methodology and calculation of the historical emission from UNDEF/UNDEG

4. Afforestation/ Reforestation: the methodology and calculation of the removal from A/R
5. Planned Degradation: the methodology and calculation of the historical emission from PDEG
6. The justification for, and calculation of, the adjustment
7. The Reference Emission Level

Section 10 gives details on measurement, monitoring and reporting (MMR), including information on:

a. the general structure of MMR, as well as the monitoring methodology and parameters for each MMR stratum
b. the organizational structure for the MMR process
c. Consistency of the ER Program MMR system with the National Forest Monitoring System

Section 11 reports on the risks of displacement (leakage).

Section 12 identifies and quantifies the risk of reversals.

7.2 BACKGROUND INFORMATION ON CARBON ACCOUNTING CHOICES TAKEN BY THE ER PROGRAM

VALIDATION OF THE ER PROGRAM UNDER THE VCS JURISDICTIONAL AND NESTED REDD+ REQUIREMENTS

In addition to being an Emission Reduction Program under the FCPF Carbon Fund, the Mai-Ndombe ER Program is seeking validation under the VCS JNR. The ER Program intends to fully apply the VCS JNR, i.e. validation, verification and issuance of VCUs. It is planned that only emission reductions in excess of the ERPA signed with the Carbon Fund will be issued as Verified Carbon Units (VCUs, i.e. carbon credits issued by the VCS).

The ER Program aims to achieve parallel VCS JNR validation to access to broader, more and long-term finance. The ERPA signed with the Carbon Fund has a volume of 10m emission reductions over 5 years. Any emission reductions in excess of these 10m emission reductions could be sold as VCUs and thus provide additional finance to run or even upscale the ER Program. Further, the VCS JNR validation provides a longer-term financing perspective beyond the Carbon Fund ERPA, which is valid only for 5 years.

The ER Program's decision to achieve additional VCS JNR validation for the Mai-Ndombe ER Program serves to explain a number of carbon accounting choices made by the ER Program which may go beyond the requirements of the Carbon Fund MF. These are:

Differentiation and inclusion of additional carbon pools

- Inclusion of the harvested wood products (HWP) pool. Accounting for this carbon pool is not explicitly foreseen by the MF (see page 28, section 5) but required by the VCS JNR unless the exclusion is conservative or de minimis (page 19/20, section 3.9.2, v3.2). However by MF standards, accounting for the HWP pool is conservative as HWP are a carbon sink. Not accounting for HWP would thus lead to an overestimation of emissions from industrial logging. Further, the HWP pool (sink) may decrease as a result of program activities (e.g. conservation concession), i.e. it has to be included according to the VCS JNR unless it is de minimis. Since

accounting for HWP was not a challenge in terms of methodology or data, and accounting for this pool leads to a more accurate estimate of the actual emissions from industrial logging, the ER Program decided to account for the HWP pool following a VCS methodology for improved forest management. However, in contrast to the VCS AFOLU requirements, emissions from the HWP pool that would occur between years 3-100 are not delayed using a 20 year linear decay function but are rather assumed to be emitted at the time of harvest. The rationale behind this decision is that these emissions are caused by activities in the ER Program area and are considered to be irreversibly committed to the atmosphere.

- Differentiation of the deadwood pool. For industrial logging, the ER Program differentiates between naturally accumulating deadwood and logging slash caused by industrial logging. This is considered sensible and common practices in VCS IFM project methodologies (cp. e.g. VCS VM0010), as program activities are likely to affect the amount of logging slash but unlikely to have any impact on the amount of naturally accumulating deadwood. This differentiation does not lead to an increase or decrease of accounted emissions and emission reductions. For UNDEG/UNDEG, the ER Program differentiates between naturally accumulating deadwood and deadwood as a result of burning. Deforestation in the program area is largely caused by land clearing through fire, which results in the combustion of a certain amount of the AGB, while the remaining fraction of AGB is charred and together with the BGB transition to the deadwood pool. In addition to the combustion factors provided by the IPCC, the ER Program has introduced an post-burning 'wood extraction factor'. This is to mirror common practice in the program area, where after land clearing with fire a large proportion of the (charred) deadwood is consumed by local people either for charcoal production or fuelwood use.

Use of VCS or CDM methodology components for REL development

As described in further detail below (section 7.2.3), the ER Program has made use of VCS and CDM methodology components and the VCS AFOLU requirements to build the REL, in addition to guidance provided by the 2006 IPCC Guidelines for National Greenhouse Gas Inventories. Apart from being a matter of convenience and cost-saving, use of VCS and CDM methodology components is believed to facilitate validation under the VCS JNR (since the REL is built to some extent on VCs validated methodological elements).

Use of VCS JNR buffer and leakage tools

For the identification and quantification of leakage and non-permanence, the ER Program has equally relied on VCS JNR tools. Specifically, the following tools were used:

- Jurisdictional and Nested REDD+ (JNR) Leakage Tool
- JNR Non-Permanence Risk Tool

These tools have been specifically developed under the VCS to account for leakage and non-permanence <u>at the jurisdictional level</u>. As with the use of VCS approved methodological components, use of these tools was a matter of convenience (no MF or other tools available) and to facilitate VCS JNR validation.

STRATIFICATION OF THE REL

Justification of the stratification

The ER Program has stratified its reference emission level - and consequently also its accounting area - based on an analysis of the drivers of deforestation and forest degradation as well as opportunities for carbon stock enhancement.

Stratification in general serves the purpose of increasing the accuracy of results (while at the same time often reducing data collection costs).

Generally accepted conditions for REL stratification are:

1. There little to no overlap between stratum.
2. Strata can be clearly delineated.
3. A modelled / documented evidence-based approach to REL / baseline calculation is used rather than historic analysis, including e.g. the use of adjustment factors
4. The underlying pattern of deforestation (reference scenario), agents / drivers and underlying causes of deforestation and degradation differ significantly between strata.
5. Stratification significantly improves the accuracy of the REL estimate.

Further, emissions from any one strata should be of a scale that justify a separate REL strata in terms of data collection costs. The VCS JNR standard allows and encourages stratification of the REL / jurisdictional baseline (cp. VCS JNR v3.2, page 22, section 3.11.3.

The following land-use type strata were originally used to stratify the ER Program area:

- Unplanned deforestation (UNDEF)
- Planned deforestation (PDEG)
- Unplanned degradation (UNDEG)
- Planned degradation (industrial logging) (PDEG)
- A/R (enhancement of carbon stocks) (A/R)

The ER Program proponents decided to distinguish between planned and unplanned degradation for the following reasons:

- Areas subject to planned degradation (industrial logging concessions) can be clearly delineated whereas areas of unplanned degradation (illegal logging, fuelwood collection) cannot.
- The REL for industrial logging is modeled based on forest inventory data, management plans (plan de gestion, plan d'amenagement) or historical records.
- The agents of planned degradation are relatively few and well known (industrial logging concession license holders) which facilitates the collection of data and consequently quantification of baseline emissions. The agents of unplanned degradation are many, diverse and not as well known, which makes collection of data and hence quantification of baseline emissions difficult. A different approach may thus be needed to quantify emissions from unplanned degradation.
- Planned and unplanned degradation are likely to be affected by a different set of factors with regard to their volume and thus emissions, i.e. that adjustment factors – if any could be justified – could likely look quite different.

- Deforestation patterns for areas within and outside legal logging concessions are quite different. They require entirely different data collection techniques, they are represented by different baseline scenarios and they ultimately require different modeling techniques.
- Most importantly, within logging concessions, future deforestation cannot necessarily be predicted by past deforestation / degradation patterns, whereas for the areas outside these concessions, it is generally accepted that past deforestation/degradation activity can be extrapolated into the future. Thus, the main stratification was introduced to spatially delineate the areas inside and outside legal logging concessions.

Similar arguments to those above: (clear spatial definition, separate baseline scenarios) for a stratification of the REL into planned and unplanned deforestation was also identified within the ER Program area. However, little historical evidence was found at scale from planned deforestation (road building, urban spread, large plantations, mining, hydropower, etc.) in Mai-Ndombe. This differentiation was ultimately not done for reasons of cost-effectiveness and lack of historical data.

Unplanned degradation and unplanned deforestation were not delineated in separate strata for the following reason: Activities causing unplanned deforestation and forest degradation cannot be clearly spatially delineated (they occur throughout the program area) and they may overlap spatially (e.g. burning of a degraded forest for crop cultivation after illegal logging or fuelwood collection)

Afforestation/Reforestation was added since carbon stock enhancement play an important role in the program design. Historically removals from A/R are zero, so there is no (separate) 'reference removal level' from A/R. However, A/R activities fulfill the criteria for stratification stated above and so A/R constitutes a separate accounting area (for which reference removals are zero).

Ultimately, the ER Program decided to subdivide the REL and ER Program accounting area into the following land-use strata:

- Unplanned deforestation and forest degradation (UNDEF / UNDEG), featuring slash & burn agriculture, fuelwood collection, charcoal production, illegal logging and other forest clearing activities.
- Planned degradation (PDEG), from legally authorized / planned industrial timber harvesting.
- Afforestation / Reforestation of previously non-forested land (A/R).

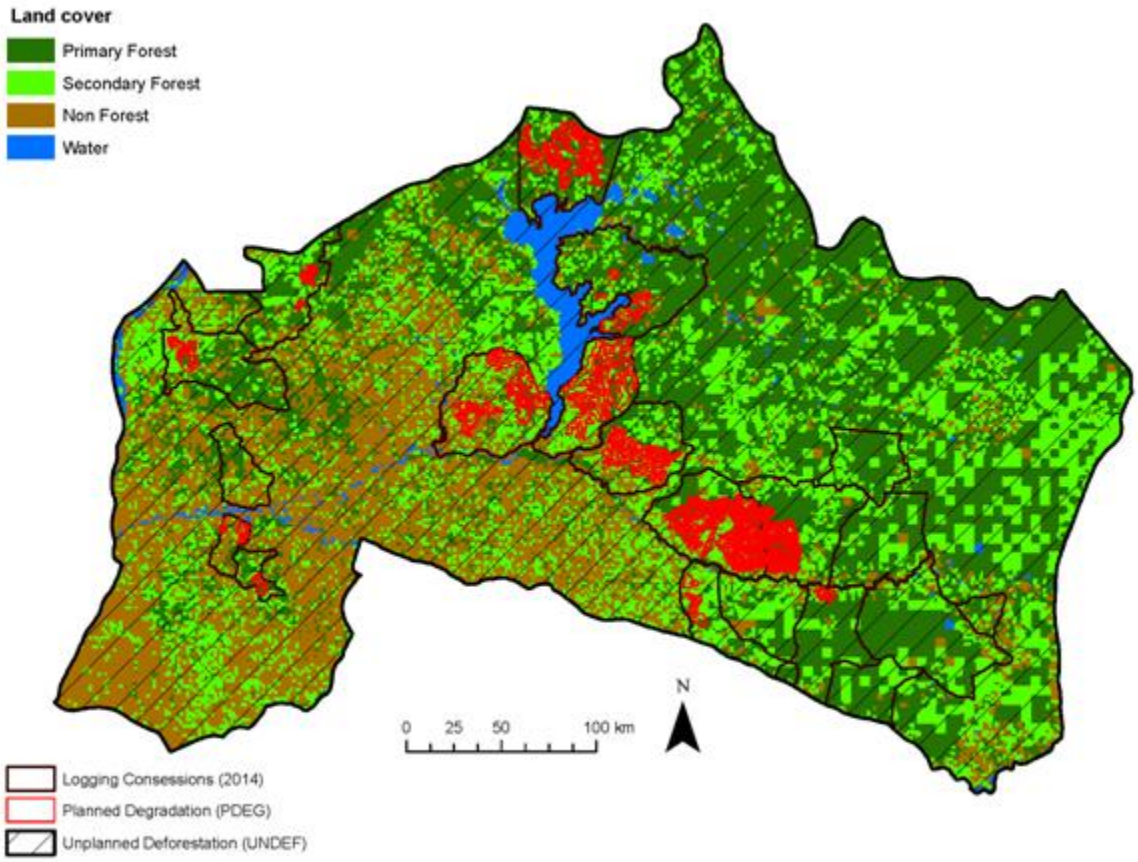
Spatial delineation

All three historical component RELs are derived from spatially delineated areas (reference areas) during the reference period:

- A/R during the reference period amounts to zero (UNDEF/UNDEG analysis provides net deforestation- and degradation rates, i.e. after subtraction of regrowth) and thus there is no overlap between the A/R stratum and the other two component REL strata.
- The geographical boundaries, or in this case the reference area for the historical REL PDEG, are the sum of all harvesting areas inside of the 20 forestry concessions that were harvested during the reference period (2004-2014).

- The geographical boundaries, or in this case the reference area for the historical REL UNDEF / UNDEG, consists of the entire area of Mai-Ndombe *minus* the REL PDEG reference area.

While it is possible, or even likely, that unplanned deforestation or forest degradation occurred following timber harvesting in some of the forestry concessions during the reference period (within the legal harvesting areas), these emissions are ignored in order to not overestimate the REL. However, as the reference area for the REL PDEG only covers areas identified by harvesting plans to be legally harvested during the historical reference period, emissions due to unplanned deforestation and degradation – but still within the logging concessions - are captured in the calculation of REL UNDEF / UNDEG.



Map 5: Stratification of the ER Program Area into REL PDEG and REL UNDEF/UNDEG Reference Areas

ER PROGRAM CARBON ACCOUNTING AND THE 2006 IPCC GUIDELINES FOR NATIONAL GREENHOUSE GAS INVENTORIES

Criterion 5 of the MF requests that *[…] The ER Program uses the most recent Intergovernmental Panel on Climate Change (IPCC) guidance and guidelines, as adopted or encouraged by the Conference of the Parties, as a basis for estimating forest-related greenhouse gas emissions by sources and removals by sinks […].*

Indicator 5.1 of the MF further specifies that *[…] The ER Program identifies the IPCC methods used to estimate emissions and removals for Reference Level setting and Measurement, Monitoring and reporting(MMR) […].*

As the MF stated that *[...] the latest IPCC guidelines must be used* *as a basis for estimating*... *[...], t*he ER Program and its partners have interpreted this in a way that all carbon accounting methods should follow the guidance provided by the IPCC (as a general basis), but the methods must not necessarily employ exactly the same and equations.

For the quantification of REL strata, the ER Program has thus also relied on other methodological guidance, such as:

- For the UNDEF/UNDEG REL: Components derived from the validated VCS methodology VM0009 'Methodology for Avoided Ecosystem Conversion, v3.0'
- For the PDEG REL: Components of the validated VCS methodologies VM0010 (v1.2) and VM0011 (v1.0) as well as the VCS AFOLU requirements (v3.4)
- For A/R accounting: Small Scale CDM methodology 'Afforestation and Reforestation Project Activities implemented on Lands other than Wetlands', Version 3, CDM EB75, Annex 32.

The ER Program uses and adapts parts of these methodologies because they provide readily available methodological components of high quality (from validated methodologies) that that are directly applicable to the ER Program scenario. Further, these methodologies are used because they offer the advantage of being consistent with the VCS JNR standard.

All of the aforementioned methodologies are also compatible with the 2006 IPCC Guidelines for National Greenhouse Gas Inventories (which is considered to be the latest version of the IPCC guidelines), with the exception of harvested wood products accounting under the PEDG REL. Since HWP accounting is not mandatory under the MF (see section on carbon pools above) and will not be accounted for at the national level (at present), this is not seen as a problem. Accounting for the HWP pool is also considered conservative.

All 3 methodologies are - by IPCC definition - so-called gain-loss methods, since they are process-based approaches, which estimate the net balance of additions to and removals from a carbon stock (cp. 2006 IPCC Guidelines for National Greenhouse Gas Inventories, Volume 4, Chapter 2, page 2.9 ff).

With the exception of the deadwood pool, all 3 methodologies use IPCC TIER 2 accounting methods. The calculation of the PDEG REL relies on 4 IPCC default values, where no national or sub-national data could be found. Of these 4 parameters (out of 44 parameters in total), 2 parameters (carbon fraction and root-shoot ratio) are not exactly TIER 1 default values but rather values that are widely used also in higher TIER carbon accounting because development of country specific values for these parameters would be costly and time intensive. The ER Program hence rates this as being in compliance with MF indicator 14.3, which calls for use of IPCC Tier-2 methods to determine emission factors but allows the use of Tier-1 methods in exceptional cases. We deem the lack of reliable country-specific data as an exceptional case.

With regard to the deadwood pool, the ER Program has decided to use TIER-1 accounting in the sense that all emissions from anthropogenically produced deadwood (logging slash, post-burning woody debris) occur immediately, as these emissions are caused by activities in the ER Program area and are considered to be irreversibly committed to the atmosphere.

While the methodologies do not specifically report emissions and removals by carbon pool and the land transitions according to IPCC categories (e.g. forest land remaining forest land, forest land converted to cropland), generating this data from the application of the methodologies would be possible. This is also confirmed by the VCS JNR (page 19, section 3.9.1) which states that *[...] activity-based accounting will*

not prevent a jurisdiction from accounting for its forests in accordance with IPCC categories of forest converted to non-forest, forest remaining forest, and conversion of non-forest to forest [...].

Finally, where IPCC equations, data and default values were used, we rely on the 2006 IPCC Guidelines for National Greenhouse Gas Inventories (which we consider to be the currently latest IPCC guidelines). Where data or methods were not available in the2006 IPCC Guidelines for National Greenhouse Gas Inventories, we use data and/or methods from the 2003 IPCC Good Practice Guidance on LULUCF.

8. CARBON POOLS, SOURCES AND SINKS

8.1 DESCRIPTION OF SOURCES AND SINKS SELECTED

The following table briefly discusses which carbon sinks and sources are included or excluded:

Sources/Sinks	Included?	Justification / Explanation
Emissions from deforestation and degradation	Yes	According to the MF, ER programs must account for deforestation. In addition to deforestation, the ER Program also accounts for emissions from degradation, as these are estimated to be significant (>10% of all forest-related emission in the reference period). According to WWC (2015), emissions from unplanned degradation account for approx. 45% of all forest-related emissions in the reference period (2004-2014), including emissions from PDEG. The ER Program differentiates between unplanned degradation (UNDEG) and planned degradation (PDEG; industrial logging), which are accounted for separately. Deforestation is referred to as unplanned deforestation (UNDEF). UNDEF and UNDEG constitute on stratum. The UNDEF/UNDEG stratum covers the entire accounting area (Mai-Ndombe province) with the exception of the PDEG stratum (see below), in order to not overestimate emissions. Exclusion of the PDEG stratum is conservative, as e.g. deforestation and forest degradation following planned industrial logging is not accounted for in the Reference Emission Level (REL), but will be accounted for during the program period. Note on planned deforestation: The ER Program evaluated planned deforestation. There are no large scale mining activities or issuance of agricultural licenses planned within the ER Program area. Road construction is mainly limited to the refurbishment of existing roads. Against this background, UNDEF covers the whole ER Program area with exemption of PDEG. If emissions occur as a result of planned deforestation, these will be accounted for under UNDEF.
Emissions from planned forest degradation (PDEG)	Yes	As emissions from UNDEG are estimate to be significant, (see above), emissions from PDEG also have to be accounted for. Further, forestry concessions are seen as important partners for reducing emissions and the ER Program is seen as an opportunity to advance with the forestry sector reform in DRC. Emissions from PDEG are accounted for from a separate stratum. The geographical boundaries, or in this case the reference area for the historical REL, are the sum of all harvesting areas inside of the 20 forestry concessions that were harvested during the reference period (2004-2014).

Removals from Afforestation / reforestation (A/R)	Yes	The ER Program envisages implementing several mitigation activities which are related to planting trees and creating alternative income sources to shifting cultivation. Hence the removals from A/R are accounted for. Note on revegetation: This stratum is constrained to A/R and human supported revegetation on specific areas (which are delineated by GPS tracking devices at the start of mitigation activities). This does not account for natural revegetation, which is covered under the UNDEF stratum (i.e. determining the net deforestation rate).

8.2 DESCRIPTION OF CARBON POOLS AND GREENHOUSE GASES SELECTED

This section briefly discusses which carbon pools and which greenhouse gases (GHG) are included or excluded under the ER Program. The section starts out discussing the consideration of carbon pools for different REL strata followed by the discussion of GHGs considered/neglected. As the ER Program uses a spatially stratified REL, and baseline activities in each of the strata have different impacts on different carbon pools, it is deemed appropriate to account for different carbon pools in these strata. Generally, the exclusion carbon pools is justified by the argument of conservativeness, i.e. that the exclusion will underestimate emissions in the REL (in line with indicator 4.2 ii of the MF).

Carbon Pools selected for UNDEF/UNDEG:

Carbon Pools	Selected?	Justification / Explanation
Above Ground Biomass (ABG)	Yes	AGB is the most important carbon pool. Deforestation results in a decrease of ABG. Hence this carbon pool is included.
Below Ground Biomass (BGB)	Yes	BGB is a significant carbon pool(use of root-shoot ratios of 20%-40% of AGB, i.e. emissions from BGB are >10% of total forest related emissions In the Accounting Area during the Reference Period. As deforestation results into a decrease of BGB, this pool is included.
Dead Wood (post-burning)	Yes	The ER Program judges that approx. 90-95% of all AGB is removed during land clearing, both through combustion and post-burning extraction of deadwood for charcoal production and fuelwood use. However, a small amount of deadwood usually remains. Excluding deadwood would overestimate emissions and thus this (sub)carbon pool is included.
Dead wood (naturally accumulated)	No	Following IPCC guidelines (IPCC 2006), it is assumed that carbon stocks in the naturally occurring dead wood pool (both standing and lying) are equivalent in both the project and baseline scenario, and therefore this pool is conservatively excluded

Harvested Wood Products	No	Not required by the MF and thus excluded.
Litter	No	Likely to be insignificant and exclusion is conservative, as emissions in program scenario are likely to be lower
Soil Organic Carbon (SOC)	No	The ER Program will result in an increase of soil organic carbon stocks. Hence SOC is conservatively excluded.

Carbon Pools selected for PDEG:

Carbon Pools	Selected?	Justification / Explanation
Above Ground Biomass(AGB)	Yes	Major emissions source as logging is the baseline activity
Below Ground Biomass (BGB)	Yes	Significantemission source in industrial logging, in particular when it comes to emissions from forestry infrastructure, where trees are completely uprooted (use of root-shoot ratios of 20%-24% of AGB, i.e. emissions from BGB are >10% of total emissions from industrial logging).
Dead Wood (logging slash)	Yes	Major emissions source as logging is the baseline activity.
Dead wood (naturally accumulated)	No	Following IPCC guidelines (IPCC 2006), it is assumed that carbon stocks in the naturally occurring dead wood pool (both standing and lying) are equivalent in both the project and baseline scenario, and therefore this pool is conservatively excluded
Harvested Wood Products	Yes	Important carbon sink as logging is the baseline activity. Inclusion will reduce the REL for industrial logging (carbon sink) and inclusion of this pool is thus conservative. The program will likely lead to a decrease of this carbon sink (less harvested timber) and thus this pool must be included.
Litter	No	Likely to be insignificant and exclusion is conservative, as emissions in program scenario are likely to be lower (implementation of RIL and establishment of conservation concessions)
Soil Organic Carbon	No	Likely to be insignificant and exclusion is conservative, as emissions in program scenario are likely to be lower (implementation of RIL and establishment of conservation concessions)

Carbon Pools selected for A/R

Carbon Pools	Selected?	Justification / Explanation
Above Ground Biomass (AGB)	Yes	Considered as the major source of removals, thus included.
Below Ground Biomass (BGB)	Yes	Considered as significant source of removals, thus included(use of root-shoot ratios of 20% or more of AGB, i.e. removals from BGB are >10% of total removals from A/R)
Dead Wood (logging slash)	No	Not applicable to this stratum and thus excluded (no harvesting in A/R sites)
Deadwood (naturally accumulated)	No	DW carbon stocks will be higher in reforested sites, than in Savannah. Hence this carbon pool is conservatively neglected.
Litter	No	Likely to be insignificant and exclusion is conservative, as emissions in program scenario are likely to be lower.
Harvested Wood Products	No	Not required by the MF and thus excluded.
Soil Organic Carbon	No	This carbon pool is considered to be insignificant and is neglected following guidance on reforestation from UNFCCC's Clean Development Mechanism (CDM EB75, Annex 32, §18, please refer to Section 8.3.2)

The ER Program selected to account for the following greenhouse gases:

Greenhouse gases	Selected?	Justification / Explanation
CO_2	Yes	The ER Program shall always account for CO_2 emissions and removals
CH_4	No	The ER Program's mitigation activities will result in a less areas burnt. The emissions related to burning are conservatively neglected.
N_2O	No	The ER Program's mitigation activities will result in a less areas burnt. The emissions related to burning are conservatively neglected.

9. REFERENCE LEVEL

9.1 REFERENCE PERIOD

The Methodological Framework (MF) of the FCPF, Indicator 11.1 notes: 'The end-date for the Reference Period is the most recent date prior to 2013 for which forest-cover data is available to enable IPCC Approach 3. An alternative end-date could be allowed only with convincing justification, e.g., to maintain consistency of dates with a Forest Reference Emission Level or Forest Reference Level, other relevant REDD+ programs, national communications, national ER program or climate change strategy'.

Considering above guidance and national as well as local circumstances, DRC suggests a historic reference period from 2004 to 2014. The main argument is to maximize consistency with the national reference level.

- The period for the national REL has not been published yet and it was only agreed in November 2015 between DIAF and FAO that the reference period for the national REL would be 2000-2014. That required the ER-Program team to take decisions in the absence of certainty about the national REL period.
- However, it was already clear that DRC will use year 2014 as the end-date of their national and sub-national reference period. Indeed, many products have been developed for year 2014:
    - A sub-national forest cover benchmark Map (Old Bandundu province) for the year 2014 was in production by DIAF with technical support of the Japanese International Cooperation Agency (JICA)
    - A national forest cover benchmark Map for the year 2014 was in production by DIAF with technical support of the FAO
    - The LiDAR-based data were collected in 2014 (LiDAR flights were conducted from June 2014 to October 2014).
- In this context, the team in charge of designing the ER-Program Reference Level has then decided in April 2014 to use a historic reference period from 2004 to 2014 in order to align the end-date of the reference period with the national REL.

Some others arguments were also considered in choosing a 2014 end-date:

- This ensures that assessment of carbon stocks is up to date (e.g. the average carbon stock of forest strata (e.g. secondary forest) may change over time which may have minor impacts on the Emission Factors. Having consistency between the end of the historic reference period and the carbon stock data, ensures that such effects are minimal. Equally important, the REL envisages the use of the LiDAR map for the determination of the baseline carbon stocks in

Savannah which will be converted to forest under the ER Program's A/R activities. Also here, consistency between the end of the historic reference period and carbon stock data is of advantage.

- Using a reference period, which ends close to the operational ER Program start eliminates the need to develop an intermediary product assessing the emissions during the gap period. A reference period that is closer to the start date of the program will most adequately reflect emissions during the program period.
- Finally, choosing 2014 as the end of the reference period offers the co-benefit, that the ER Program may align the REL under the Carbon Fund with the jurisdictional baseline under the VCS JNR. (Because VCS JNR require a maximum difference of 10 years between the end-date of the REL period and the starting of the program).

Considering the recent decision to have a historical national reference period of 2000-2014, two options have been considered in order to ensure full alignment. The feedback from the TAP will help DRC to choose one of these options:

- The first option would be to entirely align the ER-Program reference period with the expected reference period of the National REL (2000-2014). However, that was not possible right now because the ER Program uses a sampling approach and there are no sample plots currently available for the year 2000. Also, images for the ER-Program area prior to 2004 were assessed but indicated a too high cloud ratio and could therefore not be used. DRC could conduct a complementary work before the final ERPD but it will require additional costs and present also a risk to lower the accuracy (High cloud ratio)
- The second option, which is as consistent as possible and feasible, is to keep a reference period from 2004-2014 for the ER-Program. But in order to maximize consistency with the national REL, a dialogue with FAO and DIAF has resulted in an agreement by FAO and DIAF to use the 2004-2014 sample plots produced by the ER-Program to conduct an accuracy assessment of the 2000-2014 Land Cover Change (LCC) map in the ER-Program area.

9.2 Forest Definition used in the Construction of the Reference Level

The calculation of activity data are based directly on a forest definition. The Democratic Republic of the Congo submitted a host country specific definition to UNFCCC that will be applied in the design of the Jurisdictional ER Program. Respective minimum values for crown cover, tree height and area according to the official DRC forest definition are listed below:

Table 13: Forest Definition of DRC

Item	Value
Minimum Crown Cover (%)	30%
Minimum Land Area (ha)	0.5
Minimum Tree Height (m)	3

To calculate emissions more accurately and also to define forest degradation in terms of forest cover loss, the forest class was subdivide into 2 classes. We employ crown cover to define thresholds for these two defined classes: dense forest (DF) and secondary forest (SF), as show in table XX

Table 14: Definition of Forest Sub-classes

Sub-class	Crown cover range
Dense forest	75% - 100%
Secondary Forest	30% - 74.99%
Non-forest	0% - 29.99%

For the calculation of REL UNDEF and REL UNDEG (explained in detail below), the following operational sub-classes were used in accordance with IPCC GPG 2006. Operational sub-class mapping to the above forest sub-classes is shown in the table below.

Table 15: Land Cover Classes and Sub-Classes in the State-Change Model

IPCC Land cover class	Operational sub-class
Not Classified	n/a
Cloud/Shadow	n/a
No Image	n/a
Other/image error	n/a
Dense forest	Dense forest (DF)
Cropland	Non-forest (NF)
Grassland	Non-forest (NF)
Wetland/Water	Non-forest (NF)
Settlement	Non-forest (NF)
Secondary (degraded) Forest	Secondary Forest (SF)
Bare Soil	Non-forest (NF)
Burn Scar	Non-forest (NF)

9.3 EMISSIONS FROM UNPLANNED DEFORESTATION AND DEGRADATION (UNDEF/UNDEG)

METHODOLOGY

Sample design

To calculate REL for Unplanned Deforestation and Unplanned Degradation (UNDEF/UNDEG), we employed a systematic, manual classification approach, consistent with IPCC TIER3 approach, to sample data covering multiple years over the historical reference period. We then used a state-change model on the sampled data to calculate area deforested and degraded. As a pre-requisite for designing the sampling scheme, we stratified the Mai Ndombe ER Program area into land-use/land-cover pairs, ultimately consolidating into 6 major sampling strata.

Core strata were derived from a land cover map provided by the Université Catholique de Louvain. Edge strata were then created by iteratively buffering the core strata until the strata were observed to cover the majority of deforestation for a recent image (a 2014 Landsat mosaic was used to identify deforestation extent). We thereby ensured that deforestation activity was covered by the edge strata, for which we assigned a higher number of samples than for the core strata (see below). We then sampled each of these 6 areas with sample spacing proportional to the relative importance of the strata to deforestation and degradation. A table containing sample spacing strata and sample spacing for each is shown below:

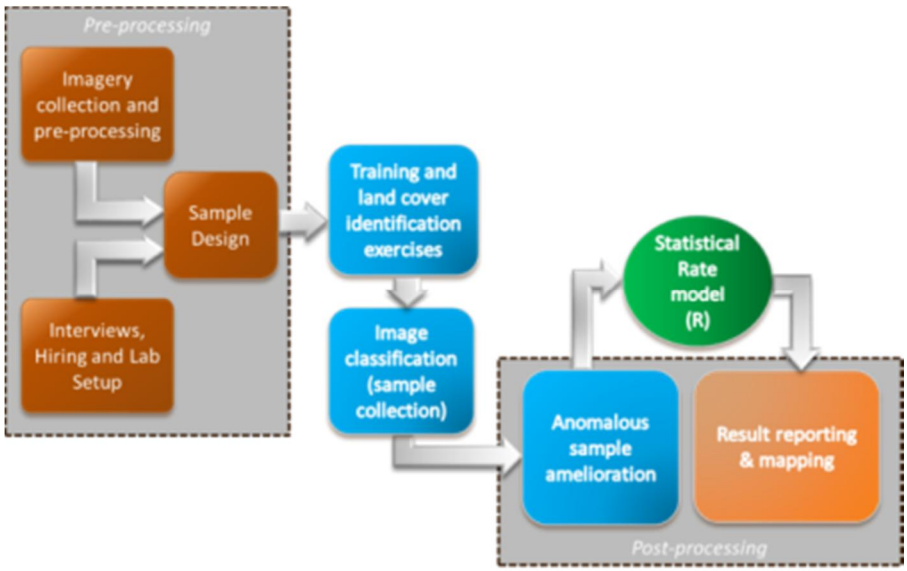
Table 16: Sample Design summary for the Mai Ndombe ER-Program REL UNDEF and REL UNDEG Calculations

Acronym	Stratum	Area (ha)	Sample spacing (m)	Nr of Samples
PFC	Primary Forest CORE	3,200,574	5,000	1,285
PFE	Primary Forest EDGE	3,062,670	2,000	11,964
NFC	Non-Forest CORE	674,831	1,600	1,988
NFE	Non-Forest EDGE	1,613,224	1,600	6,054
SEC	Secondary Forest	850,279	1,600	3,358
MIX	Agriculture / Forest Mosaic Mixture	3,214,264	1,600	12,535
Total (per image epoch)		12,615,842		37,184
Grand total (6 epochs)				223,104

Sample spacing was designed according to 2 factors. Firstly, the importance of the stratum to deforestation and degradation was considered. As mentioned above, edge strata were assumed to contain more deforestation and degradation than the core strata due to tendency of deforestation to occur at the edge of forest patches in an “impenetrable forest” ecosystem such as that found in the Congo Basin. Deforestation has been shown to occur at an increased rate at forest edges by Bucki et al, 2012 and others. Secondly, sample spacing was rounded to the nearest whole number and then optimized to account for overall number of days allocated for data collection as well as relative number of days allocated for data collection for each of the above-mentioned strata.

WWC managed the sample classification process at the University of Kinshasa in collaboration with the Observatoire Satellital des Forêts d'Afrique Centrale (OSFAC) Laboratory, hiring and training 12 remote sensing analysts that classified the data over a 6 week period under close supervision from WWC. Following sample classification, WWC conducted an extensive amelioration process in which "impossible" and "suspect" temporal land cover transitions were identified, examined and if necessary, ameliorated through expert manual review. We then were able to calculate historical deforestation and degradation rates using the state-change model. We calculated total emissions in tCO_2 emitted over the historical reference period due to deforestation and degradation for each of the 6 LULC strata used to design the sampling scheme. We also calculated percent deforested and degraded per year (%/yr) for each of these same strata. Finally, we aggregated both results and arrived at a single result for REL UNDEF and REL UNDEG for the ER-Program area. The below figure illustrates the REL calculation workflow process.

Figure 6: REL UNDEF & REL UNDEG Calculation Workflow



Imagery collection and pre-processing

We collected and pre-processed all imagery needed to perform the REL calculation. The imagery was mosaic-ed (see Annex 17), color corrected and clipped to the Mai Ndombe ER Program area extent and prepared for use with WWC's proprietary ArcGIS classification tool. A medium-resolution land-cover stratification was combined with land-use data to create land-use/land-cover pairs (see figure below). We then separated each patch into its "core" and "edge" component to support the focus of more samples in the edges of strata on the assumption that those areas would have experienced higher levels of deforestation and degradation. Edge strata were created by buffering each patch iteratively until all deforestation that had occurred up until the year 2014 had been covered by the relative edge stratum. This process served to capture all important deforestation events in the edge strata before the end of the historical reference period, thus optimizing the chances of accurately measuring historical deforestation rates.

Figure 7: Sample Approach using Core and Edge Approach

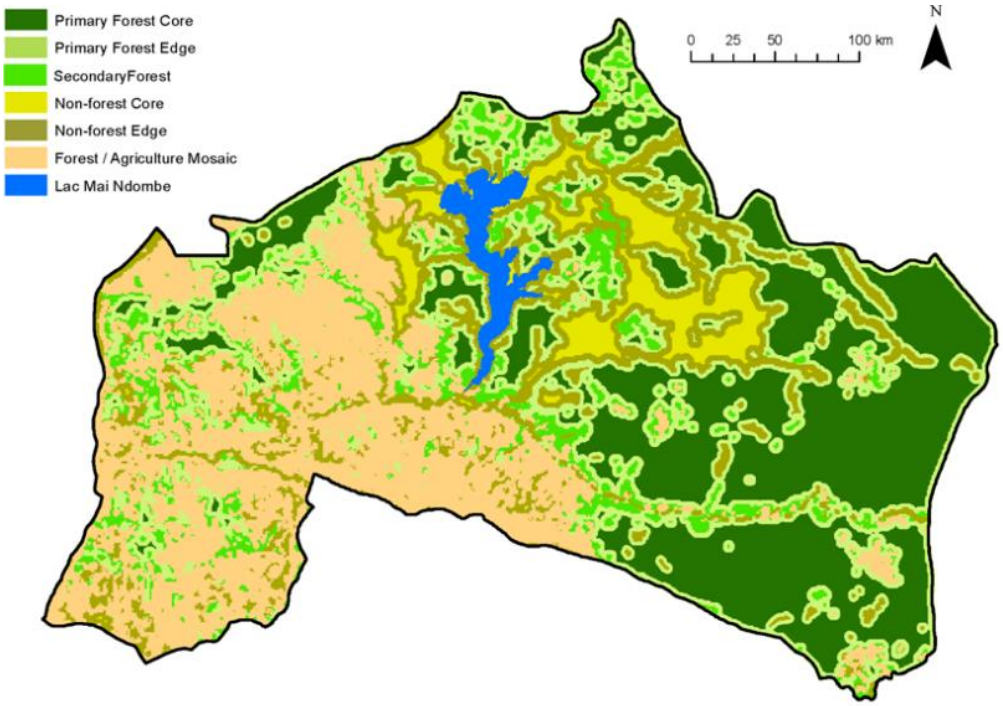
Annex 17 shows how the LULC stratification was used to design the sampling scheme for the ER Program. Samples were placed in each stratum in a regular-grid pattern with a random starting location. Grid spacing was adjusted according to the strata's size, and relative expected level of deforestation activity.

Collaboration with OSFAC: capacity building and the analyst program

WWC collaborated with the OSFAC Laboratory at the University of Kinshasa by hiring and training a group of local remote sensing analysts. We held interviews for the analyst positions, and ultimately hired 12 qualified analysts, all of whom had graduated from the University of Kinshasa with a degree in remote sensing / agronomic engineering or were at the end of their studies. Details of the analyst roster are listed in OSFAC Capacity Building Exercise.

The analysts were placed in an intensive training session from February 6th to February 13th, during which they were asked to first read the WWC training manual, containing instructions for how to utilize the WWC ArcGIS classification tool, as well as numerous examples and criteria for identifying land cover in the Congo Basin. After receiving 3 lectures, the analysts commenced to practice using the GIS tool which they ultimately used for sample classification, and were administered multiple quizzes to determine their readiness to begin production data classification. All analysts were required to score at least 90% on each quiz before they were allowed to continue in data classification for the ER-Program. All analysts succeeded in this regard and moved on to complete the sample classification exercise. Images of the analysts engaged in a training session and prior to starting classification are presented in Annex 18. To support the analyst team in their efforts, WWC created a robust training manual (see Annex 20) and provided various support tools, including the classification "dashboard". The analysts

were required to classify thousands of samples, covering all strata and all years, according to the Operational Sub-class table in Section 8.2 above.



Map 6: Stratification used for the Design of the Sampling Scheme for Land-use / Land-cover Pairs separated in 'Core' and 'Edge'

Sample classification

All samples were classified manually using a "heads-up" classification approach. Analysts viewed samples (each representing a specific point in space) overlaid on imagery, and were trained to use a variety of remote sensing image analysis techniques to identify landcover. Complete detailed description of such techniques lies beyond the scope of this report, but they include:

- Viewing imagery in both "Truecolor" and "Falsecolor" band combinations
- Utilizing image histogram equalization to correctly identify degraded forestland
- High resolution image support (when possible)
- Group analysis (decision by consensus)

As mentioned above in Section 8.2, all samples were classified according to land cover classes derived from the IPCC GPG 2006 document. Analysts used the WWC GIS navigation & classification tool (see Annex 18). For the purposes of this REL analysis, land cover classes were grouped into operational sub-classes to support the state-change model used to calculate deforestation and degradation. Details of IPCC land cover classes and their aggregation into operational sub-classes for the state-change model (Dense forest, secondary forest and non-forest categories) are provided in Table *15*.

Samples were classified over a 30-work-day period. Due to the sheer number of samples required to be classified for the extent of the Mai Ndombe ER-Program area over the 6 epochs, we employed a "zonal" approach, breaking the ER-Program area into logical portions. Using this approach we were able to

systematically assign different areas of the map to different analysts over different time periods. We eliminated analyst bias by avoiding repeat locations or repeat time-periods, assigning entirely random subsets of appropriate size to each analyst as well as random time-periods (i.e. no analyst collected samples for the same location in 2 or more years, and similarly, no analyst worked on a single year for more than 2 locations). A total of 223,104 samples were classified, covering the entirety of the Mai Ndombe ER Program area for the 6 epochs originally selected for the historical reference period.

In order to assess the accuracy of the classification made for the Reference level, an accuracy assessment has been done by DIAF with the support of FAO. (See Annex 19)

ACTIVITY DATA

Comment for TAP Review:

The Reference Emission Level for unplanned deforestation and forest degradation is based on un-adjusted area estimates. The uncertainty analysis (section 13) however is based on adjusted area estimates. The ER Program seeks guidance from the TAP whether or not the final output of the REL is to be based on adjusted areas.

Parameters

We list here the different parameters which are detailed in Annex 21:

1. Total area per year due to forest-state transitions between Dense Forest (DF) and Non-Forest (NF) between 2004 and 2014. Parameter is called primary deforestation.
2. Total area per year due to forest-state transitions between Secondary Forest (SF) and Non-Forest (NF) between 2004 and 2014. Parameter is called secondary deforestation.
3. Total area per year due to forest-state transitions between Non-Forest (NF) and Secondary forest (SF) between 2004 and 2014. Parameter is called regrowth 2.
4. Total area per year due to forest-state transitions between Dense Forest (DF) and Secondary Forest (SF) between 2004 and 2014. Parameter is called degradation.
5. Total area per year due to forest-state transitions between Secondary Forest (SF) and Dense forest (DF) between 2004 and 2014. Parameter is called pure regrowth.

Calculation of Historic Emissions from Unplanned Deforestation

We calculate a historical unplanned deforestation rate (REL UNDEF) for each of 6 strata listed previously. We used the statistical package R to develop the algorithm model which calculates deforestation in units of tonnes CO2e/yr and %/yr for each stratum. We then aggregate the rates for all 6 strata to arrive at a single deforestation rate for the entirety of the ER Program area.

We employ a state-change model which first calculates a deforestation area for each individual sample. Per-sample deforested area is then aggregated to the strata level, and finally, to the ER-Program level.

Firstly, each sample is assigned a representative area, which is defined as the number of samples in the strata divided by the area of the strata. If an individual sample is found to have undergone a state change between a forest state and non-forest that sample is flagged as “deforested”. The representative areas for all samples that were deforested are aggregated to arrive at total area deforested per strata. We multiply these areas by the appropriate deforestation emission factor (EF) to achieve tons CO2 emitted per strata due to primary deforestation and secondary deforestation. Primary deforestation and

secondary deforestation are added together, and then total emissions for each stratum area aggregated to achieve total emissions over the entirety of the ER Program Area. Finally, we calculate an average deforestation rate per year by dividing the total emissions by the number of years in the historical reference period.

See Annex 13 for the equations used to calculate UNDEF.

Calculation of Historic Emissions from Unplanned Degradation

Historical unplanned degradation (REL UNDEG) is calculated similarly to historical deforestation, except for the following key differences.

- Degradation is initially calculated as those samples that transition between dense forest and secondary forest (PF → SF)land cover states.
- Area calculated as "bad" degradation is subtracted from total degradation area.
- Area calculated as "good" regrowth is also subtracted from the total degradation area.

The subtraction of both "bad" degradation and "good" regrowth is considered conservative, as the subtraction of both these categories serves to lower degradation emissions. To identify both of these types of state transitions, we employed a multi-tiered process to automatically identify the aforementioned cases. We developed a GIS add-in tool that firstly flags "suspect" anomalous state transition stated above. We then filter "bad" degradation and "good" regrowth using pivot tables and excel formulas which search for the patterns representing the 2 cases. Areas attributed to samples fitting these 2 cases are subtracted from the aggregate degradation area.

Those samples categorized as normal degradation (i.e. transition from(PF → SF)) are by design not flagged as "suspect". These samples, as well as those "suspect" samples identified as "good" degradation (i.e. not filtered using the process described above) are allowed to be included in the calculation of degradation. Those samples identified as "bad regrowth" (i.e. not filtered using the process described above) are not included in the calculation of regrowth, as they unlikely to represent physical reality. The result is a conservative estimate of degradation, based on the identification of temporal sample transitions found to plausibly represent a physical state change between primary and secondary forest states. Using the amelioration process described above, we remove implausible transitions while including legitimate forest re-growth.

See Annex 14 for the equations used to calculate UNDEG.

Results

Following the methodology explained above, we calculate emissions from unplanned deforestation and unplanned forest degradation:

- The findings of the LULC change analysis on a sample basis show that for a total 36,733 samples analyzed, 1,298 indicate changes. Changes are reported either as primary or secondary deforestation, degradation or regrowth
- Considering the sample spacing per stratum (as specified in Table 16), the table above provides estimates of area changes. The total area changes per annum are estimated to 519,976 ha whereof degradation accounts for the largest area changes (51.1%). Deforestation and degradations rates were determined (referring to net-deforestation, after the addition of regrowth). Values range from 0.5% to 2.08%.

Table 17: UNDEF/UNDEG REL Results - Estimation of Area Changes per stratum

Stratum	Primary Deforestation Area (ha/yr)	Secondary Deforestation Area (ha/yr)	Degradation Area (ha/yr)	Regrowth (SF->PF) (ha/yr)	Regrowth (NF->SF) (ha/yr)	Deforestation Rate (%/yr)	Degradation Rate (%/yr)
PFC	10,956	8,466	95,616	29,880	1,992	0.55%	2.08%
PFE	17,149	21,091	73,999	29,359	2,048	1.21%	1.50%
NFC	797	1,747	8,351	2,724	745	0.35%	1.11%
NFE	2,836	13,209	20,977	7,665	2,018	0.92%	0.87%
SEC	1,747	14,056	19,602	4,204	2,887	1.53%	1.83%
MIX	6,284	55,836	44,961	6,797	7,977	1.69%	1.19%
TOTAL	39,769	114,405	263,506	80,629	17,667	1.12%	1.49%

▪

EMISSION FACTORS

We list here the different parameters which are detailed in Annex 22:

1. The primary deforestation emission factor, EF_p, accounts for the carbon stock difference between dense forest (DF) and residual Non-forest (NF).
2. The secondary deforestation emission factor, EF_s, accounts for the carbon stock difference between Secondary Forest (SF) and residual Non-forest (NF).
3. The unplanned degradation emission factor, EF_{UNDEG}, accounts for the carbon stock difference between Dense forest (DF) and Secondary Forest (SF)

Carbon stock data were developed under the Carbon Map and Model program, by a Light Detection and Ranging (LiDAR) flight campaign in the ER program area (LIDAR flights were conducted from June 2014 to October 2014). This program is funded by the International Climate Initiative of the International Climate Initiative of The German Federal Ministry for the Environment, Nature Conservation, Building and Nuclear Safety (BMUB) and implemented by the WWF and the University of California and supports REDD+ processes in DRC inter alia through the development of a national forest carbon stock map. To support the ER program, a separate forest carbon stock map was produced for the ER Program area.

The LiDAR data allows for the determination of average carbon stocks of primary-, secondary-, and non-forest. The results of Above Ground (AG) are provided in the table below, accompanied by the Standard Deviation (STD) and Confidence Interval (CI).

Table 18: Above Ground Carbon Stocks by Land Cover Class

Land cover class	AG Carbon (tC/ha]	Min.	Max.	CI (α=0.10)	CI (relative)
Dense forest (Canopy cover 75-100%)	144.43	75.4	323.2	+/- 4.83	+/- 3.3%
Secondary forest	86.10	14.7	188.3	+/- 2.89	+/- 3.4%

(Canopy cover 30-74.99%)					
Non-forest (Canopy cover 0-29.99%)	15.65	0.0002	89.5	+/- 5.23	+/- 33.4%

The following table provides estimates for the Below Ground (BG) carbon stocks based on root-to-shoot ratios as stipulated in IPCC GPG 2006, Table 4.4.

Table 19: Below Ground Carbon Stocks by Land Use Class				
Land cover class	BG Carbon (tC/ha]	CI (α=0.10)	CI (relative)	Source
Dense forest (Canopy cover 75-100%)	34.66	+/- 12.23	+/- 35.30%	Based on LiDaR biomass data (Saatchi et al. 2015[31]) in combination with Mokany et al. (2006)[32]
Secondary forest (Canopy cover 30-74.99%)	20.42	+/- 2.06	+/- 10.08%	Based on LiDaR biomass data (Saatchi et al. 2015) in combination with Mokany et al. (2006)
Non-forest (Canopy cover 0-29.99%)	6.15	+/- 0.81	+/- 13.16%	Based on LiDaR biomass data (Saatchi et al. 2015) in combination with Poupon (1980)[33]

The table below provides the Emission Factors (EFs) for the land use change transitions included in the REL calculation.

Table 20: Emission Factors for Deforestation and Degradation			
Emission factors	Loss of carbon in AGB+BGB [tCO_2/ha]	CI (α=0.10)	CI (relative)
Deforestation: Dense forest - non forest	576.75	+/-91.56	+/- 15.88%
Secondary deforestation: Secondary forest - non forest	310.68	+/- 51.10	+/- 16.45%
Degradation: Dense forest - secondary forest	266.08	+/-100.52	+/- 37.78%

[31]Saatchi S., Meyer V., Xu A., Ferraz A., Yan Y. and Fricker A. (2015) Mai Ndombe Biomass Map. Institute of the Environment and Sustainability, University of California, Los Angeles. A report under the Carbon Map and Model Project financed by the International Climate Initiative of The German Federal Ministry for the Environment, Nature Conservation, Building and Nuclear Safety (BMUB)

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

[33] Poupon, H. (1980). Structure et dynamique de la strateligneuse d'une steppe Sahélienne au nord du Sénégal. Office de la Recherche Scientifique et Technique Outre-Mer, Paris, France.

Secondary regrowth:non-forest - secondary forest	-310.68	+/- 51.10	+/- 16.45%
Primary regrowth: secondary forest – Dense forest	-266.08	+/-100.52	+/- 37.78%

The table below lists the default values used for the determination of the individual emission factors.

Table 21: Default Values used for the Determination of Emission Factors

Parameter	Value	Source
Carbon fraction of AG forest biomass [tC/t]	0.47	IPCC AFOLU guidelines 2006, Table 4.3 (McGroddy et al. 2004)
Root-shoot ratio: forest > 125 tC/ha	0.24	IPCC AFOLU guidelines 2006, Table 4.4 (Monkany et al. 2006)
Root-shoot ratio: forest < 125 tC/ha	0.20	IPCC AFOLU guidelines 2006, Table 4.4 (Monkany et al. 2006)
Root-shoot ratio: savannah/shrubland	0.40	IPCC AFOLU guidelines 2006, Table 4.4 (Poupon 1980)

CALCULATION OF HISTORIC EMISSION FROM UNDEF/UNDEG

Using above determined emission factors and the results of area changes finally allows for the estimation of emissions from degradation and deforestation:

- Overall emissions from deforestation amount to 52,99 million tCO2/yr) and degradation (48,66 million tCO2/yr).
- The total emissions from deforestation and forest degradation for all land use classes are estimated to 107,14 million tCO2 per year.

Table 22: REL Results - Emission Level by Stratum

Stratum	Emissions Def. (tCO2e/yr)	Emissions Deg. (tCO2e/yr)	Total Emissions (in tCO2/yr)
PFC	8 329 738	17 491 692	26 440 224
PFE	15 805 953	11 878 258	28 320 309
NFC	770 872	1 497 288	2 499 630
NFE	5 111 835	3 542 190	9 281 040

SEC	4 477 034	4 097 254	9 471 157
MIX	18 491 221	10 155 059	31 124 125
TOTAL	52 986 654	48 661 741	107 136 486

9.4 REMOVALS FROM AFFORESTATION / REFORESTATION (A/R)

Though not being linked to historic emissions, Afforestation and Reforestation is an important mitigation activity which not only sequesters GHG emissions but also provides valuable alternative income (e.g. through cash crops) to local communities. This section presents the approach for accounting of removals from A/R.

The module for 'Afforestation / Reforestation' (A/R) covers removals due to afforestation and reforestation of any land located in the ER Program area that does not qualify as forest according to the national definition of forest. The A/R module hence accounts for the increment of forest carbon stocks in trees applicable to areas which do not qualify as forest prior to the mitigation activity.

The A/R module is based on the following documents:

- Small Scale CDM methodology 'Afforestation and Reforestation Project Activities implemented on Lands other than Wetlands', Version 3, CDM EB75, Annex 32.
- A/R Methodological Tool 14: 'Estimation of Carbon Stocks and Change in Carbon Stocks of Trees and Shrubs in A/R CDM Project Activities', Version 4.1, CDM EB75, Annex 26.

The A/R module covers the following types of land use changes, as listed in Appendix B of Annex to the Decision 6/CMP.1, §4:

(a) Grassland to forested land;
(b) Cropland to forested land;
(c) Settlement to forested land.

The module is applicable to activities which do not burn the A/R area for clearing the area for Afforestation / Reforestation. This will ensure that the A/R activitiy does not result in the emission from potent greenhouse gases such as CH_4 and N_2O which are not accounted for and hence would undermine the environmental integrity of the ER Program.

The module is applicable to activities which reforest areas which do not qualify as wetland. This will avoid releasing potential emissions from wetland soils such as CH_4 and N_2O.

Once an entity (e.g. a community or a NGO supporting a community) proposes the ER Program to include an A/R activity for the accounting of removals, the following procedure applies:

- The proposing entity shall provide a shape file of the area subject to reforestation. Moreover the proposing agency shall confirm in writing, that the area will not be cleared through burning.
- The ER Program will compare the proposed area with the forest area benchmark map and with the wetland map to verify/falsify whether the area qualifies as forest and/or as wetland.

- If the area qualifies as forest and/or wetland, or if fire is used to clear the reforestation area, then the area will not be added to the A/R stratum.

Carbon stored in deadwood is neglected. As the volume of deadwood will be higher under the project scenario compared to the baseline scenario, this is considered to be conservative.

The A/R module determines the net anthropogenic GHG removals by sinks as follows:

$$C_{A/R,t} = \sum_{i=1}^{n} C_{ACTUAL.i,t} - \sum_{i=1}^{n} C_{EXISTING,i} \qquad \text{Equation (1)}$$

Where:

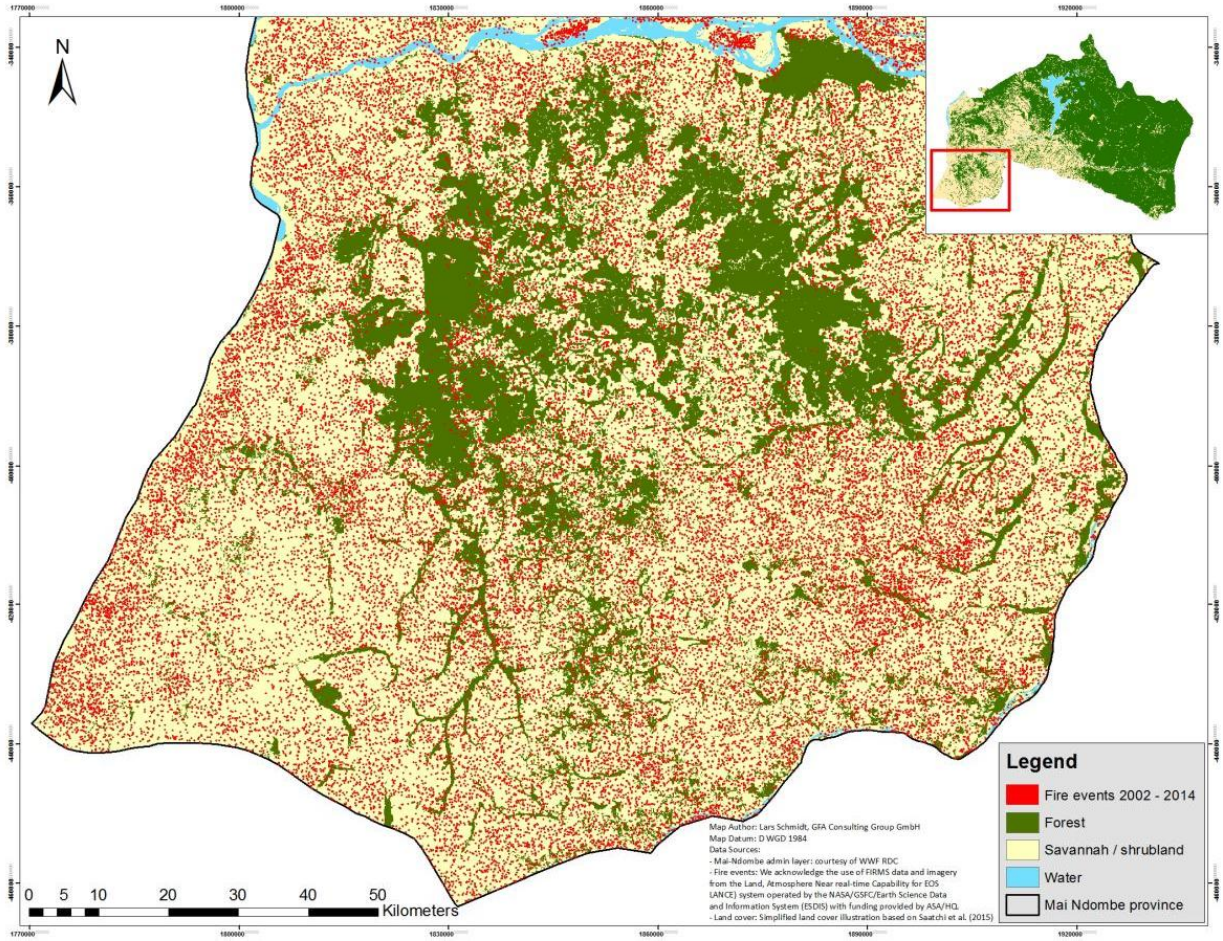
$C_{A/R,t}$	=	Net anthropogenic GHG removals by sinks, in year t; t CO2-e
$C_{ACTUAL.i,t}$	=	Actual net GHG removals by sinks, for area i, in year t, in t CO2-e
$C_{EXISTING,i}$	=	Baseline net GHG removals by sinks, for area i, in t CO2-e

The baseline net GHG removals ($C_{EXISTING,i}$) are determined using the results of the LiDAR carbon map. The LiDAR map provides special explicit carbon stock estimates for the Savannah comprising carbon stored in trees and shrubs. This allows for an efficient and accurate approach of determining the carbon stocks of the existing vegetation, prior to the implementation of the A/R activity.

In line with CDM EB75, Annex 26, possible changes in stocks in trees and shrubs in the baseline scenario are accounted as zero, as the land is subject to periodic cycles of burning, so that biomass under the baseline is assumed to be in a dynamic equilibrium. To validate this statement, an analysis of the spatial distribution of fire incidents in the Mai Ndombe Province was conducted based on fire events recorded by the MODIS sensor aboard the Terra and Aqua satellites. Fire events from January 2002 to December 2014 were taken into account. Over these 13 years, a total of 138,174 fire events were recorded. Of these, 136,414 incidents could be attributed to have occurred in either forest land or savannah / shrubland (based on a 2014 land cover map by Saatchi et al. 2015).

From these total fire incidents, 113,418 incidents are located in non-forest areas (corresponding to 83.1%). The figure below shows an area in the South West of the Mai Ndombe Province - Plateau district - which is dominated by Savannah and shrubland vegetation (i.e. mostly classified as non-forest). The figure illustrates that non-forest areas are subject to frequent burning.

Figure 8: Fire Incidents in MNDP Areas dominated by Shrubland and Savannah



Source: Source: FIRMS –EOSDIS Earthdata based on a request for the period January 2002 to December 2014

However, the results of the analysis may be biased insofar, as each MODIS fire location represents the center of a 1km pixel that is flagged by the algorithm as containing one or more fires within the pixel. As such, if the center of the fire location is at the edge of forest / non-forest patch, the fire may have occurred in either or both forest and non-forest. Further, it is important to note, that MODIS fire data does not allow to assess the total area burnt.

However, the results of the analysis provide a strong indication that large areas of savannah and shrubland are periodically burned. This is accordance with national greenhouse gas emissions baseline projections by IISD (2013) as well as expert opinion.

It is hence concluded, that non-forest areas are subject to periodic fire and hence the re-growth can be neglected.

See Annex 15 for equations to calculate the change in the carbon stocks during the program period.

9.5 EMISSIONS FROM PLANNED DEGRADATION (PDEG)

METHODOLOGY

CN-REDD, through the World Bank, commissioned FRMi to calculate the REL for Planned Degradation (PDEG). The work undertaken by FRMi build on the substantial preparatory work by GFA Consulting Group and WWF RDC (Carbon Map & Model project), which had already developed a large proportion of the PDEG methodology.

For the final methodology, a number of different existing methodologies that are used to estimate emissions from planned degradation/(industrial) timber harvesting were reviewed.

These included:

- The validated VCS methodologies VM0010 and VM0011. These methodologies are methodologies developed for VCS-type Improved Forest Management (IFM) projects, that intend to set-aside commercial timber harvesting areas for protection (so-called Logged to Protected Forest or LtFP projects). While these methodologies are only of use for conservation concessions in the project scenario, the baseline calculation can be used for commercial timber harvesting activities in general.
- Hirsh et al. (2013) developed a methodology for calculating emissions from forestry infrastructure to calculate emission reductions from reduced impact logging (RIL). The methodology was developed specifically for industrial forestry concessions in DRC and was applied to 5 forestry concessions in Mai-Ndombe province.
- Schmidt (2014) developed a jurisdictional methodology to account for emissions and emission reductions from industrial logging in the DRC. The methodology was developed based on VM0010, VM0011, the RIL methodology by Hirsh et al. (2013) and the VCS *methodology for improved forest management through reduced impact logging (RIL-C)* from The Nature Conservancy, the Tropical Forest Foundation and Terra Carbon, which is still undergoing validation by the VCS.

Based on this review, the PDEG final methodology was developed, which is presented below. With the exception of emissions from fossil fuel combustion from harvesting operations and wood processing, this methodology covers all emission sources and removals along the industrial timber harvesting & wood production chain. Emission sources and removals were categorized as follows for a better structuring of the methodology (see Table 23).

Table 23: Emissions and Removals included in the Baseline and Program-Scenarios

Category	Emissions / Removals
Forestry infrastructure	Emissions from re-opening of permanent roads
	Emissions from clearing of primary roads
	Emissions from clearing of secondary roads
	Emissions from clearing of sub-canopy roads
	Emissions from clearing of skid trails
	Emissions from clearing of log landings
Tree felling	Emissions from harvested timber (calculated in the harvested wood product's

	section)
	Emissions from logging slash (stump &crown residues)
	Emissions from residual stand damage
	Emissions from abandoned timber
Harvested wood products	Emissions from harvested wood products emitted immediately after harvest
	Emissions from harvested wood products released between years 3-100
	Removals from harvested wood products
Regrowth	Removals from regrowth on primary roads
	Removals from regrowth on secondary roads
	Removals from regrowth on sub-canopy roads
	Removals from regrowth on skid trails
	Removals from regrowth on log landings
	Removals from regrowth at felling sites

The following elements were taken from existing methodologies:

- Emissions from forestry infrastructure: Hirsh et al. (2013) and Schmidt (2014)
- Emissions from harvested timber: VM0010, VM0011 and Schmidt (2014)
- Emissions & removals from harvested wood products: VM0010
- Removals from forest regrowth: VM0010, Hirsh et al. (2013), Schmidt (2014)

Some of the elements were then updated to better reflect logging practices. Field data collection and remote sensing e.g. showed that further road categories should be differentiated (re-opening of permanent roads and sub-canopy roads), as emissions from these road categories does not correspond to emissions from primary or secondary roads.

While the methodology relies on a comparatively high number of parameters (>40) and formulas, it is still relatively simple. The decisive (activity) data is the annual area harvested and annual volume logged. Most other data is related to these two parameters as a ratio (e.g. road density, residual stand damage in relation to extracted volume, etc.).

Further, the methodology uses, where possible, concession-specific data, to allow for the calculation of as accurate as possible concession-specific baselines. Consequently, the PDEG REL is provided both as an aggregate REL (sum of historical emissions from all forestry concessions) as well as a 'nested baseline' for each forestry concession which obviously is 100% compatible with the aggregate REL_{PDEG}.

Finally, the very same methodology was used to calculate an adjusted REL_{PDEG} (both aggregate and for each concessions). For this, only the number of years was changed from 11 (reference years) to 5 (programme years).

Below, all equations for the calculation of the historical REL are presented.

See Annex 16 for all equations used for the calculation of the REL PDEG.

ACTIVITY DATA

We list here the different parameters which are detailed in Annex 23:

1. Area harvested in year y during the reference period (For years 2004-2014)
2. Area harvested in year y during program period (year 2017-year 2021)*
3. Average width of permanent roads
4. Average length of permanent roads per unit area of exploited concession area for the reference period 2004-2014
5. Average width of solar strips along permanent roads
6. Fraction of trees with a DBH>30 cm remaining on solar strips per unit area of exploited concession area
7. Average width of primary roads
8. Average length of primary roads per unit area of exploited concession area for the reference period 2004-2014
9. Average width of solar strips along primary roads
10. Average width of secondary roads
11. Average length of secondary roads per unit area of exploited concession area for the reference period 2004-2014
12. Average width of solar strips along secondary roads
13. Average width of sub-canopy roads
14. Average length of sub-canopy roads per unit area of exploited concession area for the reference period 2004-2014
15. Average width of skidtrails
16. Average length of skidtrails per unit area of exploited concession area for the reference period 2004-2014
17. Average area of log landings
18. Average number of log landings per unit area of exploited concession area
19. Volume harvested in year y of the reference period (For years 2004-2014)
20. Volume harvested in year y of the program period (For years 2017-2021)
21. Factor for abandoned timber
22. Factor for abandoned timber
23. Fraction of wood waste from other industrial roundwood products
24. Proportion of sawnwood out of total wood products
25. Fraction of wood waste from sawnwood products
26. Proportion of wood-based panels out of total wood products
27. Fraction of wood waste from production of wood-based panels
28. Fraction of short-lived fractions in other industrial roundwood products
29. Fraction of short-lived fractions in sawnwood products
30. Fraction of short-lived fractions in sawnwood products
31. Fraction of additional oxidized fractions in other industrial roundwood products
32. Fraction of additional oxidized fractions in sawnwood products
33. Fraction of additional oxidized fractions in wood-based panels products
34. Average area of felling sites
35. Average number of trees per felling site
36. Average volume per harvested tree
37. Average wood density of harvested trees
38. Biomass expansion factor
39. Residual stand damage factor

EMISSION FACTORS

We list here the different parameters which are detailed in Annex 24:

1. Fraction of average carbon stock of trees of trees with a DBH <50 cm in total aboveground biomass
2. Root-shoot ratio (RSR)
3. Fraction of average carbon stock of trees of trees with a DBH > 30 cm in total aboveground biomass
4. Average carbon stock in above ground biomass per unit area of exploited concession area
5. Fraction of average carbon stock of trees of trees with a DBH < 20 cm in total aboveground biomass
6. Carbon fraction in woody biomass
7. Average annual increment

CALCULATION OF HISTORIC EMISSIONS FROM PDEG

For the calculation of the PDEG REL, see the excel spreadsheet REL_MaiNdombe_ExcelTool_AjustementConservatif.xlsx submitted with the ERPD.

The Annex 26 provides also the individual historical annual average REL_{PDEG} for each forestry concession over the reference period.

The total REL_{PDEG} over the reference period is calculated as 7,053,852 ± 424,079 tCO_2.The annual average REL_{PDEG} over the reference period is calculated as approx. 641,259 tCO2/year.

9.6 UPWARD OR DOWNWARD ADJUSTMENTS TO THE AVERAGE ANNUAL HISTORICAL EMISSIONS OVER THE REFERENCE PERIOD

EXPLANATION AND JUSTIFICATION OF PROPOSED UPWARD ADJUSTMENT TO THE AVERAGE ANNUAL HISTORICAL EMISSIONS OVER THE REFERENCE PERIOD

FCPF eligibility requirements

The Carbon Fund Methodological Framework states that a Reference Level shall not exceed the average historical emissions over the Reference period, unless the ER Program can demonstrate to the satisfaction of the Carbon Fund that the following eligibility requirements can be met:

i. Long-term historical deforestation has been minimal across the entirety of the country, and the country has high forest cover;
ii. National circumstances have changed such that rates of deforestation and forest degradation during the historical Reference Period likely underestimate future rates of deforestation and forest degradation during the period of the ERPA.

According to the DRC's forest cover change detection map for the period 1990-2010, prepared in 2015 by the DIAF with the support of FAO, the DRC had a forest cover of approximately 152 million hectares in 2010. According to World Bank (2015), DRC's forest cover amounts to 67.58%. DRC's forest cover ratio ranks 19th out of 248 countries.

Moreover DRC features an annual deforestation rate of approximately 0.30% between 1990 and 2010. The DRC can therefore be classified as a country with high forest cover and low deforestation (HFLD).

For Maï-Ndombe the deforestation rate increased significantly over the historic reference period (107,132 ha in 2004 compared to 183,910 ha in 2014) and it is expected that deforestation and forest degradation will accelerate further in future years.
It is assumed that such an increase is a result of population growth, improved economy, and the increasing political stability that has been achieved over recent years, leading to an influx of investment into the country, improving infrastructure and therefore access to more and more parts of the country. This hypothesis is assessed through a multiple regression analysis, which is presented below.

Approach and justification for Maï-Ndombe adjustment for UNDEF REL

Population Development

There are numerous datasets reporting population for DRC, some of them report at the provincial level, and others at the territory level from which population estimates for the Maï-Ndombe Province can be derived. These include:

- FAO population data reported at the National level that includes projected population[34],
- UNDP population broken down by province and estimated for 1994 and 1998[35],

[34] http://faostat3.fao.org/download/O/OA/E

[35] http://www.cd.undp.org

- Population data reported by the DRC Ministry of Public Health for 2010 to 2015 by province[36],
- Population data reported by de Saint Moulin (2006),
- Population counts reported by M Rodriguez et al. (2015) and Bénéficier du Dividende Démographique (Gengnant et al., 2014).

For both FAO and Ministry of Health, population increases were 2.75% per year. FAO reports this as the national average, while the Ministry of Health disaggregates it across provinces[37]. However, each province has exactly the same 2.75% growth, indicating that they have taken the FAO reported growth and divided it evenly across provinces. The UNDP number shows varying population growth numbers for different provinces, but when averaged across the country population growth is zero calling into question the dataset. In turn, the average annual population growth rate provided by Leon de Saint Moulin is about 3%. Population estimates for Health zones derived using this growth rate are globally consistent with the ones obtained by applying the 3% growth rate to the 1984 population census data. Population estimates provided by the Ministry of Interior for the year 2014 to the BioCf*plus* in the Maï-Ndombe are sometimes double the population counts obtained by applying the 3% growth rate to the 1984 population census data. Gugnant et al, estimate growth per year at 2.6% in the MaïNdombe area based on an analysis of data from the de Saint Moulin study and figures from the Ministry of Health and the U.N., with a national average of 3.2% from 1984-2010. What is known is that the last population census was in 1984, and since that time all population data for DRC are estimations or projections. Thus no highly reliable data exist for population numbers or growth in population for Maï-Ndombe, however, it is clear that the population is increasing and the consensus across studies is for a 2.6 to 3% growth rate.

This population growth is undoubtedly impacting deforestation rates in MaïNdombe and provides compelling evidence that future deforestation rates are likely to rise. The upcoming DRC population and habitat census planned to be launched in the coming years will probably provide robust population data which can further be used to assess the relationship between population growth and deforestation for Maï-Ndombe.

Economic Development

A paper by Ferretti-Gallon and Busch (2014) reviewed 117 spatially explicit econometric studies of deforestation. It found that forests are more likely to be cleared where economic returns to agriculture and pasture are high. These economic returns are linked to the profit that is achieved from production and access to markets. It also found that poverty is highly correlated with lower deforestation rates, and therefore improved economy is correlated with increasing rates of deforestation. In the case of DRC, potential agricultural production is one of the highest in Africa, and at the same time access to markets is one of the poorest (Ulimwengu et al., 2009). The poor access to markets and poverty in DRC are prevalent in MaïNdombe, which has limited economic returns and therefore limited large-scale development of agriculture pasture and mining (Dorosh et al., 2010; DRC, In Press; Ulimwengu et al., 2009; Wilkie et al., 2000). Along with agriculture, the demand for fuelwood is increasing due to population growth and lack of alternative energy sources. Fuelwood demand is not only local for

[36]http://drcongo.opendataforafrica.org/ayyfgdd/population-distribution-by-province-of-the-drc-2010

[37] The report by Rodriguez et al. (2015) also used Ministry of Health data, but they appear to have obtained for Mai Ndombe.

MaïNdombe, but increasingly as a source for Kinshasa (Schure et al., 2010). It is estimated that around 24% of fuelwood enters the Kinshasa market via the Congo River from provinces like Bandundu (Schure et al., 2011). For MaïNdombe, proximity to Kinshasa along with improved road and river transport is already having an impact that can be seen in the increasing rate of deforestation (See Section Historical deforestation data), and will only increase as the access to the markets of Kinshasa are improved (Dorosh et al., 2010; DRC, In Press; Ulimwengu et al., 2009).

A number of economic factors were investigated as explanatory variables for adjusting the average historical deforestation rate, including Gross Domestic Product (GDP), agricultural production index, and the price of agricultural commodities. While that data was not able to be quantitatively linked to deforestation trends, qualitatively it provides compelling evidence for an upward adjustment to MaïNdombe historical rates of deforestation.

Gross domestic product and agricultural production index are reported nationally for 2003 to 2013 by the Central Bank of Congo[38]. National GDP has steadily risen since 2003 at a rate of 16.8% per year. The agricultural production index, which is a measure of the volume of production compared to a base year (in this case 2000) also rose steadily between 2003 and 2013 at a rate of 2.8%. This data provides evidence that the economy of DRC is steadily growing, which does provide an explanation for increasing deforestation rates in MaïNdombe for the Reference Period and onwards into the future.

Table 24. Agricultural Production in Maï-Ndombe in 2005

Crop	Green weight (in t)
Cassava	5,158,950
Maize	234,919
Rice	68,571
Plantain	62,287
Sweet potato	54,395
Millet	49,385
Potato	3,701
Peanut	623
MONOGRAPHIE DE LA PROVINCE DU BANDUNDU, 2005; Table 2	

Commodity prices for the primary agricultural products were also evaluated, however, limited data was available. FAO statistics indicate the major crops for DRC are cassava, plantains, maize and rice. For Bandundu Provence where MaïNdombe is located the primary crops are cassava, maize, rice, peanut, beans, plantains sweet potato, and potato.

Cassava dominates the market in DRC, and Bandundu province is the biggest producer in DRC with an estimated 22% of the total production (Humpal, et al., 2012; Table 2). Data from Humpal, et al. (2012) suggests that over the period of 2000-2006 production has remained relatively flat for both DRC and Bandundu.

In conclusion, despite difficulties to quantitatively correlate economic development with deforestation rates in MaïNdombe, the qualitative evidence provides a compelling case for increasing deforestation rates in the future as infrastructure improves, the general economy improves, and the wealth of

[38]http://drcongo.opendataforafrica.org/bpkbqw/main-macroeconomic-indicators-of-the-drc-2012

agriculture and mining resources in MaïNdombe are realized. The figure below presents the development of GDP population and agricultural parameters over the historic reference period.

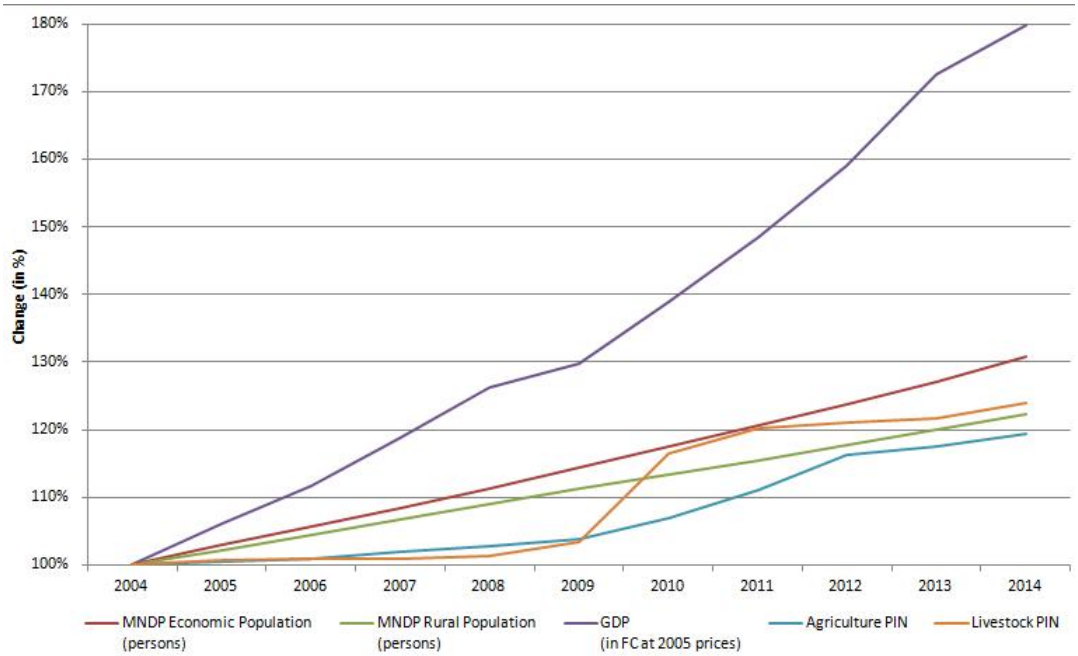


Figure 9 Evolution of GDP, population and agricultural parameters over the reference period

Regression analysis model

The proposed approach for the determination of the adjustment for the UNDEF REL employs a multiple linear regression analysis to determine the relationship between historical deforestation (dependent variable) and a number of independent variables. This results in a function which allows to calculate deforestation during the program period based on a set of independent variables (e.g. GDP in 2016). The following steps were applied:

- Deforestation is expressed as hectares deforested per annum. The change analysis was done for five epochs (providing related area estimates) which then were broken down to annual values. It is important to note that the change detection is based on a sampling approach which is inherently designed to address cloud issues but was not designed to provide annual estimates. Hence these values are considered as an approximation.
- We established the hypothesis that deforestation is a result of a) increase of agricultural production area for subsistence and cash crops, b) increase of woodfuel and charcoal and c) increase of population and d) GDP. In a next step, we collected historic data for all variables and tested the hypothesis through multiple linear regression analysis (using SPSS) with deforestation being the dependent variable. This results in a function which includes a constant and a coefficient for each independent variable. We ran several multiple linear regression analyses to finally arrive at a function that a) is qualitatively plausible with regard to explaining deforestation, b) has a satisfactorily explanatory value (R^2) and c) is statistically sound in terms of being significant, having no or a low collinearity between the independent variables.

- Comparing past deforestation as projected by the regression analysis with the measured past deforestation provides a measure of how well the derived function (a constant plus coefficients for each independent variable) predicts deforestation.
- For each monitoring period, the function will be fed with measured data for each independent variable (e.g. population data for 2016). This will allow for calculating the adjustment of the UNDEF REL which represents the 'baseline emissions' in absence of the ER Program's activities for the monitoring period with a measured 'explanatory value'.

The annual values of input parameters for population, economic development and agricultural productivity are presented in Annex 25. The hypothesis to be tested by the regression analysis for explaining past deforestation is hence formulated as:

$$Def_t = k + aEP_t + bRP_t + cGDP_t + dCaP_t + eAGR_t + fLS_t + gCeP_t + hWF_t + iOP_z \qquad \text{Equation (2)}$$

Where:

K	Constant;
a – i	Coefficients;
EP_t	Economic population, i.e. at working age in the Mai N'dombe province, in 1000 persons, in year t;
RP_t	Rural population in the MNP, in 1000 persons, in year t;
GDP_t	Gross domestic product at national level, in 1000 Franc Congolais at 2005 prices, in year t;
CaP_t	Cassava production in the MDP, in tons, in year t;
AGR_t	Agricultural Production Index (FAO), in year t;
LS_t	Livestock Production Index in the MDP, in 1000 USD, in year t;
CeP_t	Cereal production, in t, in year t;
WF_t	Wood fuel production in t, in year t;
OP_z	Oil palm production, in t, in year t.

These input parameter were entered into a statistical software (SPSS) which validates the hypothesis and conducts a series of complementary statistical tests. Inter alia the multicolinearity test indicates that many parameter are highly correlated. These parameters were excluded automatically from the analysis which then was constrained to oil palm production and rural population. Moreover, the number of observations (i.e. deforested area per year, n=11) constrains the number of parameters to be considered. In order to not artificially inflate the 'explanatory value' (i.e. the determination coefficient R^2), it is good practice to not include more than 2 parameters for 11 observations.

The Annex 25 present the different inputs and outputs of this regression analysis and the table below finally presents the results of the regression analysis for these two parameters:

Table 25: Regression Analysis - Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
2	0.990[b]	0.980	0.975	7233.656

b. Predictors: (Constant), Oilpalm_DRC, Rural_Pop

Discussion of Findings

The derived multiple linear regression function contains two coefficients, rural population (negatively correlated) and oil palm (positively correlated). While a negative correlation for rural population may seem counter-intuitive, several studies have shown that tropical deforestation is linked to urban population growth (cp. e.g. DeFries et al 2010), in particular in Sub-Saharan Africa (cp. Rudel 2013). With the ever-growing capital city of Kinshasa being in the vicinity of Mai-Ndombe province and being a beacon for the (poor) rural population, which then engages in trade activities and also increases its ecological per-capita footprint, the urbanization hypothesis seems generally feasible.

As to be expected, oil palm production area is positively correlated with deforestation. In case of SE-Asia, no one would seriously doubt such a correlation. In our case, for lack of provincial data, we again had to rely on national data. Mai-Ndombe features both old reactivated and new oil palm plantations and in general oil palm production in DRC is increasing (FAOSTAT 2015).

In terms of statistical parameters, the adjusted R^2 of the regression model of 0.975 is considered to be very good. Further, the correlations of both the palm oil and rural population coefficients are highly significant. Multicollinearity statistics (tolerance and VIF) are above 0.2 and below 5 respectively and are thus considered to be acceptable.

The overall objective of the regression analysis is to calculate the coefficient of determination (referred to as 'explanatory value' above). The coefficient of determination (denoted as 'R^2') is a number which indicates how well deforestation (dependent variable, in ha lost per year) is determined by the independent variables. The coefficient of determination can range between 0 (no determination) and 1 (complete determination). However the level of R^2 is affected by the number of variables (i.e. the more variables are included in the analysis, the higher). This effect is corrected by the determination of the 'adjusted R^2'. As indicated by the table above the analysis results in a R^2 of 0.980 and an adjusted R^2 of 0.975. It is hence concluded, that past deforestation is well determined/explained by the independent variables. Figure 10 below illustrates the results.

Monitoring of the Adjustment

The adjustment approach suggested here allows calculating the adjustment annually ex-post based on the independent variables. This ex-post adjustment is much more robust, as it does not require making an ex-ante estimate (prediction) of the independent variables. Forecasting the independent variables used in this multi-linear regression analysis would likely add a high level of uncertainty to the adjustment. Fixing the adjustment ex-post based on the monitored independent variables reduces uncertainty and makes the adjustment more credible.

In consequence, the ER Program will monitor the following additional parameters (activity data):

1. Rural population
2. Oil Palm production

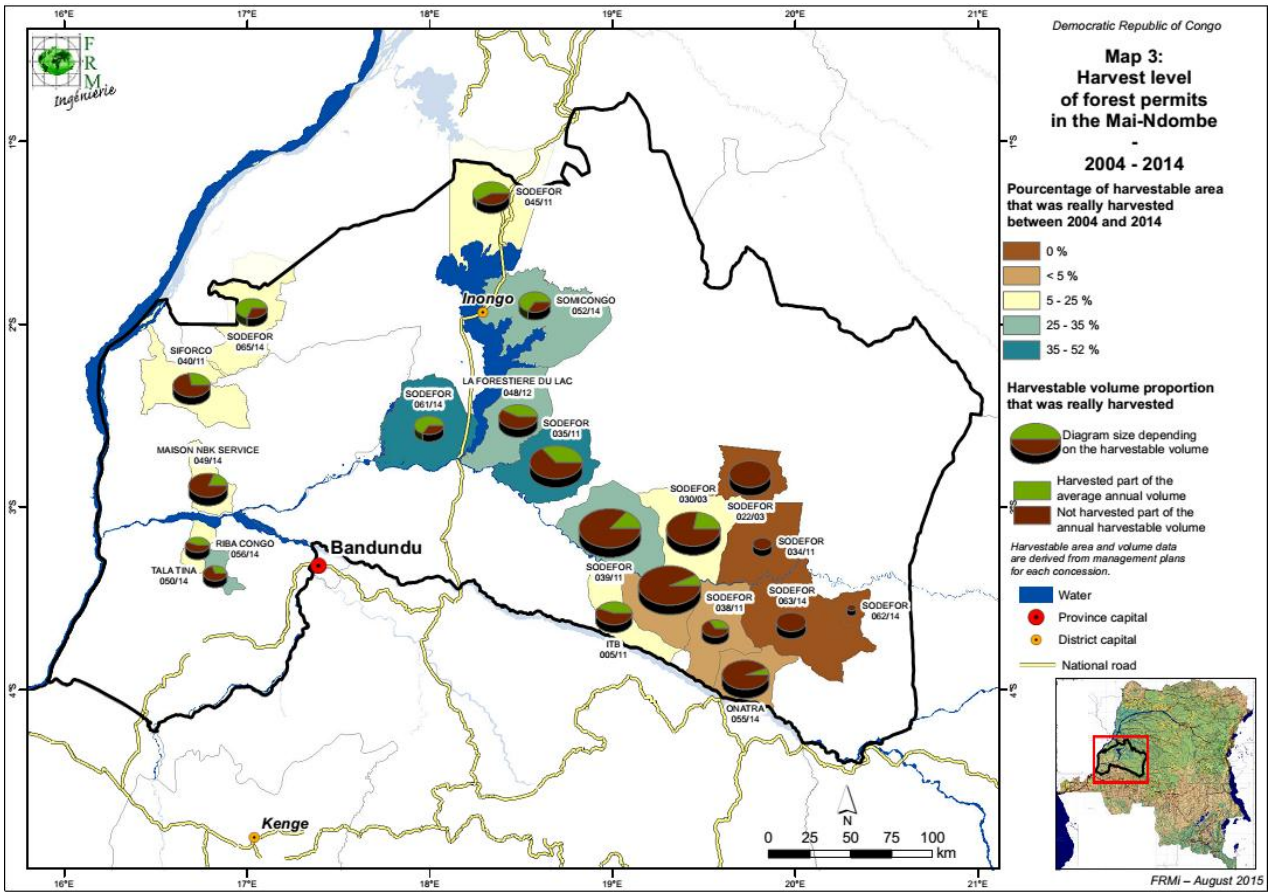
Approach and justification for Maï-Ndombe adjustment for PDEG REL

The ER Program is of the opinion that the historical REL_{PDEG} will not adequately reflect emissions from industrial logging during the program period, as harvesting areas and volumes have been historically low.

The map below shows that during the reference period 4 out of 20 concessions have not been harvested in the reference period (N° CCF 34/11, 62/14 and 64/14, N° GA 22/03) but harvesting is planned for the program period, which is indicated by the interim forest management plans (i.e. 'plan de gestion') and forest management plans ('plan d'amenagement'). Further, in 7 concessions, the actual area harvested was between 5%-25% of the area that could have been legally harvested. One such example is the SIFORCO concession N° CCF 40/11, where harvesting has only started in 2012. In the other concessions harvesting has only occurred on an intermediate basis, i.e. harvesting did not take place every year.

Further, the map illustrates that even when the actually harvested area was relatively high, actually harvested volumes (compared to legally harvestable volume) is still low in several cases (e.g. N° CCF 35/11).

Map 7: Harvesting level of forestry concessions during the reference period (Source: FRMi, 2015)



The production level of formal logging sector in DRC is extremely low comparing to others Central African countries.[39]. With more than the half of humid dense forest, DRC only produce 4% of formal wood production of central Africa with a maximum volume of 400 000 m3/year from early 1990. To give a comparison, the forest sector in the others Central African countries is around 6 Million of m3/year. Even if DRC forest are slightly poorer in commercial wood than other Central African countries, a valorization of the current attribution of concession could reach a collective 600,000 to 900,000 m3/year. The prospective study of forest sector done by FAO in 2000 was estimating a commercial volume potential of 10 million of m3/year at the national level

The wood demand on world market continue to grow (according to OIBT[40]) but the constraints to the development of DRC production are linked to internal factors such as logistical difficulties to transport products, low national demand, weak governance and low confidence of investors.

The current effort to improve forest sector governance with the support of international partners are increasing the business climate and will favorize investment and increase competitiveness of wood coming from concession in national and international markets. Production from these concessions is then likely to increase.

Recent improvements in forest governance require forest concessionaires to develop and submit detailed forest management plans for each forestry concessions. While the development of these management plans is in progress, forestry concessionaires have to submit so-called interim forest management plans (plan de gestion) which are valid for 4 years (or shorter if the management plan is approved and enters into force earlier). Of the 20 forestry concessions, 18 have approved interim forest management plans, of which 3 have submitted full forest management plans for approval. For the remaining 2 concessions, harvesting is planned but no (interim) management plans are yet available. Data from these (interim) management plans show an increase in harvesting area and volume compared to the reference period. The average annual area harvested over the reference period is approx 33,500 ha, the max. area harvested over the reference period is approx. 43,000 ha. Data from the (interim) forest management plans indicate a planned average annual harvesting area of approx. 69,000 ha. This is more than twice the historical average and approx. 150% of the historical maximum. However, as indicated above, this increase in logging area can be explained with an increase of concessions that become operational, i.e. that are actually harvested as well as an increase of harvesting in operational concessions (harvesting every year or more harvesting). The Reference level considers thus that the overall area legally available for logging each year (1/25 of exploitable area) will be effectively logged.

The average annual volume logged across all concessions in the reference period amounts to approx. 129,000 m³ (over bark), which give a historical logging intensity of approx. 4m³ / ha. This value (which is comparatively low for Central Africa) is in line with reported logging intensities for DRC see e.g. (ITTO 2004). We can assume that the forestry sector development will stimulate valorisation of new species allowing an increase of wood extraction.

The average annual volume to be logged during the ER Program period based on (interim) forest management plans amounts to approx. 500,000 m³. This is approx. 400% of the annual historical volume and gives a logging intensity of more than 7m³ / ha. Such an increase in volume is - in contrast to the increase in harvesting area - not plausible, as it entails almost a doubling of the harvesting intensity. The ER Program assumes that the forestry concessionaires have included the maximum volume that can be

legally harvested in order to not restrict future harvesting levels. As this is deemed unrealistic, the volume data was corrected downwards by using the historical harvesting intensity.

To account for the possibility that harvesting areas and volumes may fluctuate, a high uncertainty of 50% was attributed to both the harvesting area and the harvesting volume.

QUANTIFICATION OF THE PROPOSED UPWARD ADJUSTMENT TO THE AVERAGE ANNUAL HISTORICAL EMISSIONS OVER THE REFERENCE PERIOD

Determination of the Cap

The adjustment is limited to 0.1% of total forest carbon stocks in the program area. All adjustments to any of the component REL of the ER Program (UNDEF, PDEG, UNDEG) must fit under this cap. Current program data gives a total stock of 1.434 billion tons of carbon; 0.1 % of this stock is 1.434 million tons of carbon or 5,259,494 tons of carbon dioxide (Table 26). This represents the maximum upward adjustment the ER Program may apply per year.

Table 26: Determination of the Cap for the Adjustment

	Carbon Stocks (in tC02/ha)	Stratum Area (in ha)	Total Carbon (in tC02)	Adjusment Cap (in tCO2/year)
Primary forest	656.67	5,618,587	3,689,545,202	3,689,545
Secondary forest	390.59	3,353,149	1,309,713,718	1,309,714
Non-forest	79.92	3,256,307	260,234,701	260,235
Total	N.A.	12,228,043	5,259,493,621	5,259,494

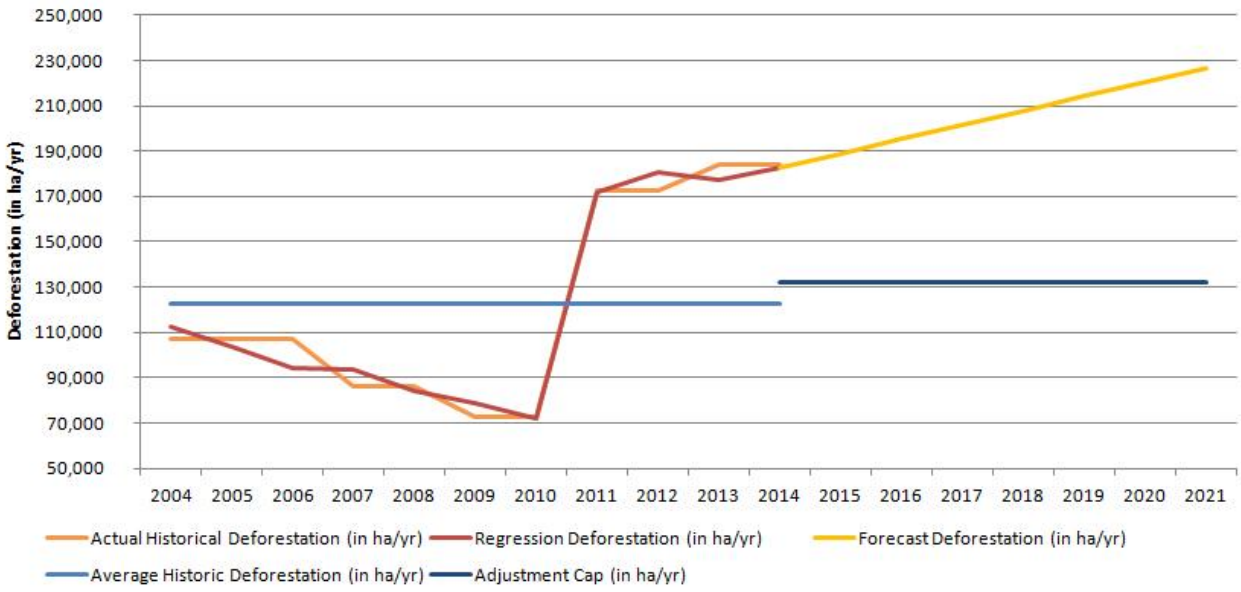
Quantification of the UNDEF adjustment

The figure below presents the results of the adjustment analysis. It shows the historic deforestation (orange line), the output of the regression analysis for the historic reference period (red line), partly based on an extrapolation of input parameter into the future (yellow line). The average historic emissions are represented by the blue line, whereas the dark blue line indicates the cap.

During the years 2011 to 2014 Mai Ndombe experienced a significant increase of deforestation, which increased the annual emissions of already beyond the cap. The output of the regression analysis indicates, that the emissions in the Mai Ndombe region will further increase, in the absence of the ER Program.

Consequently, as an ex-ante estimate, it is assumed that the adjustment exceeds the cap. However the adjustment for UNDEF will be subject to annual monitoring i.e. monitoring of input variables, which then will be fed into Equation 2 described above.

Figure 10: Results of the UNDEF Adjustment compared to the Adjustment Cap



Quantification of the PDEG adjustment

As explained above, we also provide an adjusted REL based on the (interim) management plans for each concession for the ER Program period (areas to be harvested) as well as historical logging intensity. Historical logging intensity was chosen to produce a more conservative estimate and to rule out any possibility of manipulation of volume data.

Please refer to the accompanying excel file (20160111_REL_MaiNdombe_ExcelTool_AjustementConservatif.xlsx) to see how the adjustment was calculated in detail.

The total adjusted REL_{PDEG} over the programme period 2017-2021 is calculated as 15,744,712 ± 991,764 tCO_2.

The annual average adjusted REL_{PDEG} over the programme period is calculated as approx. 3,148,942 tCO_2.

The annual difference to the historical REL_{PDEG} amounts to 2,507,683 million tCO_2, which is approx. 48% of the allowed adjustment.

The Annex 26 provides the individual annual average adjusted REL_{PDEG} for each forestry concession over the program period.

9.7 ESTIMATED REFERENCE LEVEL

The table below provides finally the ER program's Reference Emission Level based on the average historical emissions in the Program area over the historic reference period from 2004 to 2014.

Please note, the table above does not indicate annual historical removals by sinks, as the emissions from UNDEF/UNDEG are determined based on net deforestation and degradation, i.e. the removals are already subtracted.

Table 18: ER Program Reference Level

ERPA term year *t*	Average annual historical emissions from UNDEF (tCO_{2-e}/yr)	Average annual historical emissions from UNDEG (tCO_{2-e}/yr)	Average annual historical emissions from PDEG (tCO_{2-e}/yr)	Total Adjusment (tCO2e/yr)	Reference level (tCO_{2-e}/yr)
1	52 986 654	48 661 741	701 555	5 259 494	107 609 443
2	52 986 654	48 661 741	701 555	5 259 494	107 609 443
3	52 986 654	48 661 741	701 555	5 259 494	107 609 443
4	52 986 654	48 661 741	701 555	5 259 494	107 609 443
5	52 986 654	48 661 741	701 555	5 259 494	107 609 443
Total	264 933 268	243 308 705	3 507 774	26 297 470	538 047 217

9.8 RELATION BETWEEN THE REFERENCE LEVEL, THE DEVELOPMENT OF A FREL/FRL FOR THE UNFCCC AND THE COUNTRY'S EXISTING OR EMERGING GREENHOUSE GAS INVENTORY

The Democratic Republic of the Congo is currently establishing its national Forest Reference Level (FRL) which is envisaged to be submitted to the UNFCCC in September 2016. A methodological note has just been produced by the Ministry of Environment with the support of FAO in November 2015. This note defines the features of the FRL and specifies the work steps to be accomplished until 09/2016.

As the national REL is not yet established, key institutions established a working group which aims inter alia at integrating lessons learned from the MNDP REL development into the development of the national REL as well as to ensure consistency between the provincial- and national REL..

These works will be based on the general principle, that the MNDP REL, which is more detailed (e.g. covers degradation), is built into- and hence informs the national REL. This working group will follow the subsequent three steps:

1. Harmonize the Land Cover Classes: The MNDP REL features five land cover classes whereas the national REL comprises three classes. In order to integrate the MNDP REL into the national REL, land cover classes will be harmonized as specified in Table 27.

Table 27: Harmonization of Land Cover Classes in the MNDP and National RELs	
MNDP REL	National REL
Stable Primary Forest	Stable Forest
Stable Secondary Forest	
Degradation	
Stable Non-Forest	Stable Non-Forest
Deforestation	Deforestation

2. Conduct the accuracy assessment of the 2000-2014 Land Cover Change (LCC) map in the Mai-Ndombe area, using the samples taken by WWC. The sampling design must include the classification done by DIAF and OSFAC. In other word, we will estimate the change area of 2004-2014, using the 2000-2014 map produced by DIAF as background and the sampling of WWC to adjust the area to 2004-2014.
3. The result of the assessment will be the area estimates by class of Mai-Ndombe area in the National Reference Emission Level. So the result will be an area with a confidence interval (for example: *Stable Forest: 1000 Ha ± 100, stable non forest 500 ha ±50 and deforestation 100 ha ±10).*

Following these three steps, the MNDP REL will inform the national REL. Moreover it allows for building on the achievements and lessons learned of the Mai-Ndombe REL development. However the MNDP REL's findings on degradation will be neglected, as the national REL will follow a more coarse land cover classification.

In term of emission factors, DRC considers that EFs derived from LIDAR data are more accurate than EFs derived from the National Forest Inventory based on plot data. Hence the Emission Reduction Program is encouraged to proceed using LiDAR based EFs. For the national REL, the working group will evaluate whether national EFs may be based on national LiDAR data, on the national Forest Inventory, or a combination of both.

10. APPROACH FOR MEASUREMENT, MONITORING AND REPORTING

10.1 MRV APPROACH FOR ESTIMATING EMISSIONS OCCURRING UNDER THE ER PROGRAM WITHIN THE ACCOUNTING AREA

GENERAL OUTLINE OF THE MONITORING PLAN

This section describes the general outline of the monitoring plan and is inherently linked to the Reference Emission Level approach laid out in Section 8.

- The ER Program assumes the overall responsibility for the implementation of the monitoring of the emissions due to land use change of the ER Program area. In this regard the ER Program assumes a managing role. The individual monitoring activities will be implemented both by state agencies (such as DIAF) and other entities including individual villages or forest concessionaires. Where applicable, the ER Program will carry out QAQC measures – either itself or through third parties – to ensure a high quality of monitoring results prior to verification.
- The monitoring plan is in line with the approach of the REL. The REL follows the stratification by land use, land cover and by activities leading to four separate REL modules (UNDEF, UNDEG, PDEG and A/R) improving the overall accuracy of the overall REL of the proposed ER Program. The monitoring plan is tailored to meet the requirements of these threeREL Modules.
- Monitoring activities itself are partly carried out by the ER Program (wall-to-wall LUC analysis), while supporting activities (e.g. local monitoring of A/R performance) are carried out by communities and conservation agencies (such as e.g. the WWF) or forestry concessionaires. The ER Program monitoring approach focuses on the direct monitoring of emissions and removals (i.e. activity data and emission factors), whereas the forestry concession MRV scheme focuses on activity data. The community-based MRV schemes focus on the monitoring of activities. The monitoring of activities is the basis for proxy payments effectuated under the Program. As chapter nine addresses MRV of emissions/removals, activity related MRV is discussed, but the related monitoring parameter are not included in this section.
- The proposed wall to wall MRV system will ensure consistency with the sampling approach used for the determination of the REL:

- The sampling approach determines deforestation and degradation rates which were applied to the forested area of the MNDP at the beginning of the historic reference period. The combination of deforestation/degradation rates with the initial forest area of the MNDP results in the quantification of absolute deforestation and degradation.
- The wall to wall MRV equally determines absolute deforestation and degradation (i.e. primary/secondary forest converted to non-forest or secondary forest) which produces the identical output as the sampled REL (if applied correctly).
- To ensure the consistency of both approaches, the ER Program will apply both methods (i.e. wall to wall and sampling) during its first verification period. This shall demonstrate that both approaches lead to the same output in terms of areas deforested and areas degraded.

- Calculation of uncertainty for emission reductions: Uncertainty related to the quantity of emission reductions will quantified using Monte Carlo methods. Underlying sources of error in data and methods for integrated measurements of deforestation, forest degradation and enhancements (e.g., as in a national forest inventory) will be combined into a single combined uncertainty estimate and will be reported at the two-tailed 90% confidence level.

MONITORING OF UNPLANNED DEFORESTATION AND DEGRADATION

Unplanned deforestation accounts for approx. 96% of total historic emissions, and hence also accounts for the greatest emission reduction potential. Considering its importance, the following section outlines the ER Program's approach to accurately account for emissions from unplanned deforestation and degradation during the program period (term of the ERPA).

The FCPF MF requires the application of the National Forest Monitoring System (NFMS) for monitoring and reporting, which will be implemented by DIAF. However, as the NFMS is not yet operational, and as the NFMS will not be conducted on annual basis, the following section outlines the proposed monitoring approach of the ER Program which is nested and aligned with the NFMS:

The proposed UNDEF/UNDEG monitoring system has the subsequent objectives:

- The main objective is to monitor Land Use/Land Cover Change occurring during the implementation of the ER Program. Comparing program emissions with the REL will allow to quantify possible emission reductions which may be sold and generate carbon revenues.
- Moreover, the UNDEF/UNDEG monitoring system shall spatially quantify deforestation and degradation and thus facilitate the just sharing of financial benefits based on performance.
- Finally, the monitoring system will allow to assess the performance of individual activities and provide valuable feedback to the ER Program (i.e. MRV of activities) which may refine its strategy and plan e.g. for the re-investment of carbon revenues in well performing mitigation activities (i.e. adaptive management strategy).

It is important to note, that the UNDEF/UNDEG REL is based on a sampling approach, whereas the monitoring of UNDEF/UNDEG is based on a wall to wall approach. Both approaches allow for the quantification of areas deforested and areas degraded. In order to ensure the consistency of the MRV

with the REL, the ER Program will validate the consistency of MRV approaches with the REL approaches. To this purpose, the ER Program will apply both methods for the reporting of its first verification period. This shall demonstrate that both methods lead to very similar results. Once the consistency of both approaches is validated, the ER Program will proceed with an MRV approach solely based on wall-to-wall analysis for all subsequent verification periods.

The ER Program's monitoring system will assess emissions of Land Use Change for UNDEF/UNDEG following the subsequent methodology:

1. Establishment of the forest area benchmark map. The ER Program will use the national LU/LC map from 2014 as the forest area benchmark map. This map is being produced by DIAF with support from JICA and is in the last stages of development. It will be available at the end of 2015.
2. Steps for defining Land Use Change at the level of the ER Program
    - Use of Global Forest Watch to identify deforested Areas. The web portal Global Forest Watch (GFW) analyzes MODIS-Terra/Aqua satellite imagery in 16 day intervals to detect areas with indications for forest losses. GFW covers only the portion of the tropical rainforest Mai-Ndombe. The ER Program will receive email alerts based on pixels of 500m width. Output data is available in SHP, KML, and CSV.
    - The ER Program will collect and store this data on an ongoing basis. Every month, the ER Program will make a first analysis using Landsat 8 images allowing the ER Program to supervise regularly land use changes in the target areas indicated by the alerts. In this first step, polygons indicate areas subject to change will be recorded in a database including the following attributes: Area, type of change, stratum, date and the name of the technician conducting the analysis.

- Download and Pre-treatment of LANDSAT Images. A series of satellite images Landsat 8 (OLI) and 7 (ETM +) will be downloaded in order to run the change analysis. The images will be geo-rectified (if applicable) and an atmospheric correction (TOA or LEDAPS) will be conducted. Finally, clouds will be detected and excluded. The images will be compiled to mitigate problems of clouds and haze. Finally, images will be projected in UTM 34 system with a pixel size of 30 meters.

3. Description of Parameter for Analysis. The analysis will be conducted on an annual basis and will cover the whole ER Program area (i.e. wall-to-wall, including A/R- and PDEG areas). Consequently, a forest area map will be created every year, which is compared with the forest area benchmark map from 2014 (see above). This allows for assessing changes in land use and land cover.

    The analysis will be conducted based on a semi-automated process. The analysis will put emphasis on the verification of those areas that were identified by the GFW tool. The minimum mapping unit (MMU) is composed of 9 pixels with a resolution of 30 meters equaling 810 square meters[41].

[41] Please note, the size of MMU is linked to the use of Landsat imagery. In case other images become available or a new technology allows the ER Program to be more precise, the MMU could become closer to the national forest definition.

The number of classified pixels will be determined to calculate a change detection matrix, and total number- and percentage of hectares of dense forest converted to secondary forest/non-forest and secondary forest to non-forest. This will allow for quantifying deforestation and forest degradation.

4. Procedure for Quality Control / Quality Assurance. This section describes the approach to calculate uncertainties and estimate of the accuracy of activity data. The method to estimate the accuracy of activity data is based on 'Estimating accuracy and area and quantifying uncertainty using stratified estimation' (Olofson et al., 2013) and 'Good practices for estimating area and assessing accuracy of land change' (Olofsson et al., 2014):
    - Samples of the change map will be compared with reference data, such as high-resolution images (Google Earth, LiDAR, Images SPOT, etc.) or field data.
    - The number of samples will be determined by stratum (following equation 13 of Olofson et al., 2014)) and will be localized randomly by keeping a minimum distance of 1 km between each sample.
    - The samples will be organized in an error matrix based on the classification of the forest area benchmark map. Finally, estimates of the accuracy with their respective confidence intervals calculated for each land use / cover stratum will be conducted. This will allow for adjusting activity data by the 90% confidence interval.

UNDEF/UNDEG monitoring parameters

The Annex 28 present in detail the following monitoring parameters for assessing emissions (and potential emission reductions) of UNDEF/UNDEG:

- Area deforested, per land use /cover stratum
- Area degraded, per land use /cover stratum

MONITORING OF PLANNED DEGRADATION (PDEG)

The ER Program allows for the implementation of two principal mitigation activities within forestry concessions. These are:

1. Reduced Impact Logging' (RIL). RIL entails emission reductions achieved through a reduction in forest road and skidtrail density, reducing damage to the residual forest stand as well as reducing the overall logging volume, e.g. by increasing the target diameters of merchantable species (e.g. at DBH 70 instead of 60 for a particular species)
2. 'Conservation Concession', which is the set-aside of forests foreseen for industrial logging operations. This comprises
    a. Set-aside of an entire forestry concession which is converted into a conservation concession; or

b. Set-aside part of a logging concession (e.g. HCVF areas), whereas exploitation continues around/next to these protected forest areas. This option may be combined with Option 1 (RIL), whereas RIL would be implemented in the non-HCVF areas.

General principles of PDEG monitoring

The ER Program assumes that not all forestry concession in Mai Ndombe will actively participate – i.e. engage in emission reduction activities during the term of ERPA. Yet, all emissions from all forestry concessions have to be monitored, reported and verified. In consequence, the ER Program will operate a tiered[42] MRV system for PDEG:

- Tier 1 is a simplified low-cost MRV for non-participating forestry concessions, i.e. MRV is balanced towards capturing emissions with minimum required accuracy causing as little costs as possible to the ER Program. Tier 1 MRV is restricted to all activity data that could or is likely to change during the program period (e.g. volumes, but not parameters such as e.g. wood density). The ER Program will to some extent rely on existing reporting structures of the forestry administration (volume and harvested area). The remaining activity data will be sampled from a number of concessions and will be carried out by a third party contracted by the ER Program (see below).All activity data from Tier 1 monitoring – data from government records, UNDEF/UNDEG monitoring and field sampling - will be aggregated by the ER Program and converted into emissions using the same emission factors that were used for the REL. The costs for third party monitoring (field sampling and RS of some concessions) and additional ER Program work are estimated at EUR 100,000 annually. Emission factors are assumed to be the same as in the REL, which is deemed conservative. The Tier 1 MRV is operated solely by the ER Program.
- Tier 2 is a more detailed MRV for participating forestry concessions, i.e. MRV is tailored to achieve a good balance of both costs and accuracy and thus maximize returns for both the ER Program and the participating forestry concessionaire. Under Tier 2, participating forestry concessions are responsible for monitoring and reporting and, as part of an independent Quality Control, subject to verification by the ER Program and if required through a third party (see Figure 11 below). These costs are borne by the participating forestry concessions by means of a reduced payment. The exact parameters and procedures for monitoring and reporting of emissions for participating forestry concessions are set out below. Depending on the activity that is to be implemented (RIL, Conservation Concession, HCVF), forestry concessionaires have to monitor and report different parameters. To give an example: In case of a full conservation concession, no PDEG specific parameters have to be monitored and reported, as the UNDEF/UNDEG monitoring system will provide all data necessary to determine whether or not the

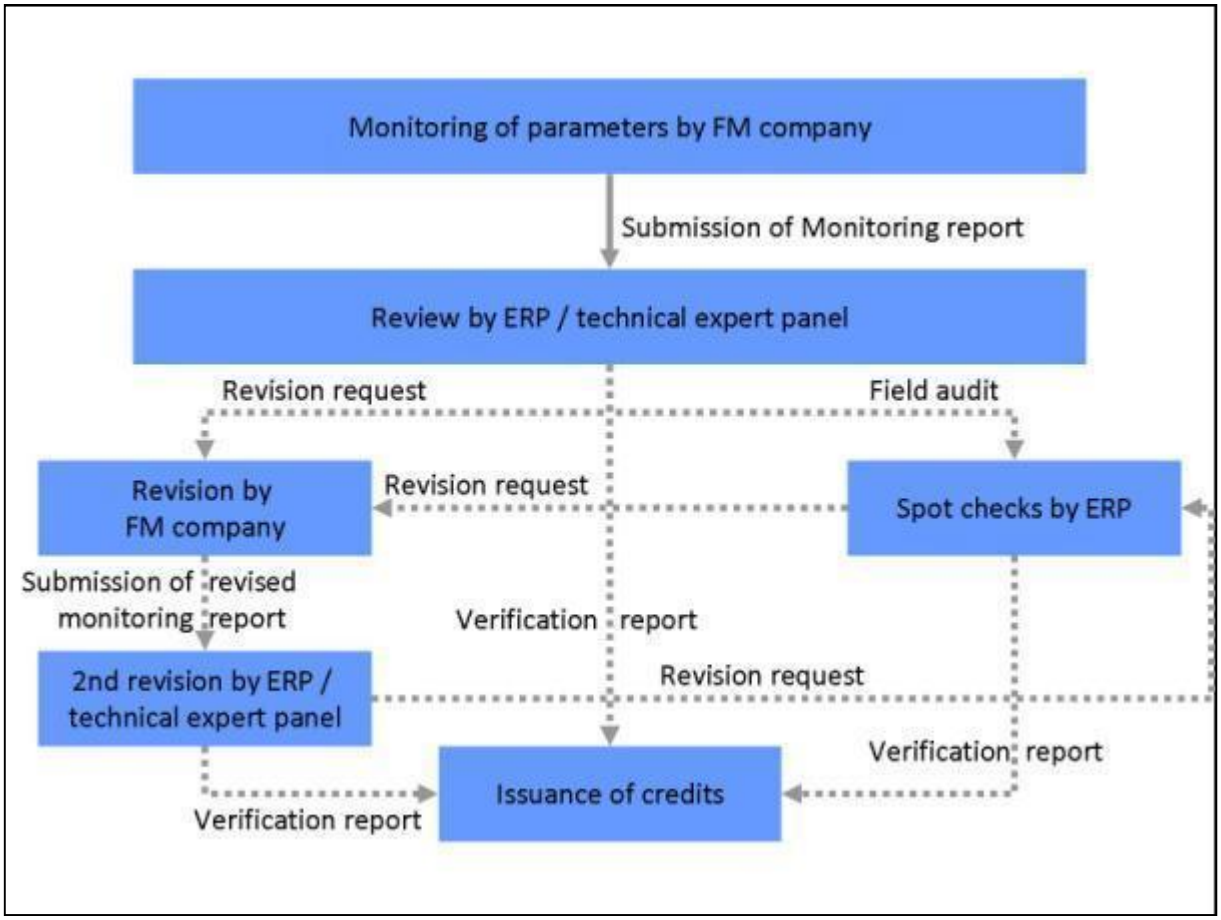
[42]Tier 1 and Tier 2 here have no relation to the tiered approach (Tier 1-3) as described by the IPCC.

concession was well protected or subject to deforestation and forest degradation (see point 2 below).

In addition to PDEG specific monitoring, as part of a further Quality Control Procedure, all forestry concessions are subject to monitoring of unplanned deforestation and degradation (illegal logging) through UNDEF/UNDEG monitoring, as elaborated under the UNDEF MRV section (see Section 9.1.2 above).

Further, forest concessions may be subject to monitoring of direct leakage cp. Section 10). If a concessionaire holds several concessions and implements a mitigation activity in one of its concessions, then the annually logged volume must be monitored in the concessions which belong to the same concessionaire, but where no mitigation activities are implemented. This shall ensure that the reduction of harvested timber volume (achieved by the mitigation activity in one concession) is not compensated by an increase of logging volume in other concessions belonging to the same concessionaire. This will support the environmental integrity of the ER Program.

Figure 11: TIER 2 monitoring, reporting & internal ER Program verification scheme for avoided planned degradation



PDEG monitoring parameters

The Annex 29 present in detail the monitoring parameters for assessing emissions (and potential emission reductions) of PDEG:

In contrast to Tier 1, all data monitored and reported is specific to the concession where mitigation activities are implemented. The monitoring and reporting requirements differ depending on which mitigation activity is implemented.

Monitoring parameters all forestry concessions

1. Area harvested in year y during the programme period
2. Volume harvested in year y during the programme period
3. Length of permanent roads
4. Length of primary roads
5. Length of secondary roads
6. Length of sub-canopy roads
7. Length of skidtrails

For all remaining parameters of the PDEG methodology – both activity data and EF, the values from the calculation of the REL will be used (those related to area, volume or road length will change accordingly). This is deemed conservative, as these values represent business-as-usual and forestry concessionaires have no reason (gain) to increase anyone of these values (on the contrary, increasing e.g. road or skidtrail width would results in additional costs).

Monitoring parameters participating forestry concessions - RIL

Forestry concessions implementing RIL must monitor and report all additional parameters which are likely to change as a result of RIL practices. Monitoring and reporting follows a predefined measurement protocol, which has been established by FRMi for the PDEG REL study. For reporting, standard templates to be developed by the ER Program will be used.

8. Average width of permanent roads
9. Average width of primary roads
10. Average width of secondary roads
11. Average width of sub-canopy roads
12. Average width of skidtrails
13. Average width of solar strips along primary roads
14. Average width of solar strips along secondary roads
15. Fraction of trees with a DBH>30 cm remaining on solar strips per unit area of exploited concession area
16. Average area of log landings
17. Average number of log landings per unit area of exploited concession area
18. Residual stand damage factor
19. Factor for abandoned timber

Monitoring parameters participating forestry concessions – Conservation Concession & HCVF

Forestry concessions that are converted into conservation concession or which set-aside a proportion of their concession for conservation (HCVF) do not need to monitor or report any PDEG specific parameters for the areas conserved. Performance in these areas will be captured by the ER Program-wide UNDEF/UNDEG monitoring system.

MONITORING OF AFFORESTATION / REFORESTATION

To account for the removals of 'Afforestation / Reforestation', the following approach is shall be applied:

- In order to benefit for achieved removals under the Program, any agent implementing an A/R activity shall submit a shape file exactly delineating the A/R area to the Emission Reduction Program.
- The ER Program will compare the A/R area with the forest area benchmark map verifying that the area is not classified as forest. The ER Program will notify the agent on the outcome of this eligibility check. The area can only be counted towards the A/R stratum if and only if it is not classified as forest. This will ensure the environmental integrity of the ER Program (Quality Control).
- As discussed under Section 4.3 above, the ER Program will implement several A/R activities e.g. the establishment of A/R sites for growing cash crops such as Avocado, Safou, Mango, etc. or 'Assisted Natural Regeneration' related to the protection of Savannah from fires. All activities will be subject to specific/differing MRV schemes laid out below.
- Once planted, trees start to sequester carbon. However, the ER Program will only account for the carbon stock increment, once the A/R site qualifies as forest according to DRC's forest definition (cp. Section 8.2). Hence, the ER Program will, as part of the MRV scheme conducted under UNDEF, verify/falsify whether the A/R areas are classified as forest (Quality Control).

A/R monitoring parameters

The Annex 30 present in detail the following monitoring parameters for assessing removal (and potential emission reductions) of Afforestation/Reforestation:

- Tree biomass per hectare in plot p of stratum i;
- Area of the Afforestation/ Reforestation Stratum i;

MONITORING OF THE UNDEF ADJUSTMENT

As discussed in Section 9.4, the adjustment for UNDEF is based on a regression analysis. This section specifies monitoring parameter which will monitored for each verification period. The monitoring parameter will be fed into the regression analysis to calculate the deforestation area in the Business as Usual scenario, i.e. in absence of the ER Program interventions.

UNDEF Adjustment monitoring parameters

The Annex 31 present in detail the following monitoring parameters for assessing the UNDEF adjustment:

- Rural population in the Main Ndombe Province
- Oil palm production

10.2 ORGANIZATIONAL STRUCTURE FOR MEASUREMENT, MONITORING AND REPORTING

The overall structure of the ER Program's MRV system is as follows:

- The ER Program will assume the overall responsibility for conducting MRV. As outlined in the table at the right, the reporting will be conducted on an biennale basis. Reporting for the emissions, emission reductions and removals will be conducted in the year after the occurrence of emissions.
- The monitoring of UNDEF/UNDEG including QA/QC procedures will be conducted by two remote sensing experts seconded by the DIAF to the ER Program. Moreover these remote sensing activities will support the MRV of PDEG and A/R. This includes the analysis of fire events (based on automated requests to FRIMs) and provide related findings as input into the community MRV and the PDEG MRV.

Table 28: Timeline of Reporting

Year to be reported	Year when reporting will be conducted
2016	2017
2017	2019
2018	2019
2019	2021
2020	2021

The experts will work in the ER Program office which will facilitate quick and informal exchange between MRV officers and field officers.

- The MRV of PDEG will be carried out by the Program, the forestry concessionaires and qualified third parties contracted by the ER Program depending on their level of engagement (please refer to Section 10.1).
- The MRV of A/R will be conducted by respective implementing agencies and conservation NGOs. The ER Program will provide information on the occurrence of fire based on FRIMs requests which will serve implementing agencies as input. Moreover the ER Program will conduct Quality Control steps to ensure accuracy and conservativeness.

Implementing agencies will determine based on a sampling approach tree height and DBH per AR and ANR stratum considering year of implementation. In addition, implementing agencies will verify fire events e.g. in areas protected for Assisted Natural Regeneration to quantify loss events, if any. Related MRV costs are included in the implementation costs of A/R activities. Hence the ER Program's MRV costs are constrained to remote sensing based fire detection.

- Based on the findings of the quantification of emissions and emission reductions, and considering the costs/investments in distinct mitigation activities, the ER Program will evaluate the cost effectiveness of each mitigation activity. This will provide valuable input in the further development of the ER Program's strategy for the re-investment of carbon revenues (i.e. follow an adaptive management structure).

Table 29: Summary of Activities and Estimation of annual Monitoring Costs

Step	Tasks	Interval	Monitoring Costs (in USD)
UNDEF/UNDEG wall to wall LULC change analysis	▪ GFW Analysis;	weekly	10,000 (yearly)
	▪ Landsat 8/7 Analysis;	biennale	50,000
UNDEF/UNDEG sampling LULC change analysis	▪ Landsat 8/7 Analysis will be conducted once, to validate the consistency between sampling based REL and wall-to-wall UNDEF/UNDEG MRV;	once, first verification period	100,000
UNDEF/UNDEG QA/QC	▪ Identification of samples and high resolution images; ▪ Verification of forest area map using and determining accuracy; adapting forest area map to 95% confidence interval;	biennale	10,000
PDEG	• Reporting of standard parameters by all forestry concessionaires (no extra costs, regular reporting); • Remote sensing and/or field sampling by third party of certain parameters for all forestry concessions on behalf of the ER Program; • Monitoring and reporting of additional parameters by participating forestry concessions (costs borne by the	biennale	100,000

	concessionaires);		
A/R Fire detection	▪ Providing shape files of ANR and AR areas to FIRMs inquiring automatic notification; ▪ In case of automatic notification of the Program, inform responsible implementing agency or conservation NGO on potential loss event;	weekly	10,000 (yearly)
A/R field monitoring	▪ Determination of appropriate sample number considering year of planting and strata; ▪ Measurement of tree high and DBH following the sampling approach incl. verification of potential loss events; ▪ Report findings to ER Program;	biennale	N.A.

10.3 Relation and consistency with the National Forest Monitoring System

The NFMS will apply a 'wall-to-wall' approach, i.e. covering the total forest fund of DRC. The Mai Ndombe ER Program's MRV will be integrated into the National Forest Monitoring System. This will follow similar procedures as for the integration of the MNDP REL into the national REL (please refer to Section 9.6).

Both MRV systems will use the same/very similar approaches to ensure consistency:

- The ER Program will use a wall-to-wall approach corresponding to the NFMS
- The ER Program will use the same land use / land cover classification as the NFMS. The land use / land cover classification needs to be consistently applied across the REL, benchmark map and each monitoring event.
- The ER Program will use the same analysis method for land use / land cover change detection as the NFMS to account for deforestation.

However, the NFMS is constrained to the assessment of deforestation and will not account for forest degradation. Hence the ER Program will report its findings on deforestation to the NFMS according to the land use classification presented in Table 27. The NFMS will integrate the reported area changes for MNDP into the national accounting system. In summary, the MNDP ER Program will inform the NFMS on the areas deforested.

It is envisaged that this approach will result in an accurate forest area monitoring approach which is well integrated into the NFMS and which may also provide valuable lessons learnt as inputs into national processes (e.g. accounting for forest degradation).

The ER Program will apply existing national maps/products:

- The ER Program monitoring system will use the Bandundu forest cover map produced by JICA (based on ALOS & Landsat 8 data) for the year 2014 as the ER Program forest area benchmark map. This map provides a more detailed land use / land cover classes then the NFMS. However these can be aggregated to ensure consistency. This will allow using one benchmark map for both the ER Program and the VCS Jurisdictional Programme.
- Overlaying the JICA land use / land cover map of Bandundu with the LiDAR biomass map will result in a highly accurate forest carbon benchmark map.

11. DISPLACEMENT

11.1 IDENTIFICATION OF RISK OF DISPLACEMENT

This section discusses the risk of displacement/leakage, i.e. the increase of emissions outside the program area due to program activities. This analysis (including Section 10.2) follows the FCPF Methodological Framework as well as the JNR Leakage Tool (Version1, Feb. 2014, VT004). The table below provides a brief summary of the analysis of drivers and agents laid out in Section 4.1-4.4.

Table 30: Identification of Drivers & Agents of Deforestation and Degradation

Drivers	Agents	Risk of Displacement	Justification of risk assessment
Shifting cultivation	*Local population*	*Low*	Activity shifting of shifting cultivation would require the local population to re-locate their agricultural practices or move to outside the program area which is unlikely. Further, the ER Program is not taking any prohibitive measures with regard to agricultural practices, nor any measures to reduce the area under cultivation. Rather, communities that do engage in reducing deforestation and forest degradation are rewarded. However shifting cultivation to a limited extent produces products for Kinshasa, where market leakage may occur. The ER program will implement a set of mitigation activities to address market issues, please refer to the analysis below.
Charcoal production	*Local population*	*Low*	Please refer to comment above.
Savannah burning	*Local population, farmers & cattle holders*	*Low*	Please refer to comment above.
Artisanal logging	*Artisanal loggers*	*Medium*	Artisanal logging is not conducted based on permanent forest concession licenses and hence is for the government difficult to control. Unlike for local population, artisanal logging enterprises are not bound to land property and may move to other regions. However the ER Program envisages respective leakage mitigation activities; please refer to the analysis below.

Industrial logging	*Forest concessionaires*	*Low*	Unlike artisanal loggers, industrial logging companies are bound to 25 year concession lease contracts. However if a logging company holds several concessions, activity shifting may occur. Moreover, as timber is supplied to national and to a limited extend, international markets, market leakage may occur. However the ER program incorporates mitigation measures such as RIL, which do not significantly affect timber production volumes and comprises large scale reforestation for timber production; please refer to the analysis below.

In a next step, the VCS tool requires the assessment of the global market leakage. An ER/JNR program may create global market leakage if the program reduces the production of a commodity which is linked to international markets. In such cases, other countries may pick up the reduction in supply leading to an increase of emissions elsewhere. According to the tool, global market leakage must be considered if 5% or more of DRC's production of a certain commodity is exported (§5.3.2.1). In the following key commodities are discussed:

- Artisanal loggers and industrial logging companies produce roundwood which may be processed to timber and supplied to Kinshasa/Matadi, from where a part is exported. The average annual, industrial timber production volume in the ER program area is determined at 0.24 million m3 per year (average 2002 to 2014; source PDEG study by FRM). A CIFOR study (2014[43]) estimates that 76% of total timber production is generated by artisanal timber production, which ceteris paribus results into an additional timber supply from the program area of 1.01 million m3. FAO (2012[44]) reports a total national production of 4.45 million m2, whereas exports amount to 0.16 million m2 (i.e. 3.5%). Hence timber is not classified as global commodity.
- Local population in the ER program area produces charcoal which is partially supplied to Kinshasa to meet the city's energy demand. Kinshasa's population is estimated to 10.12 million with 87% of the population meeting their cooking energy demand through charcoal. Kinshasa's energy demand is estimated to 4.6 million m3/year (CIFOR, 2011[45]). However FAO (2012) notes that DRC does not export any woodfuels. Hence charcoal is not classified as global commodity.
- Moreover key agricultural cash crops are cassava and maize (cp. Lukwasa et al., 2012). However assessment of the FAO STAT database indicates that DRC produced 16.5 million t cassava and 1.25 million t maize but did not conduct any exports. Hence cassava and maize are not classified as global commodity.

[43]Lescuyer et al., 2014, The domestic market for small-scale chainsaw milling in the Democratic Republic of Congo, CIFOR, Occassional Paper 112.

[44]FAO, 2012, State of the Wold's Forests, FAO, Italy.

[45]Shure et al, 2011, Woodfuel for urban centres in the Democratic Republic of Congo, CIFOR Brief No 7.

As none of the commodities produced in the ER Program area, qualify as global commodity, no respective leakage discount applies. In a next step, 'Domestic Market and Subsistence Leakage' is assessed.

Table 31: Domestic Market and Subsistence Leakage		
a)	The jurisdictional program affects the production of relevant domestic commodities and/or subsistence activities.	15
b)	Mitigation: The jurisdictional program incorporates measures that maintain production of relevant domestic commodities within the jurisdiction; and the jurisdictional program does not affect the production of relevant domestic commodities: ▪ As general principle, mitigation measures to address emissions from shifting cultivation are designed in a way that production levels are not constrained. The number of shifting cultivation fields shall remain constant so that communities can proceed with their current livelihoods. However if needs for additional fields arise, the communities will create these fields in the Savannah, i.e. without new deforestation (cp. Draft conservation and reforestation contracts). ▪ As one of the ER Program's mitigation measures, the support of agroforestry systems (funding: 12.43 million USD) is envisaged to create 120.28 million USD income for local communities over ten years. This will support communities in achieving higher agricultural productivity levels, compared to the baseline. ▪ Supported natural regeneration for charcoal production (funding: 3.39 million USD) is expected to produce 400,659 t of charcoal with a value of 9.08 million USD over ten years (cp. Investment Plan). ▪ The ER Program will implement 'Reforestation for Timber Production' as one of its mitigation activities. This activity is envisaged to reforest 6,400 ha with a total funding volume of 3.20 million USD (cp. Investment Plan). ▪ Reduced Impact Logging is designed in a way to reduce the residual damage of logging operations and reduce road width and length but does not significantly reduce logging volumes.	-5
c)	Mitigation: The jurisdictional program incorporates measures that address subsistence drivers of deforestation and degradation. Please refer to 'b)' above, bullets 1-3.	-5
d)	Mitigation: The jurisdictional program is embedded in the National REDD+ Strategies which are supported by the FCPF Readiness program. From national perspective, the jurisdictional program is considered as the first application and test pilot of the National REDD+ Strategies. The National REDD+ Strategies are a multi-sectoral initiative approved and supported by the Council of Ministers aiming at the realization of the national vision for green development (Please refer to Section 2).	-4
e)	Mitigation:The jurisdiction program is developing conservation strategies including leakage mitigation activities in consultations with agents of deforestation and degradation: ▪ Groupe de Travail Climat REDD+ (GTCR) is a coordination agency for the participation of the civil society in the program. GTCR is inherently involved in the program design and acts as one of four program partners. ▪ Conservation and agroforestry activities are based signing proxy based payment contracts with local communities which ensures excellent community involvement. ▪ Many consultation have been done in DRC relative to REDD+ strategy and it will continue at a more local level in implementation phase (Please refer to Section 5).	-1
Total Domestic Market and Subsistence Leakage [as applicable, (a + b + c + d + e + f)]		0

The ER Program accounts and monitors emissions from degradation. The UNDEF/UNDEG stratum covers conversion from Dense forest (tree cover from 75% to 100%) to secondary forest (tree cover from 30% to 74.99%). The PDEG stratum follows a monitoring scheme which is based on field measurements. Moreover the UNDEF/UNDEG analysis will cover the PDEG stratum as quality control procedure (please refer to Section 9). As degradation is monitored, there is no risk of leakage from deforestation to forest degradation. Hence, according to the VCS tool §5.4.3.1 a leakage discount factor of 0 is applied.

The subsequent table determines the overall leakage discount based on the assessments of global commodity leakage, domestic market and subsistence leakage and based on deforestation to degradation leakage:

Table 32: Overall Leakage Assessment

Leakage Category	Rating
a) Global Commodity Leakage	0
b) Domestic Market and Subsistence Leakage	0
c) Deforestation to Degradation Leakage	0
Overall Risk Rating [PG + PDS + CR + FR + NR]	0

11.2 ER PROGRAM DESIGN FEATURES TO PREVENT AND MINIMIZE POTENTIAL DISPLACEMENT

The Program's design features to prevent and minimize potential displacement were included as part of the leakage- and leakage mitigation assessment under Section 10.1.

As indicated by Table 32 above, the assessment of leakage risks and related mitigation strategies results in a discount of 0%. The ER Program will re-assess leakage at every verification event (envisaged annually) to comply with VCS JNR requirements. If leakage occurs, the ER Program will account for leakage emissions as follows:

$$L = (JBE_{def+deg} - JPE_{\mathrm{def}+deg})xLD_{def+deg} \qquad \text{Equation (3)}$$

Where:

L = Leakage (tCO2e)

$JBE_{def+deg}$ = Jurisdictional baseline emissions and/or removals from deforestation and degradation (tCO2e)

$JPE_{\mathrm{def}+deg}$ = Jurisdictional program emissions and/or removals from deforestation and degradation (tCO2e)

$LD_{def+deg}$ Leakage deduction for deforestation (percent)

12. REVERSALS

12.1 IDENTIFICATION OF RISK OF REVERSALS

The assessment of natural and anthropogenic risks of reversals was conducted following the VCS JNR Non-Permanence Risk Tool, Version 3.0. The tool is used to determine:

- Political and Governance Risk
- Program Design and Strategy
- Carbon Rights and Use of Carbon Revenues
- Funding Risk
- Natural Risk

The following section provides the risk assessment for each of the five risk categories. Please note that, following the structure of the tool, the overall risk is based on the initial risk rating minus the mitigation strategy rating. Hence this section includes the ER Program's mitigation strategy.

POLITICAL AND GOVERNANCE RISK

The table below provides the political- and governance risk assessment for the Democratic Republic of the Congo.

Table 33: Political and Governance Risk

Risk Factor	Risk Factor and/or Mitigation Description	Risk Rating
a)	DRC's governance score over the amounts to -1.63, Please refer to Table 34 for a detailed assessment.	8
b)	The sub-national jurisdictional program is being coordinated directly by the provincial government and benefits from strong institutional support of the federal government.	0
c)	Mitigation: The jurisdictional REDD+ program has been established as long term initiative which is in-dependent from changes in government. ▪ Legal: Inter alia, the program is based on agreements between the DRC and the World Bank's Forest Climate Partnership Facility (FCPF). Clear legal links have been designed between national government as the guardian in respect of national REDD+ standards, provincial government as guardian of good implementation and performance of the program and signatory of the ERPA. ▪ Sustainability of Mitigation Actions: Also individual mitigation activities were designed in a way that ensure avoidance of reversal e.g. reforestation of cash crops will ensure that local communities will have higher household income levels in the	-1

	mid to long term (i.e. without further REDD+ payments) to ensure the long term sustainability of mitigation measures. ▪ Governance Structure: The management of the program will be assumed by an implementation body for the first years of the program (please refer to Section 6.1, 'Institutional Arrangements'). It will allow some time to set transparent and clear scheme under the ER-Program that the provincial government will be able to manage at a medium term. ▪ Control Mechanisms: Different mechanism will be implemented in order to address governance issues as (i) a multi-stakeholder steering committee in charge of validation of the work prepared by the Implementation body, (ii) a transparent grievance and redress mechanism (Please refer to Section 14.3) and (iii) independent observers as OGF and the MOABI Platform.	
d)	Mitigation: The jurisdictional program and the provincial government of Bandundu are committed to improve governance issues within the framework of REDD+ readiness. ▪ A study is currently led in order to assess timber companies in the JNR program area on their legality of operations to provide a clear and transparent cooperation between companies and the JNR program. This activity will result in a simple and robust monitoring system of legality of timber operations and strengthens the engagement of the administration. ▪ An activity to reinforce on-site control and checkpoint will be implemented to limit and reduce illegal logging and poaching which is often linked to corruption. ▪ As part of DRC's national REDD+ readiness achievements, DRC included REDD+ issues (e.g. land use planning policies, land tenure) in the country's Economic Governance Matrix. This matrix is a key Government planning instrument and is monitored on monthly basis by the Technical Committee for Reform Monitoring (please refer to Section 2.3)	-2
Total Political and Governance Risk (PG) [as applicable, (a + b + c + d)]		5

The table below provides information on the overall governance rating of DRC for the years 2009 to 2013 as well as the rating of six individual parameters.

Table 34: Worldwide Governance Indicators for DRC

Year	2009	2010	2011	2012	2013	Mean
Voice &Accountability	-1.45	-1.44	-1.52	-1.51	-1.47	-1.48
Political Stability and Absence of Violence	-1.99	-2.23	-2.24	-2.14	-2.23	-2.16
GovernmentEffectiveness	-1.71	-1.73	-1.67	-1.66	-1.59	-1.67
Regulatory Quality	-1.53	-1.58	-1.52	-1.51	-1.28	-1.48
Ruleof Law	-1.63	-1.61	-1.61	-1.65	-1.55	-1.61
ControlofCorruption	-1.36	-1.42	-1.40	-1.30	-1.30	-1.36
Five Year Average across all Indicators						-1.63

Source: World Bank, 2014, Worldwide Governance Indicators

PROGRAM DESIGN AND STRATEGY

The table below provides the assessment of the JNR program design risks and related mitigation strategies.

Table 35: Program Design and Strategy

Risk Factor	Risk Factor and/or Mitigation Description	Risk Rating
a)	Default Program Design and Strategy risk rating	10
b)	Mitigation: The JNR program incorporates a set of measures that maintain the production levels of significant commodities driving deforestation and degradation. Key commodities and related REL strata are: ▪ Unplanned Deforestation and Degradation (UNDEF/UNDEG): Shifting cultivation leads to the production of manioc, corn and charcoal which is partially sold to generate cash income, partially used for domestic purposes. ▪ Planned Degradation (PDEG): Industrial timber companies log trees to supply timber to domestic and international markets. The following measures are incorporated in the JNR program to mitigate risk of reversals (cp. JNR Investment Plan): ▪ As general principle, mitigation measures to address shifting cultivation are designed in a way that shifting cultivation is not constrained. The number of shifting cultivation fields so that communities can proceed with their current livelihoods. However if needs for additional fields arise, the communities will create these fields in the Savannah, i.e. without new deforestation (cp. Draft conservation and reforestation contracts). ▪ The support of agroforestry systems (funding: 12.43 million USD) is envisaged to create additional 120.28 million USD income for local communities over ten years. ▪ Rehabilitation of cocoa, café, palm oil and rubber plantations (funding: 11.98 million USD) is envisaged to create additional revenues/ products in the amount of 29.11 million USD over 10 years). ▪ Supported natural regeneration for charcoal production (funding: 3.39 million USD) is expected to produce additional 400,659 t of sustainable charcoal with a value of 9.08 million USD over ten years. This production of sustainable charcoal will complement traditional and currently unsustainable charcoal production which is envisaged to phase out over time, so that the overall productivity remains at the same level. ▪ Artisanal logging: The ER Program aims to reduce illegal logging in the program area by the establishment and reinforcement of logging check points and on-site control. ▪ Conservation concessions will stop timber operations and hence will reduce to a reduction of timber supply. The expected reduction amounts to 1,44 million m3 over five years. ▪ Reduced Impact Logging is designed in a way to reduce the residual damage of logging operations and reduce road width and length but does not significantly reduce logging volumes. ▪ The mitigation activity FS4 aims at increasing timber supply on 6,000 ha over five years. The expected timber supply over the first five years amounts to 882,000 m3 which partially compensates for the reductions of conservation concession	-3

activities.

Assessment of Program Design Risk Mitigation Strategies			
Drivers	*Type of Driver*	*Program maintains production of commodities at:*	*Program supports agents involved in subsistence drivers*
Shifting cultivation	*Subsistance and Cash Crop*	*Increased level*	*Majority*
Charcoal production	*Mainly commodity but complemented by limited fuelwood collection for subsitance*	*Same level*	*Majority*
Savannah burning	*N.A.*	*N.A.*	*N.A.*
Logging Operations	*Commodity*	*Decreased level*	*Minority*

c) Mitigation:The JNR program incorporates a set of measures that maintain the subsistence of local communities. -3

An EU funded study, (Lukwasa et al., 2012) assess the average household (HH) income in the program area through a total of 1,933 interviews. Findings show that the average HH income amounts to 207 USD/HH. The average agricultural area, per HH amounts to 1.20ha/HH. Hence the average annual income per hectare amounts to 172.5 USD.

As integral activity, the JNR Program will support the development of agroforestry systems (please refer to information 'general principle' and 'agroforestry under 'b)' above). This activity will support local communities in creating agricultural products with a monetary volume which is above current HH income levels. The break even is estimated for year 4 (cp. related shifting cultivation feasibility study, Carbon Map and Model Project).

d) Mitigation: The jurisdictional program is embedded in the National REDD+ Strategies which are supported by the FCPF Readiness program. From national perspective, the jurisdictional program is considered as the first application and test pilot of the National REDD+ Strategies. The National REDD+ Strategies are a multi-sectoral initiative approved and supported by the Council of Ministers aiming at the realization of the national vision for green development (Please refer to ERPD Section 2 and National REDD+ Strategy, Section 4.3). -1

e) Mitigation:The jurisdiction program is developing conservation strategies in consultations with agents of deforestation and degradation: -1

- Groupe de Travail Climat REDD+ (GTCR) is a coordination agency for the participation of the civil society in the program. GTCR is inherently involved in the program design and acts as one of four program partners.
- Conservation and agroforestry activities are based signing proxy based payment contracts with local communities which ensures excellent community involvement.
- Many consultation have been done in DRC relative to REDD+ strategy and it will continue at a more local level in implementation phase (Please refer to Section 5).

f) Mitigation: The national government has received or is receiving REDD+ readiness support from UN-REDD and from FCPF, qualifying as multilateral donors supporting the development of REDD+ programs and strategies that mitigate reversal risk. -1

Total Program Design and Strategy (PDS) [as applicable, (a + b + c + d + e + f)] 1

CARBON RIGHTS AND USE OF CARBON REVENUES

Table 36: Carbon Rights and Use of Carbon Revenues

Risk Factor	Risk Factor and/or Mitigation Description	Risk Rating
a)	Like many countries, DRC's constitution confers ownership of all natural resources above and below ground on the state (cp. Land Law No. 73-021 of 20 July 1973). This regulation does not explicitly refer to carbon rights, however as carbon rights qualify as natural resources, they are considered as property of the state. To ensure the establishment and adaptation of a robust legal and regulatory framework for REDD+, DRC, with support from CN REDD, developed an ambitious action plan (cp DRC R-Package, p19f) that covers, among others, land tenure, carbon rights, land-use planning and mainstreaming of REDD+ into the Forest Code. A framework law on the environment was adopted in 2013, and its implementing decrees are being prepared (Law on the Environment). However laws, policies or regulations establishing clear, uncontestable carbon rights have not yet been enacted.	4
b)	As noted above, carbon rights are in general classified as natural resource and are the property of the state.	1
c)	Mitigation: As indicated above, DRC is engaged with support of the FCPF in a reform of carbon right ownership. DRC envisages a system, which similar to Joint Implementation projects, carbon right ownership is confirmed through a state approval process (cp DRC R-Package p19). DRC is currently reviewing his "Homologation Decree" which will clarify carbon rights and will allow transfer of carbon titles within the country through the homologation process and standards. Moreover the JNR program envisages supporting the development of participatory land use plans (so-called 'Plan simple d'amengaement du terre', PSAT) which form the basis for participatory planning of mitigation activities. The PSAT includes stipulations that carbon rights are under the ownership of the community, and once approved by the respective authority, the community holds the actual carbon rights (cp. first PSATs approved).	-1
d)	Mitigation: The jurisdictional program establishes a grievance mechanism to resolve any potential conflicts related to carbon rights and benefit sharing. Please refer to the ER PD, Section 14.3	-1
e)	There will be no use of carbon revenues for purposes not related to REDD+. The jurisdictional program envisages administrative costs of 7.09 million USD over a period of 10 years for project management, remote sensing, field measurements and financial fund management. This equals 10.0% of the total funding volume.	1
f)	Mitigation: There are several best practice standards for stakeholder involvement in place: ▪ DRC established an Environmental and Social Management Framework,	-1

which was funded by the FCPF and validated by the World Bank; ▪ With support from UN REDD, a Safeguard Information System was put in place (UN REDD); And ▪ The jurisdictional program is designed to ensure excellent participation of agents (e.g. participatory land use planning and related design of mitigation activities).	
Total Carbon Rights and Use of Carbon Revenues (CR) [as applicable, (a + b + c + d + e + f)]	3

FUNDING RISK

The table below provides the assessment of funding risks.

Table 37: Funding Risk

Risk Factor	Risk Factor and/or Mitigation Description	Risk Rating
a)	Default funding risk	6
b)	Mitigation: The cash flow breakeven point is five years or less from the current risk analysis. The jurisdictional program is envisaged to generate carbon revenues in the amount of 72 million USD over the first five years which will result in a surplus of 27.88 million USD. This surplus will be reinvested to scale up emission reductions (cp. investment plan).	-2
c)	Mitigation: The jurisdictional program has secured 72.4 million USD of funding (including upfront investments) which cover implementation costs (cp. investment plan).	-2
d)	DRC is not establishing a domestic voluntary or compliance market. Not applicable	0
e)	The Jurisdictional Programme is part of the FCPF CF and will sign an ERPA over 10m of emission reductions with an approx. value of 50million USD (cp. FCPF).	-1
Total Funding Risk (FR) [as applicable, (a + b + c + d + e)]		1

NATURAL RISK

The jurisdictional program does not perceive any large natural risks due to fire, pests, extreme weather events or any other natural risks. The forest areas are humid also during the dry periods and hence feature a low risk of burning.

To substantiate this opinion, an analysis of the spatial distribution of fire incidents in the Mai Ndombe Province was conducted based on fire events recorded by the MODIS sensor aboard the Terra and Aqua

satellites. Fire events from January 2002 to December 2014 were taken into account. Over these 13 years, a total of 138,174 fire events were recorded. Of these, 136,414 could be attributed to have occured in either forest land or savannah / shrubland (based on a 2014 land cover map by Saatchi et al. 2015). From these total fire incidents, only 16.9% are located in forest areas.

Considering that a MODIS pixel features a length of 250m, a pixel represents 6.25ha. Assuming that the pixel was completely burnt (which is conservative), the (maximum) areas burnt represent 143,981.7ha. However, according to the results of the UNDEF REL, the total areas that underwent forest cover change (i.e. primary deforestation, secondary deforestation and degradation) are estimated to 4.18 million ha over the period 2004 to 2014.[46]

It is concluded that the existing fire detections do not sufficiently explain the measured forest area changes. The results of the analysis provide a strong indication that while fire is used by farmers to clear forests, these fires do not lead to larger scale forest fires as is e.g. the case in Indonesia and other Southeast Asian countries.

The figure below shows a part of the Main Ndome Province, South East of the Mai Ndombe lake. The figure illustrates that the large majority of fire incidents is located in Savannah and shrubland, where as fires in forested areas do not occur at large extent.

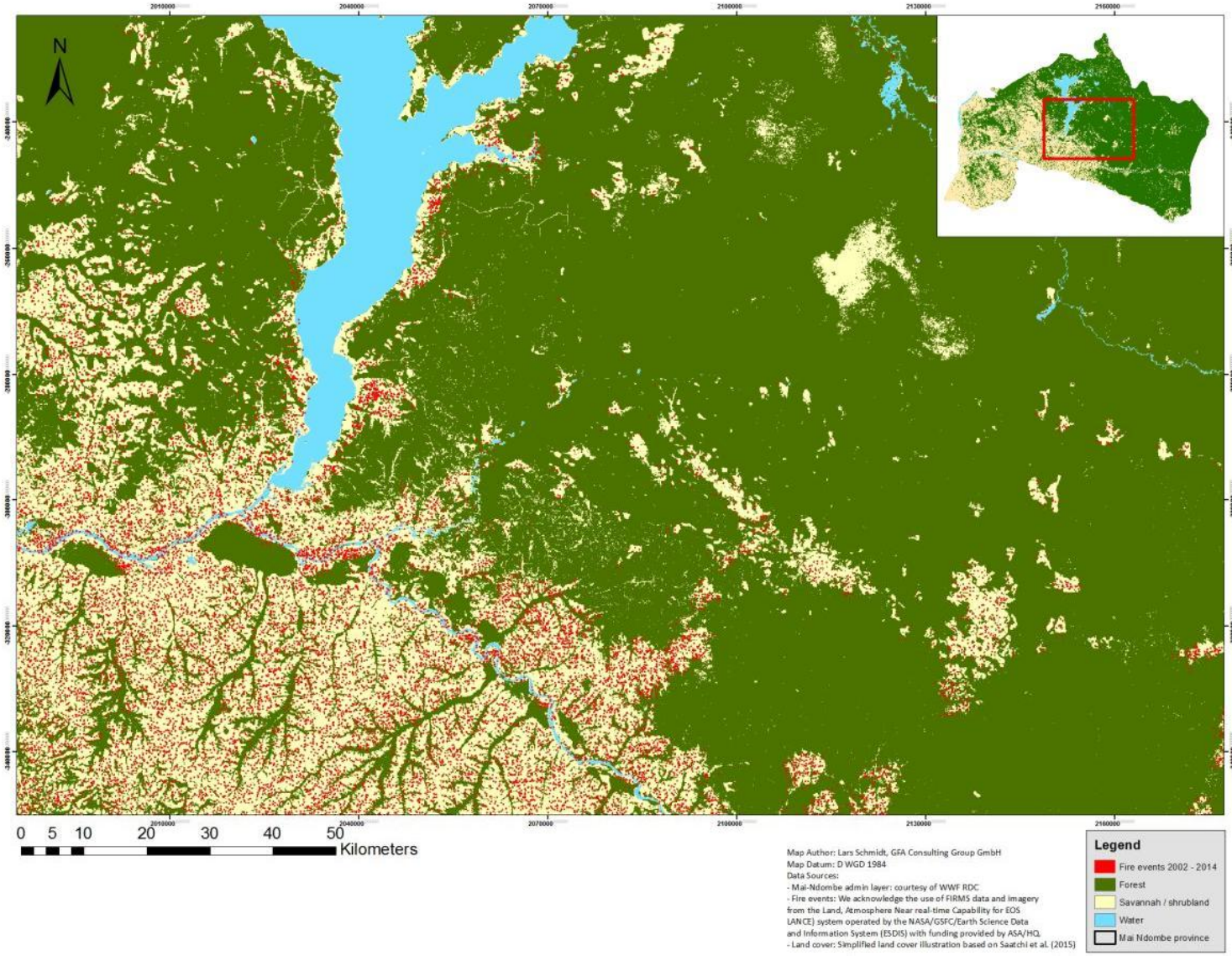
Finally, an accurate LiDAR forest carbon stock map was developed (cp. final report by the Carbon Map and Model project). The map indicates density (in t.ons dry matter) which is converted to carbon stocks. If large loss events would have occurred decades ago, the map would indicate large patches of young forests having low biomass/carbon stock volumes. However such incidents were not identified.

Based on above considerations, natural risks are rated as follows:

Table 38: Natural Risk	
Significance	Minor
Likelihood	Every 10 to less than 25 years
Initial Natural Risk Score	5
Mitigation	*No*
Total Natural Risk (NR)	*5*

[46] However, the results of the analysis may be biased insofar, as each MODIS fire location represents the center of a 1km pixel that is flagged by the algorithm as containing one or more fires within the pixel. As such, if the center of the fire location is at the edge of forest / non-forest patch, the fire may have occured in either or both forest and non-forest. Further, it is important to note, that MODIS fire data does not allow to assess the total area burnt.

Figure 12: Fire Incidents in Part of the MNDP dominated by Forests



OVERALL NON-PERMANENCE RISK RATING AND BUFFER DETERMINATION

This section determines the program's overall risk rating based on the findings of Section 1-5.

Table 39: Overall Risk Rating

Risk Category	Rating
Political and Governance Risk (PG)	5
Program Design and Strategy (PDS)	1
Carbon Rights and Use of Carbon Revenues (CR)	3
Funding Risk (FR)	1
Natural Risk (NR)	5
Overall Risk Rating [PG + PDS + CR + FR + NR]	15

12.2 ER PROGRAM DESIGN FEATURES TO PREVENT AND MITIGATE REVERSALS

The ER Program design comprises risk mitigation strategies to address four out of five risk categories. The description of the risk mitigation strategies is included under Section 11.1.

12.3 REVERSAL MANAGEMENT MECHANISM

Selection of Reversal management mechanism

Considering that the ER Program CF Buffer system is still under development, the ER Program will use the VCS Registry System and its reversal management mechanism. This is based on the following considerations:

- Compared to the initial design of the FCPF Draft Buffer Guidelines, the VCS reversal mechanism allows to pool emission reductions among several programs which allows for insuring against large risks.
- Moreover using the VCS non-permanence buffer approach and the linked registry system will allow for using an independent transport and hence credible mechanism for managing those ERs which are not sold to the FCPF CF.

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	Yes
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.	No

For option 1, explanation of Reversal management mechanism

The reversal management mechanism is substantially equivalent to the risk mitigation assurance provided by the ER Program CF Buffer approach:

- Whereas the FCPF approach covers three buffers (reversal, legal title, uncertainty), the VCS approach consists of one buffer which covers all risks (reversal, governance, program design carbon rights);
- The chosen approach pools emission reductions among several ER programs and hence allows for covering high-impact risks;
- The buffer tool provides a standardized approach for the quantification of risks and risk mitigation strategies, covering the scope of the FCPF buffer approach and allowing for a precise calculation of non-permanence risks.
- The insurance by the buffer will cover the term of the ERPA and is designed as a long lasting instrument which may be beyond the ERPA with the Carbon Fund;
- Similarly to the FCPF buffer approach, the VCS buffer approach allows for re-assessing risks and for releasing buffer ERs, if appropriate.

Consequently it is envisaged that the proposed buffer approach meets the requirements of the MF.

12.4 MONITORING AND REPORTING OF MAJOR EMISSIONS THAT COULD LEAD TO REVERSALS OF ERS

The ER program's monitoring approach will account for deforestation and forest degradation in the UNDEF/UNDEG stratum, the PDEG stratum and also to A/R stratum to check for forest losses. This system will allow covering any medium and large scale reversal due to pests, diseases, forest fires and other potential (natural or anthropogenic) hazards.

As part of its monitoring processes, the ER program will conduct an analysis of Global Forest Watch data. This is an automated process which covers all strata and will be conducted on weekly basis (cp. Section 9.2 and Table 29). This will allow to pre-identify potential reversals. Following this procedure, the ER program will notify the Carbon Fund on any potential reversals within 90 calendar days after the identification of a potential reversal.

13. UNCERTAINTIES OF THE CALCULATION OF EMISSION REDUCTIONS

13.1 IDENTIFICATION AND ASSESSMENT OF SOURCES OF UNCERTAINTY

This section summarizes the ER Program's approach to identify, minimize and quantify uncertainty following the 2006 IPCC Guidelines for National Greenhouse Gas Inventories (Chapter 3) and the FCPF Methodological Framework.

According to the MF, the ER Program is requested to follow a stepwise process for addressing uncertainty related to the REL (and MRV):

1. Identify and assess sources of uncertainty
2. Minimize uncertainty where feasible and cost effective
3. Quantify remaining uncertainty

UNPLANNED DEFORESTATION & UNPLANNED DEGRADATION (UNDEF/UNDEG)

The overall methodology used for the calculation of the $REL_{UNDEF/UNDEG}$ comprises a subset of methods related to sampling, manual classification, modelling and calculation of emission factors. The sources of uncertainty of each method was identified and assessed. See the description of UNDEF/UNDEG activity data and emission factors for the parameter specific uncertainty.

The IPCC (2006) differentiates between different categories of uncertainty. Of these, we have identified the following as being applicable to the $REL_{UNDEF/UNDEG}$

- Statistical random sampling error:
    - The $REL_{UNDEF/UNDEG}$ is based on approx. 36,000 sample points where land cover and land use were assessed of the period of the reference period (2004-2014). Sampling is an accepted method to determine a given parameter at lower cost/effort compared to full measurement (here wall-to-wall approach). Using sampling introduces error, which can be quantified and minimized by e.g. increasing the no. of plots.
    - The emission factors are based on approx. 80,000 1-ha subplots of LiDaR data. This is the area sampled with the LiDaR sensor and for which - based on the LiDaR-biomass model - biomass at the 1-ha scale is available. Emission factors were derived from these

1-ha subplots as the mean biomass for a given stratum. As such the emission factors are also subject to a sampling error.

- Misclassification error: Manual classification of satellite imagery may entail both random and systematic errors through the analyst.
- Model error:
  - The $REL_{UNDEF/UNDEG}$ is calculated based on manually classified data, which is processed using an algorithm developed for the statistical software environment R.
  - The emission factors for the $REL_{UNDEF/UNDEG}$ are based on a LiDaR-biomass model developed by Saatchi et al. (2015), which itself includes errors related to ground measurements of biomass, errors related to allometric equations from Chave et al. (2014) and error related to the LiDaR sensor.

AFFORESTATION / REFORESTATION (A/R)

The A/R module will account for removals that will be achieved by afforestation and reforestation activities. As this module is not linked to historic emissions, uncertainty assessment cannot be conducted. However this section describes how the uncertainty of removals will be conducted, once reforestation and supported revegetation activities are implemented.

In line with the CDM Small Scale methodology 'Afforestation and Reforestation Project Activities implemented on Lands other than Wetlands' (Version 3, CDM EB75, Annex 32), biomass increment will be estimated following the A/R Methodological Tool 14: 'Estimation of Carbon Stocks and Change in Carbon Stocks of Trees and Shrubs in A/R CDM Project Activities' (Version 4.1, CDM EB75, Annex 26). Following the tool and the methodological choices taken in Section 8.3.3, uncertainty is associated with the mean biomass stock per hectare for stratum i ($b_{TREE,i}$). Against that background, the following IPCC causes of uncertainty may occur:

- Lack of representativeness of data: BHDs and/or tree species height measurements that will be undertaken to quantify future growth of biomass stocks may not be representative; E.g. measured samples may not appropriately reflect different A/R activities (e.g. agroforestry, timber plantation) or the establishment of the activity / year of planting.
- Measurement error: In future measurement campaigns, there may occur random or systematic errors of BHD or tree height measurements.
- Missing Data: Future biomass measurements may be incomplete, e.g. for a A/R activity only BHD may be measured and tree height may be omitted.

PLANNED DEGRADATION (PDEG)

The methodology (or model) used for the calculation of the REL_{PDEG} comprises 43 parameters. The sources of uncertainty of each parameter was identified and assessed. See the description of PDEG activity data and emission factors for the parameter specific uncertainty.

The IPCC (2006) differentiates between different categories of uncertainty. Of these, we have identified the following as being applicable to the REL_{PDEG}

- Lack of data: We have not experienced a total lack of data for anyone parameter. However, some data for some concession has not been available and in such cases data had to be generated using interpolation/extrapolation to fill these data gaps.
- Lack of representativeness of data: As we could not sample all concessions, the use of the sampled data implies that the condition (e.g. road width) in all concessions is comparable to the sampled concessions.
- Statistical random sampling error: Applicable to all parameters that were sampled by us, e.g. road width, size of log landings etc.
- Measurement error: Applicable to all parameters that were directly measured by us, e.g. parameters sampled in forestry concessions such as e.g. road width or road length using remote sensing analysis. Further, applicable to all parameters that were measured by third parties and collect by us (e.g. volume).
- Misreporting: This may be applicable to all data that we collected from unverified sources, e.g. volume data from either government or forestry records.

13.2 STEPS TO MINIMIZE UNCERTAINTY

At present, the ER Program is still in the stage of preparation (application to the Carbon Fund. It is managed by CN-REDD and supported through number of partners and consultants. The development of the different REL components has been carried out by WWC, GFA and FRM. Each one of these companies has applied its internal QA/QC procedures to ensure a high quality of the delivered product.

Once the ER Program has institutionalized itself, it will develop standard operating procedures to consequently reduce major uncertainties related to the REL.

The ER Program has already envisaged Quality Assurance / Quality Control activities to reduce uncertainty related to MMR. Please see section 10 for more details.

UNPLANNED DEFORESTATION & UNPLANNED DEGRADATION (UNDEF/UNDEG)

The ER Program has tried to reduce uncertainty where possible in the following ways:

- Statistical random sampling error:
    - WWC sampling approach: The sampling error was reduced by using a high number of samples (approx. 36,000).
    - LiDaR-based emission factors: To reduce uncertainty, the entire LiDaR dataset was used to produce mean biomass values for each stratum.
- Misclassification error: Both systematic and random errors through misclassification of satellite imagery were addressed through a detailed training of the analysts, which included a training manual, a training course and a test prior to admission to the analyst work. For more details see Annex 6 and Annex 8 on the 'analyst program' and analyst training manual. Further, all classification work was supervised and samples that showed improbable land cover transitions were either excluded or underwent a manual amelioration process.
- Model error:

- Possible errors in the algorithm developed for the statistical software environment R.
- The error in AGB estimation from the LiDaR-biomass model developed by Saatchi et al. (2015) is estimated at approx. 14%, which is deemed acceptable.

AFFORESTATION / REFORESATION (A/R)

To minimize uncertainty, the training manual 'Addressing Emissions from Shifting Cultivation' was developed which provides general procedures for implementing and monitoring forest protection-, supported natural regeneration and reforestation activities.

PLANNED DEGRADATION (PDEG)

For all parameters, we have tried to reduce uncertainty where possible in the following ways:

- Measurement errors:
  - Where data has been directly measured, we have given care to apply good measurement practices through clear and unambiguous measurement protocols, as well as test measurements and by employing qualified personnel. Further, results have been quality checked for plausibility and implausible results have been excluded where they would lead to an overestimation of emissions (e.g. unrealistic harvesting intensities).
  - In general, our measurement protocols lead to conservative values. For direct measurements, we have chosen plausible measurement units (e.g. for road width decimetres instead of centimetres) and measurement results were always rounded down.
- Uncertainty related to statistical random sampling error: For parameters that we sampled during the study, we have calculated the required sample size based on a pre-sample to achieve as good as possible results (level of error of 10-30%) at the 95% confidence level.
- Lack of representativeness of data:
  - To improving the representativeness of our data, we have stratified forestry concessions in various ways for different parameters (e.g. industrial and semi-industrial concessions with regard to roads).
  - Where available, we used concession specific data (e.g. above-ground biomass, volume, roads).
  - Our sampling design covered 4 concessions of 3 different leaseholders employing different harvesting practices and having different technical capacities.
- Lack of data: When applying interpolation/extrapolation (e.g. for volume) to compensate for lack of data, we have used mean values from comparable concessions.
- Misreporting: To reduce uncertainty related to misreporting, we have checked reported values for plausibility (e.g. volumes). Where data was found to be implausible, it was either reduced or replaced by interpolation/extrapolation.

In general, for cases where we could not judge whether a value was realistic or not, we have applied the principle of conservativeness, i.e. taking the lowest available value in order to not overestimate emission reductions.

13.3 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), we have quantified uncertainty for all activity data and emission factors. We use the 'simple error propagation' method (IPCC 2006), calculating uncertainties in all activity data and emission factors before aggregating them to emission categories and finally the RELs for the individual strata. According to IPCC (2006), in order to quantify uncertainty using the simple propagation of error method, estimates of the mean and the standard deviation for each input are required, as well as the equation through which all inputs are combined to estimate an output. The following approach was applied:

- Where the mean, standard deviation and sample size is available, we calculate the 90% confidence interval. Where they are not available, we follow the guidance provided by the IPCC (2006) and use expert judgment to directly derive a confidence interval (relative).
- In all cases, we assume that the confidence interval is symmetrical.

Uncertainty is then calculated using the formulas from the 2006 IPCC Guidelines for National Greenhouse Gas Inventories (i.e. equations 3.1 and 3.2).

UNPLANNED DEFORESTATION & UNPLANNED DEGRADATION (UNDEF/UNDEG)

The uncertainty analysis of the $REL_{UNDEF/UNDEG}$ was carried out jointly by OSFAC, WWC and GFA. It is based on two separate uncertainty estimations: One related to the change detection of the sampling approach (activity data) and the other related to the emission factors.

Calculation of uncertainty of activity data

Uncertainty of activity data is based on an accuracy assessment carried out by OSFAC. The accuracy assessment includes accuracy of deforestation (dense or secondary forest to non-forest), degradation (dense forest to secondary forest), regeneration (non-forest to secondary forest and secondary forest to dense forest) and no change (forest remaining forest, non-forest remaining non-forest). For each land cover transition and the 'no-change' category, 50 sample points were randomly selected.

Based on the confusion matrix produced by OSFAC, the 90% confidence interval for each land cover transition was calculated using the following guidance:

- Olofsson et al, 2013, Making better use of data accuracy in land change studies: Estimating accuracy area and Quantifying uncertainty estimation;
- Olofsson et al, 2014, Good Practices for Estimating and Assessing accuracy area of land exchange.

The Annex 32 provide details calculation based on the result of the OSFAC accuracy assessment (confusion Matrix), the calculation of Stratified Estimator and finally the calculation of Standard error and 90% confidence interval.

Uncertainty for the individual components of the $REL_{UNDEF/UNDEG}$ is finally calculated as follows

Table 40: Uncertainty for the individual components of the $REL_{UNDEF/UNDEG}$

Land cover transition	Value [ha]	90% CI	Relative uncertainty

Primary Deforestation	337,295	± 115 006	34%
Secondary deforestation	1,348,513	± 381 969	28%
Degradation	1,736,101	± 395 009	23%
Secondary regrowth	249,177	± 251 120	101%
Primary regrowth	806,851	± 350 940	43%

Calculation of uncertainty related to emission factors

Calculation of uncertainty related to AGB and BGB estimation and finally emission factors follows the error propagation method as provided in the 2006 IPCC guidelines.

Table 41: Uncertainty related to AGB and BGB estimation

Sources of errors	Relative uncertainty			Data sources
	Dense forest	Secondary forest	Non-forest	
Ground measurement error	10%	10%	10%	Saatchi et al. (2015)
LiDaR height measurement error	0.33%	0.55%	3.01%	Saatchi et al. (2015)
LiDaR height to biomass model error	10%	10%	10%	Saatchi et al. (2015)
Sampling error	3.34%	3.36%	33.43%	Based on data from Saatchi et al. 2015
Total error AGB	14.54%	14.55%	36.43%	Error propagation
Total error BGB	35.30%	10.08%	13.16%	Based on Mokany et al. (2006)
Total error AGB+BGB	7.43%	3.37%	9.44%	Error propagation

Consequently, uncertainty related to forest and residual carbon stock was calculated.

Table 42: Forest and residual carbon stock uncertainties

Stratum	AGB+BGB [tC/ha]	90% CI	Relative uncertainty
Dense forest	179.09	± 24.30	13.57%
Secondary forest	106.53	± 12.69	11.91%
Non-forest	21.80	± 5.76	26.41%

Based on the carbon stock uncertainties, uncertainties for the emission factors were then calculated.

Table 43: Emission factor uncertainties

Emission factor name	Value [tCO2/ha]	90% CI	Relative uncertainty
Primary Deforestation	576.75	± 91.56	15.88%
Secondary deforestation	310.68	± 51.10	16.45%
Degradation	266.08	± 100.52	37.78%
Secondary regrowth	-310.68	± 51.10	16.45%
Primary regrowth	-266.08	± 100.52	37.78%

The table below summarizes the uncertainty of the emission / removal categories and provides the total uncertainty of the $REL_{UNDEF/UNDEG}$.

For calculation details, see the excel spreadsheet 'ERP_MaiNdombe_Uncertainty_UNDEF_UNDEG' annex to this document.

Table 44: Uncertainty of emission / removal categories and total uncertainty of the $REL_{UNDEF/UNDEG}$

Emission / removal category	Value (2004-2014) [tCO2]	90% CI	Relative uncertainty
Primary Deforestation	194,535,351	±73 167 017	± 37,61%
Secondary deforestation	418,949,454	±137 224 484	± 32,75%
Degradation	461,934,235	±203 713 938	± 44,10%
Secondary regrowth	-77,413,154	±79 048 937	± 102,11%
Primary regrowth	-214,683,299	±123 680 005	± 57,61%
REL UNDEF/UNDEG	783,322,587	±295 345 253	± 37,70%

AFFORESTATION / REFORESTATION (A/R)

The ER program will assess uncertainty of removals from A/R in line with the procedures of the CDM A/R Tool-14: Estimation of carbon stocks of trees and shrubs in A/R CDM project activities, Version 4.1, as follows:

$$u_C = \frac{\sqrt{\sum_{i=1}^{M} w_i^2 x \, {s_i^2}/{n_i}}}{b_{TREE}}$$

Equation (4)

Where:

u_C = Uncertainty in C_{TREE};

s_i = Variance of the tree biomass per hectare across all sample plots in stratum i,

n_i = Number of sample plots in stratum i.

The mean biomass per hectare in a stratum i is estimated as follows:

$$b_{TREE,i} = \frac{\sum_{p=1}^{n_i} b_{TREE,p,i}}{n_i} \qquad \text{Equation (5)}$$

Where:

$b_{TREE,p,i}$ = Mean tree biomass in plot p, in t.d.m/ha.

The variance of tree biomass in stratum i, per hectare is determined as follows:

$$s_i^2 = \frac{n_i x \sum_{p=1}^{n_i} b_{TREE,p,i}^2 - \left(\sum_{p=1}^{n_i} b_{TREE,p,i}\right)^2}{n_i x (n_i - 1)} \qquad \text{Equation (6)}$$

As removals from A/R are not based on historic activity data, but on an ex-ante estimate of planned mitigation activities, , the uncertainty analysis cannot be conducted. The procedure above hence describes how the uncertainty analysis of removals will be conducted, once A/R activities are implemented.

To provide a conservative ex-ante estimate, uncertainty of A/R removals is assumed to amount to 20%.

PLANNED DEGRADATION (PDEG)

As quite a substantial amount of data for PDEG is concession specific, uncertainty of historical baseline emissions is calculated for each concession before being aggregated to a total uncertainty value for the total REL_{PDEG}.

As mentioned above, uncertainty for PDEG is calculated using the simple error propagation method. Given the fact that the uncertainty calculation for the PDEG REL involves 20 concessions and 43 parameters (sometimes different for each concession), the tables are to large to present here. Consequently, for the individual uncertainty related to each parameter, see section 9.3.5 (activity data and emission factors). For calculation details, please see the see the accompanying excel spreadsheet 'uncertainty_analysis_PDEG_historical_REL'.

The Annex 32 presents the aggregated relative uncertainty for the major emission and removal categories related to the historical $PDEG_{REL}$ as well as the relative importance of each category in terms of % of total emissions and removals. The table is color-coded to highlight where the ER Program could invest to reduce uncertainty, provided the cost-benefit is positive.

<u>Total uncertainty for the total adjusted REL_{PDEG} is estimated at ± 991,764 tCO_2 or ± 6.30%</u>

OVERALL ASSESSMENT OF UNCERTAINTY

Relative and total uncertainty (90% confidence interval) for the historical REL is provided in the table below

Table 45: Total uncertainty of the historical ER Program REL

REL type	Value (2004-2014) [tCO2/ha]	90% CI	Relative uncertainty
UNDEF/UNDEG	783,322,587	±295 345 253	± 37,70%
PDEG	7,039,921	± 424,079	6.02%
A/R	0	± 0	20%
TOTAL ER Program REL (2004-2014)	790,362,508	± 291,011,182	36.82%

14. CALCULATION OF EMISSION REDUCTIONS

14.1 EX-ANTE ESTIMATION OF THE EMISSION REDUCTIONS

The emissions reductions have been estimated for each module (UNDEF/UNDEG, PDEG and A/R) considering the existing level of up-front investments and actors engaged in the program (please refer to Section 4.3 and 6.2). The section below presents a brief summary on the ex-ante estimates for the different mitigation activities, structured by REL stratum.

ERs from Unplanned Deforestation and Forest Degradation Stratum

The ex-ante estimates for emission reductions from UNDEF/UNDEG are based on the expansion plan of mitigation activities and based on the nesting of the WWC Mai Ndombe REDD+ project.

- The expansion plan (cp Financing Plan, 'UNDEF-DEG Summary') envisages build out rates (i.e. ha/yr) for all eight mitigation activities for a ten year period. These activities not only create direct emission reductions (e.g. through carbon sequestration in A/R activities), but also create alternative income which reduces pressure on existing forests. In order to estimate the emission reduction potential, it is assumed, that the mitigation activity implemented on one hectare reduces the need for deforestation by 1 hectare. To assess quantitatively, the weighted average emission factors of deforestation and degradation were considered. Moreover, to account for difficult working environment, a general performance ratio of 20% was applied. In parallel, the carbon potential of community conservation activities have been estimated based on the number of ha projected in the investment plan.
- The second part of the expected emission reductions is related to the inclusion of the WWC/ERA Main-Ndombe REDD+ project. Over its operating history, the project managed to keep its actual deforestation close to zero. To estimate the ex-ante reduction of the WWC project, an amount of 2 000 000 Gross ER have been estimated.

These two elements constitute the expected emission reductions under the UNDEF/UNDEG stratum.

ERs from Planned Degradation Stratum

The ex-ante estimates of emission reductions from PDEG are based on two activities:

- The areas for reduced impact logging are estimated to increase from 6,914 ha in year 1 to 41,485 ha in year 5. (It correspond to an increase of 2 concessions in year 1 to 12 concessions in year 5)
- The areas for conservation concessions are estimated to 172,856ha, constant over the five year period. (It correspond to 2 concessions under conservation)

These areas indications are based on substantiated expressions of interests from forest management companies to partner with the ER Program. It is expected, that a successful implementation under year 1 and year two may create additional momentum.

ERs from Afforestation/ Reforestation

In order to provide an ex-ante estimate of the removals from Afforestation / Reforestation and Assisted Natural Regeneration, the following steps were applied:

- Section 4 provides a description of the different mitigation activities foreseen under the ERPD. These are based a) on available funding and b) the Program's strategy for reinvesting
- Those activities which are linked to planting trees or to assisted natural regeneration were included in the respective analysis.
- Each of the activities follows a specific build out plan and was assigned a specific performance co-efficient (i.e. a co-efficient that expresses the Program's expectation that a mitigation activity realizes e.g. 50% or 75% of the calculated removals) which were considered in the analysis.

The ex ante estimate of emission reductions is based on the methodology laid out in Section 9.3.3. However, as the carbon sequestration of A/R does not qualify as historic emissions, the related estimates were not included in Section 9, but may be found in the ER-Program financing plan. The ex-ante estimate of removals show an exponential increase which is related to a) the continuous growth of trees, once planted and b) the Program's extension of the A/R and ANR areas. These figures were included in the table below.

Summary of ER ex-ante estimation

The below table provides an ex-ante estimate of emission reductions during the ERPA term, by stratum which also considers a strong performance of the nested Wildlife Works Carbon project. Moreover in line with the findings of Sections 10 to 13, the following set-asides were determined.

- The displacement analysis shows, that considering the ER program's displacement strategies, leakage is unlikely to occur.
- The risk- and risk mitigation evaluation results in the set-aside of 15% of emission reductions in the risk buffer.
- Finally, the uncertainty analysis indicates that the uncertainty amounts superior to 30% and hence a set-aside of 8% (i.e. applicable to overall uncertainties from 30%) applies.

As indicated by the table below, the ER Program may generate 29,84 million net emission reductions during the term of the ERPA.

Table 46 - Estimation of expected emissions under the ER Program (tCO2-e/yr)

Year	Reference level (tCO2-e/yr)	ERs UNDEF/UNDEG	ERs A/R	ERs PDEG	Set A-side of ERs Uncertainty	Set-aside of ERs Risk	Expected net ERs
1	107 609 443	3 412 202	0	0	272 976	511 830	2 627 395
2	107 609 443	4 824 403	48 134	360 054	418 607	784 889	4 029 095
3	107 609 443	6 907 841	82 413	432 065	593 786	1 113 348	5 715 186
4	107 609 443	9 254 717	178 092	504 076	794 951	1 490 533	7 651 401
5	107 609 443	11 950 230	292 827	576 086	1 025 531	1 922 872	9 870 740
Total	*538 047 217*	*36 349 393*	*601 466*	*1 872 281*	*3 105 851*	*5 823 471*	*29 893 818*

15. SAFEGUARDS

15.1 DESCRIPTION OF HOW THE ER PROGRAM MEETS THE WORLD BANK SOCIAL AND ENVIRONMENTAL SAFEGUARDS AND PROMOTES AND SUPPORTS THE SAFEGUARDS INCLUDED IN UNFCCC GUIDELINES RELATED TO REDD+.

NATIONAL FRAMEWORK FOR ENVIRONMENTAL AND SOCIAL MANAGEMENT OF REDD+ ACTIVITIES

The Strategic Environmental and Social Assessment (SESA, ref.: SESA Report on the FCPF website) of REDD+ in DRC has been conducted in a very inclusive way with very strong participation by civil society and the other stakeholders involved. The SESA process was conducted throughout 2012 and part of 2013 in parallel with the development of the National REDD+ Strategy Framework. The identification of the seven pillars of the REDD+ Strategy and their activities also resulted from a consultation process. The associated risks identified and respective recommendations have been taken into account in the design of the strategy. The consultation process is well documented in the SESA report.

Asa result of the SESA process, the DRC adopted an Environmental and Social Management Framework (ESMF, ref.: ESMF on the FCPF website) and the following five specific frameworks that address particular aspects of REDD+ investments: pests and pesticides management framework, cultural heritage management framework, Indigenous Peoples Planning Framework, process framework and resettlement policy framework. These frameworks 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. It should be noted that the DRC is the first country in the world with environmental and social safeguard instruments on REDD+ duly validated by the World Bank (May 2015).

The DRC has also defined its national social and environmental standards in order to have its own national regulatory framework and ensure the integration of social and environmental considerations in the implementation of REDD+, in full compliance with the Cancun Agreements and related international regulatory frameworks (ref.: national standards). A broad participatory development and capacity-building effort was undertaken with civil society over an eight-months period. The standards contain 7 principles, 22 criteria, and 22 mandatory framework indicators. They cover participation, governance and transparency as well as the increase and sharing of potential social and economic benefits, mainstreaming of gender issues, the respect and promotion of rights and appeal procedures. These standards are now being tested at several pilot sites in the DRC including the Mai Ndombe jurisdiction. The results will enrich the national safeguard instruments, which will be subject to national communications with UNFCCC.

APPLICATION OF SOCIAL AND ENVIRONMENTAL MANAGEMENT IN THE MAI-NDOMBE ER PROGRAM

The ER Program's intervention strategy has been developed in alignment with the National REDD+ Strategy Framework and has taken into account the recommendations resulting from the SESA process and national ESMF. As a first experience in the application of national instruments of REDD+, the program will test the application of safeguards instruments in the implementation phase of REDD+.

The management of social and environmental aspects of the program is fully integrated into the identification, design, monitoring, and evaluation of its activities. All projects/activities implemented by the program must comply with the requirements of the ESMF at every step of their implementation.

Consideration of safeguards in the identification and design of projects. Projects in the preparation phase will have to demonstrate that they meet or take steps to meet the national requirements regarding social and environmental standards, in particular with regard to governance, accountability, FPIC and monitoring. Each project will be screened using a standardized template and categorized according to associated risks and mitigation potential. The templates will be completed by project developers or LEA supporting the implementation of community micro-projects. They will then be collected by the REDD+ Executive secretariat through the registry. Depending on the risks identified, an environmental and social impact assessments may be required and/or the development of environmental and social management plans (ESMP). The ESMP, prepared by project developers and/or LEA, must be approved by the REDD+ Executive secretariat. For projects with little environmental and social impacts, a guide on good social and environmental practices will be applied.

Monitoring and evaluation of the implementation of safeguard measures. Project developers are subject to compliance with ESMP if necessary, as well as national social and environmental standards (which are the minimum requirements to be followed). The monitoring of standards and the specific requirements of the ESMP are the basis of the monitoring and evaluation of the proper application of the safeguards.

A detail safeguards analysis has been done and is presented in Annex 12. It present the social and environmental risks of each key activity of the program and the mitigation measures.

15.2 DESCRIPTION OF THE ARRANGEMENTS TO PROVIDE INFORMATION ON SAFEGUARDS DURING THE ER PROGRAM IMPLEMENTATION

The sound application of safeguards as well as the generation of non-carbon benefits[47] during the implementation of the program will be disclosed through the following channels: (i) regular information posted in the National REDD+ Registry (ii) an independent information platform (MOABI) and (iii) a monitoring report on the environmental and social standards of the program published annually (or bi-annually). The information described here is included in Annex 9.

[47] National Social and environmental standards of the DRC describe both the minimum safeguard measures and the expected co-benefits of REDD+ activities, therefore this section has a lot in common with section 9.2 on the approach toward providing information on non-carbon benefits.

The national REDD+ registry will publicly display the environmental and social impact studies, the environmental and social management plans, and the monitoring of indicators providing information on the proper application of safeguard measures for each project and program in the country. The ER program management unit, working closely with the LEA, will be responsible for uploading the information in the registry. The integrated REDD+ projects will also be directly accountable with regard to the uploading of information in the registry. Furthermore, the registry will also provide information on complaints and appeals relating to each project and their processing status and the resolution adopted where necessary (see Section 15.3 below). The Moabi platform will is an additional tool where civil society and mandated independent observers can post their comments and expertise on compliance with safeguards.

A working group is currently supporting the definition of indicators and monitoring arrangements for the Mai-Ndombe ER Program building on the national standards. This process is supported by the REDD+ SES initiative and conducted in a participatory manner with the provincial government and designated representatives from local communities and Indigenous Peoples. A workshop to build the capacity of provincial stakeholders in the Mai Ndombe ER Program was organized from May 11 to 13, 2015, and provided an opportunity to discuss the risks and opportunities of REDD+ activities as well as monitoring arrangements for safeguards. Additional capacity building workshops will be held before the program starts to implement the Safeguards Information System (SIS) in the jurisdiction., are planned before starting the implementation of the RE program to made it possible to ensure appropriation that is consistent with the expected change in mentality of the beneficiaries.

Data collection. Monitoring data related to social and environmental aspects will be collected by the Local Development Committees (CLD), project holders, LEAs and the program management unit, but also by monitoring missions conducted by decentralized agencies and local advisory committees such as the CARGs. Figure 13 below presents a summary for each category of indicators, data sources, collection frequency, and the entities responsible for monitoring and reporting.

Data analysis and reporting. The program management unit will do a first data analysis and prepare the report in collaboration with the Provincial Steering Committee as well as civil society and representatives of local communities and Indigenous Peoples. will participate in the review in accordance with arrangements that are to be defined. Once the report is approved by the Provincial Steering Committee of the program, the report will be shared publicly on the national REDD+ registry and be sent to the FCPF Carbon Fund. The report will also be used to compile the national report on safeguards to be submitted to the UNFCCC.

In order to ensure the credibility of the report by the program management unit, the independent observer will act alongside civil society to verify the proper implementation of safeguards. It will produce an independent report with recommendations, which will be sent to the Minister of Environment for corrective actions as needed. The report will be assessed and validated by the National REDD+ Steering Committee.

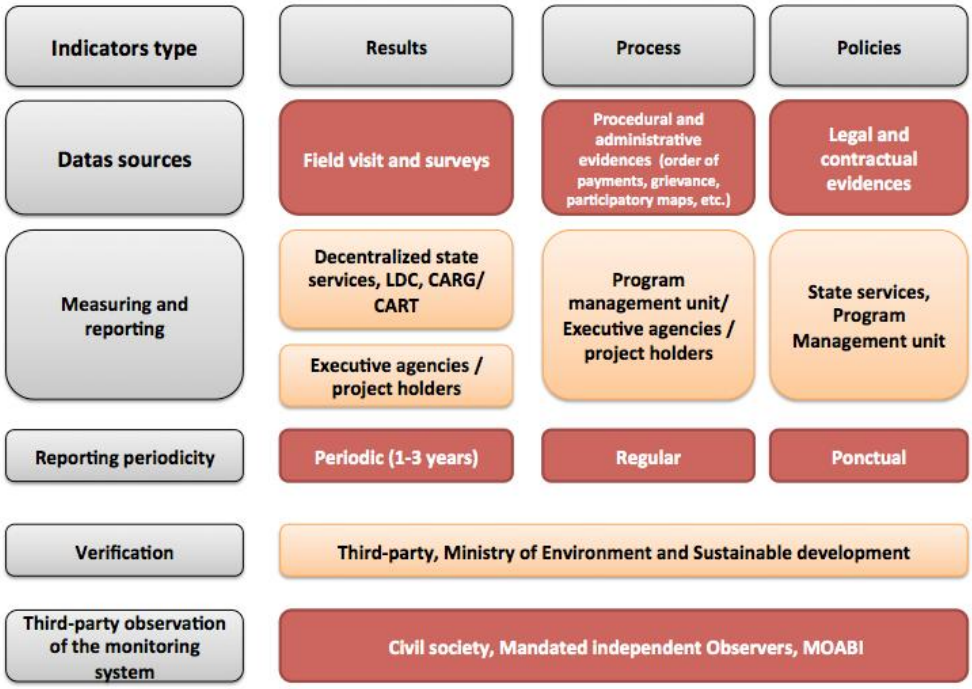


Figure 13: Arrangements for the monitoring system for safeguards and non-carbon benefits

15.3 Description of the Feedback and Grievance Redress Mechanism (FGRM) in place and possible actions to improve it

The Social and Environmental Safeguards Assessment (SESA) process already proposed general principles and guidelines of grievance and redress mechanisms but there is still the need to define precise procedure and an adapted capacity building plan. A study that began in December 2015 will provide national and sub-national guidelines based on lessons learned by April 2016 (ref. Terms of reference on the FCPF website). The Mai Ndombe ER Program will be the first program to implement the new national guidelines. The effective implementation of FGRM in the program area will be under the responsibility of the program management unit and the implementing agencies and will be accompanied by outreach and capacity building activities. From the middle of 2016, the FGRM will be tested and the national REDD+ registry will provide a transparent platform for filing complaints and monitoring their handling.

While the development of a national FGRM with formal procedures is still ongoing, there are several mechanisms available on site allowing for the provision of feedback and the management of complaints, including through the various committees presented above such as CLD, CARG and CART). Experience with local types of complaints mechanisms are emerging in the context of the pilot projects, and the CN-REDD is currently analyzing their strengths and weaknesses. Currently complaints that emerge in the ER-Program consultation and design phases are channeled through the REDD+ Focal point and the communities designated representatives (see Section 5) which are in direct link with the National REDD+ Coordination. The National REDD+ Coordination is piloting a collaborative work with his partners and the designated representatives to design the Safeguard Information System and the FGRM.

The SESA process in DRC has already established the key principles of the Feedback and Grievance and Redress Mechanisms: independence, impartiality, transparency, accessibility, efficiency, predictability,

stakeholders engagement, compliance with human rights, non-coercion, flexibility and professionalism. It also includes certain steps for operationalizing the FGRM (see Figure 14)

The following paragraphs summarize the different considerations and discussions occurring during the design phase which permitted to design the main elements of a FGRM for the Mai-Ndombe ER program, as well as to identify the roles of different bodies (also see Annex 9). Further steps will ensure that this mechanism is elaborated in a participatory manner. Firstly the present description of the mechanism will be developed and refined on the basis of the current study analyzing the lessons learned in term of GRM. This study will be led by a consortium including civil society organizations and targeted consultation with representatives of communities and Indigenous Peoples including women and youth will be done in order to develop and validate the mechanism that will be proposed in this study.

Issuing of complaints. Any person or organization will be able to make a complaint about a REDD+ through the proposed procedure, which will be available in the national REDD+ registry. The filing of a complaint will automatically inform the national authorities in charge of REDD+, as well as involved project holders or implementing agencies. In the case of rural people who have no access to the internet, i.e. most of those affected by REDD+ activities, specific offices will be set up as part of the advisory boards such as LDCs and CARGs/CARTs. These offices will be equipped with internet access allowing them to relay the complaints to the registry and inform the Provincial Steering Committee. The organizations of civil society can also serve as local contacts for the filing of individual or collective complaints, including through the MOABI platform.

Reasons for and type of complaints. Complaints may primarily relate to the contracts and agreements between parties. For instance, communities may want to complain about the contracts signed with project holders or the implementing agencies (e.g. as regards conditions or performance) , in particular to ensure the effective implementation of planned investments in the SDPs of the territories. Non-compliance with social and environmental standards may be another reasons for complaints by affected parties (e.g. poor participation, lack of transparency, rights to land and resources). The program will ensure, particularly through LEAs, that the parties and especially Indigenous Peoples and communities are well informed about opportunities to raise concerns and complaints and, importantly, about the rights, benefits and conditions associated with REDD+ investments. Grievance and complaints which are not directly linked with the implementation of the program and/or which can't be really solved by the program collaborative mechanisms and which concern for example corruption, coercion, violation of rights and/or policies will be referred to administrative or judicial bodies for formal investigation.

Handling of complaints. The procedure to cancel or to forbid bad practices which are generating grievances are to be addressed to the administrative and judiciary institutions that are habilitated to receive and treat the cases. The same for plaints on any mismanagement of the contracts obliging as well the project itself and the local communities or anyone else (administrations etc.). The cases being collected by the CLDS and CARG (which are composed of a mixture of public and civil agents) or emitted by any civil institution or individual are treated at three levels :

1) A level of mediation <u>and</u> decision which is <u>internal</u> to the implementing scheme, including the CLDC, the CARGs, the administration, the civil society and at least, the provincial Steering Committee, headed by the governor of the province. Some of them will have administrative rights and obligations to deal with the cases. A procedure for handling complaints will be defined in detail but will mainly follow the following steps: (i) Complaints will be addressed primarily at the local level through the LDC/CARG/CARTs, (ii) If the complaint cannot be processed at this level (e.g. no consensus, no suitable mandate), it will be forwarded to the Provincial Steering Committee for instructions, (iii) The Provincial Steering Committee will trigger an investigation (which will include a civil society representative). (iv) Based on the results of the investigation, the Steering Committee will arbitrate if

possible or refer the matter to the National REDD+ Committee. The National Committee will assess the case and forward it to the respective court or tribunal as needed.

2) An external mediation, through the ombudsman. The ombudsman is a mediator. As so he/she can help the parties to get to a consensus. The program may refer to independent mediators at various levels facilitate amicable settlements but it will also put into place a continuous position of "ombudsman" (organization or persons) to investigate the various complaints in order to facilitate their examination and handling. The latter would then be able to analyze sets of complaints, produce a summary report with recommendations to the Steering Committee and the implementing agencies and track actions taken by the program. Any one from the implementing scheme can call for the ombudsman help

3) If not, if there is no consensus or if it is not implemented, a decision is asked to the relevant judiciary institutions.

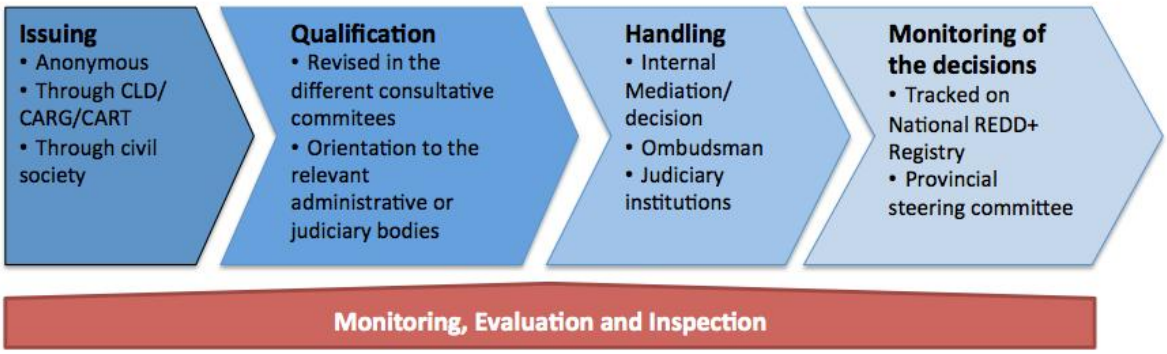


Figure 14 - Issuing procedures and complaints management at national level (source: National REDD+ Strategy Framework)

Monitoring of the implementation of decisions. Resolutions or arbitration to resolve complaints and appeals will be published on the national REDD+ registry. The implementation of decisions will then be monitored by the Provincial Steering Committee and the program management unit, and if necessary, by local executive agencies and the CARTs/CARGs. The decisions to resolve complaints may lead to financial sanctions or withdrawal of approval in the case of integrated projects.

Monitoring, Evaluation, and inspection. The role of monitoring and evaluation and external control of implementation will be fulfilled continuously by civil society through its local networks to ensure that (i) the means for issuing complaints are accessible and functional; (ii) the handling of complaints is effective and transparent and (iii) decisions are applied effectively. Civil society in particular will rely on the technologies developed by the NGO MOABI to share its analyses and findings on the effectiveness of the procedure on the ground. At the local level, representatives of communities, Indigenous Peoples including women and youth will be involved in the evaluation of the mechanism.

The program will provide the financing for the program-level FGRM. An initial budget is proposed in the financial plan of the program and includes the following activities:

- Capacity building of stakeholders involved in the various stages of the issuing and processing of complaints (e.g. civil society networks, local and provincial governments) and training in eight territories.
- Internet equipment (in 19 sectors)
- Control missions at the provincial and territorial levels

16. ARRANGEMENTS FOR BENEFIT-SHARING

16.1 DESCRIPTION OF ARRANGEMENTS FOR BENEFIT-SHARING

The principles, beneficiaries, and operational conditions of the distribution of carbon revenues discussed between stakeholders and presented in this section will guide the development of the benefit-sharing plan within the Mai-Ndombe ER-Program to be attached as an annex to the Emission Reduction Payment Agreement (ERPA) signed with the Carbon Fund. These principles may be revised at the end of the term of the ERPA, based on an evaluation of this initial phase of implementation of the program.The preliminary plan proposes an indicative distribution key for the sales under the ERPA during its period of execution. This indicative distribution will be updated and validated prior the signature of the ERPA.

For the program management unit and for those who will control its execution, the benefit-sharing plan will be the reference document for (i) the allocation of revenue from the sale of emission reduction credits (ERC) of the program between activities more or less directly generating emissions reductions and (ii) the monitoring of the distribution of income at the local level between the stakeholders, in conformity with the condition of repartition that will be settled in the sub-contracts of the program.

REDD+ BENEFITS

Benefits covered by the benefit-sharing plan: revenues from the sale under the ERPA with the Carbon Fund of the Emission Reduction Credit generated by the program among a set of carbon and non-carbon benefits generated from REDD+ activities.

The carbon benefits are streams of revenue related to the valuation of an environmental service for the avoidance of forestry carbon emissions or the sequestration of it. This service is provided through contributing activities on one hand to avoid deforestation and/or forest degradation (carbon not emitted) and on the other hand to restore or extend the forest cover (carbon sequestered). This carbon may take the form:

i. of investments required to generate emission reductions;
ii. of payments for environmental services (PES);
iii. of financial assets (ERC) negotiable over the counter or in a regulated market;
iv. of the proceeds from the sale of ERCs;
v. of goods and services financed by the PESs or the proceeds of the sale of ERCs.

Carbon benefits materialize downstream or upstream of the execution of expected activities or the measurement of their carbon impact depending on whether they are more or less conditional on each other.

For performance-based payments, the performance measurement is either the amount of carbon not emitted or sequestered (Emission Reduction Credit), or a number of non-deforested, regenerated, or planted hectares, which is a proxy for carbon performance (based partly on an estimated amount of carbon per hectare) whose measurement is less costly and complex to implement than a carbon MRV system.

Beyond the valuation of the Emission Reduction Credits, REDD+ benefits include social and environmental co-benefits associated with the delivery of this service. (Please see section 17).

REDD+ BENEFICIARIES

Beneficiaries from benefit sharing: stakeholders who have a direct or indirect influence on the evolution of the forest cover, whether positive or negative, are eligible.

a. Participants with a direct influence, i.e. the legal or de facto managers of forestry resources who decide on how to enhance their value (production of goods). It is the state's public domain (protected areas); land concessions (agriculture, forestry, animal husbandry) and forestry (7 companies out of 18 concessions), small scale producers, local communities and Indigenous Peoples (farmers, charcoal burners, hunters, or farmers) in customary lands;

b. Participants with indirect influence, i.e. players in the agricultural sector, forestry and charcoal burners in positions of contractors, buyers, processors, distributors, local, national and international consumers, whose request for environmental co-benefits associated with these sectors (e.g. driven by a bonus-malus taxation system) can focus demand and therefore management decisions by the producers;

c. The political and administrative stakeholders at different administrative levels - the executive and the elected provincial officials, the deconcentrated services of the state at the level of territories, elected councils from sectors or chiefdoms, groups (customary entities) - which control but also guide investment decisions through subsidies or tax incentives, or the issuing of titles for access to resources (licenses, concessions).

d. Indigenous Peoples. If the purpose of carbon incentives is to target the agents of deforestation and/or degradation of forest identified in the analysis of the direct and indirect drivers of deforestation (Section 4.1), the program intends to recognize the historical role of Indigenous Peoples in sustainable forest management and help to reverse the dynamics of their marginalization in the non-sustainable forest management systems of today. Present in the only district in Mai-Ndombe and now partly settled, they also practice slash and burn agriculture. Frequent marginalization in local governance bodies and the low level of recognition of their traditional hunting and gathering rights calls for a differentiated consideration of their needs by the program. In this way, the program will address their frequent marginalization in local governance bodies and the low level of recognition of their traditional hunting and gathering rights in an integrated system for the planning of land use associated with incentives. The program will ensure the incorporation of their rights and needs into this planning.

BENEFIT SHARING SUB-CONTRACTS

The benefit-sharing mechanisms will be executed through a contractual architecture with the different operators involved in the activities of the program. The contractual setting for the Maï-Ndombe Program supporting the envisaged ERPA with the Carbon Fund of the FCPF rests on two distinct sub-ERPA pillars:

I. Carbon-related contracts (with project holders)

- These are the "partnership contracts" concluded under the Homologation Regulation with respect to projects within the *Maï-Ndombe* Program; (see section 4.4 and 17)
- The contracts identify project and direct ERC holdings, set methodological and standard rules for project implementation and define the modalities for REDD+ benefit-sharing between the central government, the provinces, local communities and others;
- The existing model contract (Annex IV of the Regulation) will be amended as part of the revision to take into account the application of the domestic standard, domestic issuance, and consolidated benefit-sharing approaches with stakeholders on the basis of the principle of voluntary participation (see below: "Implementation contracts") rather than government-imposed REDD+ action;
- The contracts can specify that all or certain portions of ERCs allocated to project holders should be transferred to the government or to any other authorized entity for commercialization purposes;
- The contracts are concluded between the project holders and the central government (i.e. the Ministry responsible for the environment).

II. Implementation contracts (with stakeholders, which are not project holders)

- These contracts are for conclusion between the government or the project holders and a wide range of stakeholders – defined in the Regulation as "any natural or legal person, local communities, Indigenous Peoples, authorities, village associations and non-governmental bodies (recognized by the law) which may be affected directly or indirectly by the project" (article 3 of the homologation decree) – in order to:
    - Achieve the approval of all relevant parties; and
    - Secure implementation of the REDD+ activities planned;
- The contracts specify the tasks and activities as well as indicators (e.g. deforestation / reforestation targets), but they are formally disconnected from the carbon-related contracts and do not imply the allocation, sale or transfer of ERCs;
- The contracts may lay down the rules for compensation (fixed or as a percentage of the ERC proceeds) and they may include rules on risk sharing, but their execution and implementation is *strictu sensu* not linked to the carbon performance of the project or program or the issuance and transfer of ERCs;
- Importantly, the contracts will always include an exclusivity and no-compete clause concerning the REDD+ activities and their exclusive eligibility under the national REDD+ program (or the REDD+ project in question); this clause strictly adheres to the rules on "double-counting",

which are an integral part of the national REDD+ program, in general, and the contractual obligations under any ERPA, in particular.

The contractual arrangements are described in the following flow chart:

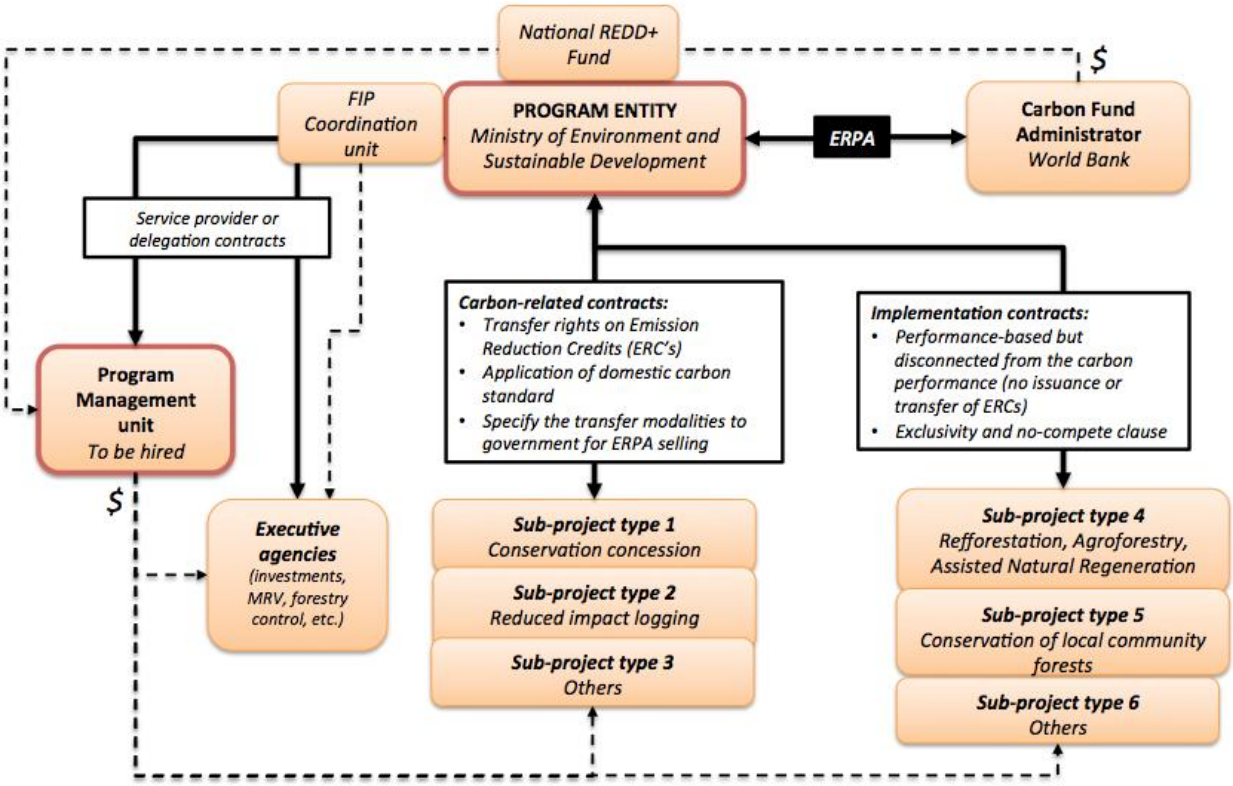


Figure 15: Contractual arrangements of the ER-Program

BENEFIT SHARING PRINCIPLES

Some principles in term of benefit-sharing have been agreed during the development of the Emission Reduction Program Idea Note (ER-PIN) and the design phase. Here is a synthetic vision of this principles and how they will be included in the design and negotiation of the different sub-contracts presented above:

General principles

- The distribution of carbon benefits will be partly based on non-carbon benefits. It is in fact expected that non-carbon benefits will take over from the carbon revenues as incentives to reduce deforestation and degradation. In a program designed to promote the development of economic activities, the carbon benefits are an investment lever that loosen cash constraints. Based on a cost-benefit analysis incorporating non-carbon benefits for which there is a market, feasibility studies conducted as part of the preparation of the investment plan examined the level of incentive necessary for the stakeholders to change their practices in order to offer a premium that exceeds the mere compensation of the opportunity cost for this change.

- The transparency of the benefit-sharing contracts and the principle of free, prior and informed consent will apply to agreements between the government and nested projects holders, sub-contracts between the latter and local communities, and others implementation and proxy performance-based contracts with the private sector or local communities. For all the sub-contracts with forest or other agricultural concession, the FPIC principles will apply if the activities proposed have consequences on communities land-use rights and/or existing agreement (e.g. *cahier des charges* with forest companies).
- Generate a capacity for reinvestment. The program will generate net benefit through (i) the margin between the proxy payments and the carbon revenues and (ii) the benefits shared by nested project holders after covering their operational costs (as agreed in their carbon-related contracts). This net benefits will be allocated to a revolving fund which will be used by the program to up-front finance new enabling or sectoral activities (during the ERPA period or after). To the extent that the program performs, the surplus generated will then allow the program to ensure its own financing.
- Some allocation of revenues will be directly done to support key stakeholders, independently of their direct performance which is often not measurable. It concern Indigenous Peoples, which have a differentiated historical responsibility as described previously, but also the State at the provincial and territorial level, which have a direct responsibility in the success of the program and which require incentives in order to participate actively in the implementation and control of activities within the province. All the remaining benefits are allocated to the central government through the National REDD+ Fund to be reinvested in the program or others REDD+ activities within the country.

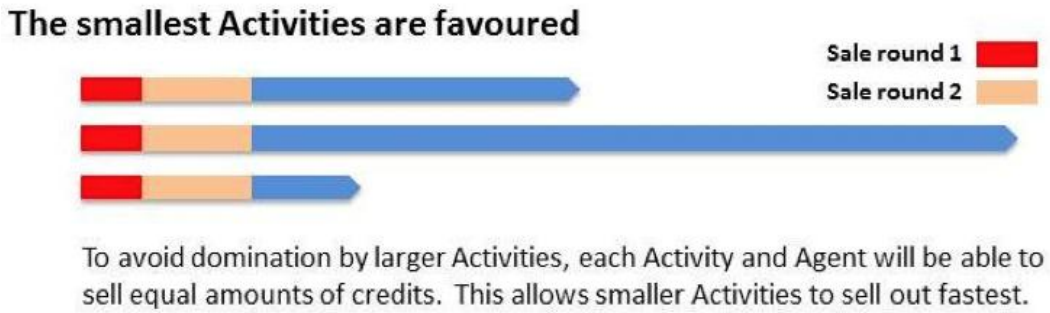
Principles in the distribution of Emission Reduction Credit.

- The emission reductions generated in the program area will take the form of Emission Reduction Credits (ERCs) registered in the national REDD+ register once the emission reductions are measured and verified. This ERCs are allocated to the ER-Program entity (DRC government) and also to holders of projects who signed carbon-related contracts with the government (through homologation regulation).
- The program will recognize the prior agreements linked with forest carbon valorization signed by the government and subcontracts that are attached to it. It is the case of the ERA project which signed an agreement in 2011 with the government and now held by Wildlife Works Carbon. Benefit-sharing principles with the government and communities settled in this agreement will be respected. However an alignment of the Reference Level with the program will be negotiated in order to ensure a balance between the need to align the project and program baseline but also to recognize the important private investment made by the project until now.
- Except for this case where carbon rights have already been recognized/transferred by the state to the project holder, new nested projects will have to go through homologation Regulation and will be allocated a reference level aligned with the one of the program but allowing an adapted incentive for the project holder to tackle existing and future risks of deforestation/degradation.
- In each program monitoring report, ERC generated will be allocated transparently to the different project holders according to their performance against their specific REL.

- All the remaining Emission Reduction Credit generated will be considered as the result of up-front investment as FIP and others relevant activities and policies in the area and will be owned by the government of DRC (for selling or UNFCCC reporting purposes).

Principles in the sales of Emission Reduction Credit

- Purchase program with the Carbon Fund: The Government of DRC propose to report and sell Emission Reduction every 2 years to the Carbon Fund until 2021. An advance payment of 10% is proposed for the first year (as explained in section 6.2) which will be reimbursed by the following selling to the Carbon Fund
- If the purchase volume is insufficient and the credit generation differential is too great between the different nested projects (project under carbon-related contracts), instead of distributing the funds in proportion with the performance of each project, sales of credits through the program will be performed in successive rounds at the lowest possible allocation so as to ensure that projects with low levels of allocation will have priority in benefit sharing. (see figure below).



- If the DRC government recognizes the principle of serving the nested projects as a priority because they are paid exclusively ex post based on a certified measurement of their carbon performance (return on investment stake), it also recognizes the need to take into account the reinvestment capacity of the program (selling from the government to be reinvested). Consequently, project holders who signed carbon-related contract will negotiate with the DRC government the share of their ER credits that can be sold through the program to the Carbon Fund. This negotiation will be a compromise between the economic balance of the project and the capacity of reinvestment of the program.
- In case of non-performance or sub-performance of the overall program after one reporting period, the program will still keep track of individual performance of nested projects and will establish mechanisms to remunerate projects who performed. It can be done by (i) selling ERC from the previous reporting period if available, (ii) remunerating directly projects through money kept for reinvestment if available (ii) establishing a shared buffer account for the program and nested project (as the one existing under VCS JNR standard).

INDICATIVE SHARING PLAN

This indicative sharing plan offers a simulation of sharing revenues from the sales by the program of 15 $MtCO_2$ emission reductions at a level of 6,5 $/t in the form of a $78 million sale spread over five years, minus the 10% advance on the ERPA obtained for start up. This purchasing program represents 50% of the potential emissions reduction estimated at 29 Mt over its first five years of implementation. (see section 13)

Table 47: Indicative benefit sharing plan for the FCPF ERPA

Benefits sharing plan	ERPA 10% advance payment	Total 5 years ($)	% ERPA
Program transaction and monitoring costs	975 000	9 750 000	10%
Execution of carbon-related contracts with nested project (cost + profit)	2 153 750	29 152 014	30%
WWC project	1 478 750	14 787 500	15%
Reduced Impact Logging/Conservation concession projects	0	6 549 906	7%
Nested project communities benefit sharing	675 000	7 814 608	8%
Reinvestment in the program activities	6 500 000	49 120 986	50%
Investment in enabling activities	4 500 000	16 400 000	17%
Invetment in communities sectoral activities	0	23 800 000	24%
Co-investment with private sector	2 000 000	5 400 000	6%
Operating cost	0	6 800 000	7%
Sharing of benefits free of contracts: Indigenous Peoples, province	0	9 477 000	10%
Total		97 500 000	100%

16.2 SUMMARY OF THE DEVELOPMENT PROCESS FOR BENEFIT SHARING ARRANGEMENTS

For the definition of enabling investments, the process began at the time of the program design, capitalizing on the feedback from the participatory mapping projects undertaken both in the territory of Bolobo and in Oshwe as part of negotiating the social clause specifications for forest concession holders (almost one million hectares have been mapped in this way by WWF, about 146 terroirs were involved and nearly 350 local development and conservation committees have already been organized) and for the preparation work of the PIREDD Plateau.

For the identification of sectoral activities, diagnostic surveys were conducted successively in each of the two districts based on the 2011 household survey. Funded under the Carbon Map Model, cost-benefit analyzes were produced during 2014 (i) at the level of customary lands of the Bolobo Territory to define a community intervention strategy with draft contracts of the PES type and (ii) on Oshwe forest concessions with the REDD+ lever for the forest concession holders on the basis of the work of the FORAFAMA project.

Based on the results of the study on the sharing of REDD+ benefits realized in 2011 by CODELT, a study on benefit-sharing was initiated by NC-REDD in 2015 to elaborate the principles in the ER-PIN with regard to a review of national and international experiences, using a simulator of REDD+ benefits, proposals for sharing of the assorted benefits of contractual options for implementing them at both program and national level.

A steering committee comprising representatives of civil society (GTCR), the private sector, and the central and provincial administration was formed to monitor the study and discussion of institutional arrangements within the technical secretariat in charge of preparing the program document in order to reconcile the positions of stakeholders to the extent that the investment options became clearer and the eligibility of payments based on carbon performance or proxy performance was specified.

Following the May 2015 workshop that helped stabilize the principles and benefit-sharingoptions to be discussed, a process of more intensive consultation began to gather input from a broad range of representatives from national civil society. Civil society lawyers were also mobilized to bring the review of the order for approval to the government.

In the continuation, meetings with local stakeholders at three key sites in the program area (South-Kwamouth, Bolobo, Inongo) and two sites outside began in July, allow to clarify the conditions for the operationalization of the benefit-sharing plan within the sub-contracts between the program and the local communities or concession holders and these communities. The results of this work will finally feed into proposals for national guidelines.

16.3 DESCRIPTION OF THE LEGAL CONTEXT OF ARRANGEMENTS FOR BENEFIT-SHARING

See section 4.4, 15.2 and 17.for details about legal context, program arrangement and contractual architecture

17. NON-CARBON BENEFITS

17.1 OVERVIEW OF POTENTIAL NON-CARBON BENEFITS AND IDENTIFICATION OF PRIORITY NON-CARBON BENEFITS

This subsection has been partially addressed in sub section 4.3. The intervention strategy is presenting in detail how these benefits will be generated by program activities.

Increase household and private sector incomes

Generating additional income from higher yields and diversification of the sources of agricultural revenue is at the heart of the strategy of the program. It aims to use agroforestry to demonstrate the profitability of working in savanna areas independently from carbon revenues (food crops based on improved varieties in combination with wood energy or fruit, palm oil, rubber). Furthermore, it targets to rehabilitate or develop perennial crops generating alternative but also intensive revenues in a diverted workforce of a slash and burn fallow type (coffee and cocoa in forestry zones).

The executed cost-benefit analysis illustrates the interest of communities in changing the itinerary that preserves their NTFPs, representing also potential sources of revenue.

It is expected that non-carbon benefits in some cases take carbon revenue relays as incentives to maintain low carbon development options promoted by the program. To make these options viable, the program will strengthen the sectors of perennial crops and wood energy so as to maintain continuous demand. The program therefore appears to be designed as an incubator for economic activities where carbon benefits arise for the private sector as an investment lever, loosening the constraints on access to capital and cash flow until the investments reach maturity.

In the form of grants to local communities and co-financing the private sector, the program will represent a driver for value production in rural areas, creating jobs (direct and indirect) and revenue.

Socio-economic Investments

Once launched, the program will fund major investments in the infrastructure of general interest. Part of the carbon revenues will be reinvested in order to extend these investments. Tax revenues generated by the forestry control strengthening and taxation of unsustainable charcoal will not only contribute to its self-financing but will also feed the provincial budget which will, in turn, benefit from the retrocession of a share (4%) of the revenues of the ERPA. At the same time, the specification note mechanism will be extended both to land concessions involved in the REDD+ activities and to forest concession holders who are strengthened by channeling a portion of the carbon benefits.

Reinforcement of Governance

The intended objectives of the enabling investments are (i) the reinforcement of the land governance and resources through the recognition and securing of rights, participatory and transparent planning of investment, poverty reduction, and strengthening the rule of law (respect of contracts, control, monitoring, and appeal mechanisms). Also, the below cited objectives are the reason behind the existence of monitoring and safeguard mechanisms.

The expected key co-benefits for local communities and private operators will rise from the identification of their rights during the elaboration of the regional management and development plan. The individual and collective rights recognized in this way will become enforceable on the administration and third parties. Subcontracts between the program and LEAs, as well as with concession holders and small-scale operators will contribute making the FPIC procedure universal. By supporting the creation of forest concessions for local communities the program will finally put into practice the community forestry.

For the private sector, the commitment to REDD+ is likely to strengthen the confidence of business partners in the legality of timber. The same applies to a conservation company such as WWC for the ERA project. The program finally provides an investment opportunity for manufacturers seeking sustainable supply sources. For the forestry sector, it is also a challenge to improve the business climate and restore confidence with state services.

Environmental Co-benefits

The major environmental co-benefits are expected from the research on reinforcement of the climate service on carbon sequestration provided by forest. The above-mentioned co-benefits are related to the maintenance of forest cover, the biodiversity it shelters, and the role it plays in maintaining soil (against erosion) and fertility. These are the enclosed activities allowing natural regeneration of anthropogenic savannas (i.e. shaped by man via regular fires), which have the most direct impact in this respect.

The impact of plantations and cash crops is indirect resulting from the alternatives given to fallow slash and burn, in terms of food as of income. It is under the condition of the land use plan limits fulfillment, and in the absence of leaks, that is to say deforestation outside of the accounted area of the program.

The program generates the possibility of sustainable management of resources by creating the foundation to support the dynamics of spatial planning at the different levels (local, decentralized territorial entity, decentralized administrative entity). It has been initiated through the program by means of the multi-stakeholder platform, via promotion of cross-sectoral planning of the investments needed for the long-term maintenance of forest cover.

The program will also strengthen the dynamics of planning not only in production forests that are granted but also in protected forests with the support provided for the development of community forestry. At the level of land concessions such as the territories involved in REDD+ activities, a strengthening of the application of the legislation on flora and fauna is anticipated.

17.2 APPROACH TO PROVIDE INFORMATION ON PRIORITY NON-CARBON BENEFITS

This subsection has been discussed in subsection 8.2, because the program has an integrated approach to monitoring and evaluation of safeguards and non-carbon benefits (co-benefits are part of the REDD+ social and environmental standards of the DRC)

The proper application of safeguards and also the production of non-carbon benefits during the implementation of the program will be announced through the following channels; (i) regular information posted on the National REDD+ Register (ii) an independent information platform (MOABI) and finally (iii) a monitoring report on the environmental and social standards of the program published annually (or bi-anally) assessing the results and progress of the program in relation to each of the principle and criteria of the social and environmental standards.

18. EMISSION REDUCTION CERTIFICATES

18.1 ER AUTHORIZATION PROGRAM

Name of entity	Ministry of Environment, Nature Conservation and Sustainable Development
Contact person	Victor Kabengele
Title	National REDD+ Coordinator
Address	Avenue Colonel MONDJIBA N°63 BIS Concession COTEX Municipality of Ngaliema/Kinshasa, DRC
Telephone	+243 824 378 018/+243 999 995 462
Email	abckab@gmail.com
Website	http://www.mecnt.gouv.cd/
Reference to the decrees, laws or other types of decisions identified by this national authority within the ER-P.	1. Ordonance No 08/074 of 24 December 2008 defining the responsibilities of the Ministry; 2. Ministerial decree No 09/40 of 24 November 2009 concerning the creation, composition and organization of the implementation structure for the process of achieving emission reductions in deforestation and forest degradation (“REDD”); 3. Ministerial Order 004/CAB/MIN/ECN-T/012 of February 15, 2012 fixing the procedure for approval of REDD+ projects; 4. Presidential Ordonance No 15/015 of 21 March 2015 on the remit of the ministries;

18.2 TRANSFER OF EMISSION REDUCTION CERTIFICATES

The DRC central government holds the role of coordinator for the country's (national) REDD+ activities and, in that role, defines management elements and functions for REDD+ programs and projects developed underneath the national REDD+ governance level. This includes decisions on the structure and process for ERC generation, direct ERC holdings by program and project holders, and the option of back-to-back commercialization of ERCs by such holders, without the mediation of the central government.

Within the DRC government, the Ministry for the Environment, Nature Conservation and Tourism is the competent authority for REDD+ implementation, project authorization, and main entity for REDD+ valorization.

The Ministry will sign the ERPA and assumes direct liability towards the contracting partner – here the FCPF Carbon Fund – for REDD+ implementation, ERC generation, and exclusive transfer of good and valid title.

It is noted that for its financial implications, the ERPA must be approved by the Ministry of Finance.

Execution and fulfilment of the ERPA does not involve any other authorizations. The sale and transfer of emission reductions relate to emission reductions only and do not affect any beneficial, legal or customary interests or rights in land (see above section 4.4).

The Ministerial Regulation on REDD+ Project Authorization of 201248 ("REDD+ Regulation 2012" or "Regulation") – currently under revision – has as its objective to:

i. Provide an identification and registration process for sub-national REDD+ activities not implemented directly by the Government but nested in the national REDD+ program;
ii. Create a continuous national REDD+ registry to track sub-national activities and the direct issuance of ERCs to project holders; and
iii. Define general conditions for the direct commercialization of ERCs by project holders.

Key features of the REDD+ Regulation 2012

The Regulation describes the process for project holders – legal personalities, land tenure holders or others, whether public or private – to inscribe their activities in the national REDD+ program, to have it validated against an "international" standard, as approved by the DRC government (see Annex V of the Regulation), and to receive direct access to ERCs issued and nested within the national scheme for back-to-back commercialization.

Authorization follows a 3-step cycle: (1) approval (approbation, article 11) by the "permanent Commission", created under the authority of the registrar (the Ministry in charge of the environment); (2) the execution of a "partnership contract" between the registrar and the project holder (contrat de partenariat, the model is included in Annex IV)) on stakeholder involvement, benefit sharing and rules for the valorization of the "environmental services" reflected by the project (article 15); and (3) positive external validation, which is conditional for the coming into force of the partnership contract (article 18). The validator verifies the existence of, among others, the partnership contract as well as the conclusion of an agreement between the project holder and affected local communities and/or

[48] Arrêté Ministériel N° 004/CAB/MIN/ECN-T/012 du 15 Feb 2012 fixant la procedure d'homologation des projets REDD+.

Indigenous Peoples, assesses the project design description (PDD) against the requirement of an international standard, and examines the results and impact of the stakeholder consultation (article 18). The validator, after confirming that the project requirements are met, transmits the validation report to the registrar, which authenticates and publishes the report. Publication has the effect of project authorization and grants the right to the project holder to commercialize ERCs issued for the project independently (article 20).

It is noted that the authorization process is mandatory for all project holders whether private or public, except the regions, which hold genuine constitutional rights and legislative powers and are not directly bound by the Ministerial Regulation in question. If a region wishes to integrate in the national REDD+ program as program holder of its own – as is the case of Maï-Ndombe – the central government and the region in question clarify the terms of engagement, jurisdictional validation and nesting, as well as the rules for ERC account holdings and direct commercialization through an internal governance act.

2015/16 Revision of the Regulation

A revision of the Regulation is under way and expected to be adopted in the first half of 2016 ("Revised Regulation"). The Regulation was criticized by civil society on form – it has been adopted in the absence of any wider stakeholder consultation process – as well as on substance. It requires formal legal incorporation of project holders (article 2), to the disadvantage of communities and public collectives, and it overlaps with the concept of forest conservation concessions, created under Decree No. 08/2008, which gives concession holders the right to the valorization of forest-inherent environmental services, on the condition that all extractive exploitation be avoided.

While these issues are being addressed, the revision will also take the opportunity to introduce a domestic carbon-cum-socio-environmental standard for the validation of project activities and the *issuance of DRC-specific REDD+ credits*. Project holders will still be permitted to seek issuance of international credits, but all international credits will need to be converted from domestic credits.

19. DATA MANAGEMENT AND REGISTRY SYSTEMS

19.1 PARTICIPATION UNDER OTHER GHG INITIATIVES

The ER-Program will register with the Verified Carbon Standard (VCS) under its Jurisdictional Nested REDD+ (JNR) framework.

The Mai-Ndombe REDD+ project (VCS ID 943), led by WWC, will be registered as a nested project in the program under JNR Scenario 2 (see the Jurisdictional and Nested REDD+ (JNR) Requirements 2.1.1(2)). In a coordinated way, both the project and the jurisdiction will contribute GHG credits to the jurisdictional buffer pool and request issuance of verified carbon units (VCUs).

The DRC hosts also some CDM projects out of the Program boundaries but which could address the drivers of deforestation, these are:

a. The IbiBatéké degraded savannah afforestation project for fuelwood production (REF 4176), afforestation and reforestation project estimated to produce 54,511 metric tonnes CO_2 equivalent per annum in ERs.

b. The Congo Improved Cook Stoves program (REF9638), energy demand program of activities estimated to produce 36,167, metric tonnes CO_2 equivalent per annum in ERs (WESD Capital/Ecosur - Bisonabino project)

19.2 DATA MANAGEMENT AND REGISTRY SYSTEMS TO AVOID MULTIPLE CLAIMS TO ERS

The ER-Program will be included in the National Registry of the DRC's national REDD+ program. This Registry will allow to track and monitor all the ERs generated by the program and provide regular information about issuances, transfers and sales of this Emission Reductions.

The National Registry will provide all the information about projects and programs in the country, such as: Entities who own the ERs Titles, geographic boundaries, Reference Level, monitoring report on activities, safeguards and non-carbon benefits, etc. This Registry is currently in design and will be operational mid-2016. Its requirements specification fit with MF criteria. An administrative procedure linked with the Homologation Regulation exist and is currently revised to address more actual challenge of information about REDD+.

This revision will allow to clarify that Emission Reduction Credits will be issued exclusively through the National REDD+ Registry. Registry accounts will be created for all authorized project holder as well as the government (with specific sub-accounts for regions/jurisdictional programs).

After any Emission Reductions are reported and verified, the respective ERCs will be issued directly into the relevant account(s), with a separate quota going into one or more of the relevant (government) buffer accounts (to account for uncertainties and reversals).

ERC issuance requires both carbon verification and verification of the relevant social and environmental thresholds defined under the domestic standard.

Project holders may freely transfer ERCs issued to them, under a sales agreement, conversion (from domestic ERCs into e.g. Verified Carbon Units) or other.

The following figure explains the creation, issuance and transfer of the ERCs generated for Maï-Ndombe, in the context of a sale to the Carbon Fund of the FCPF.

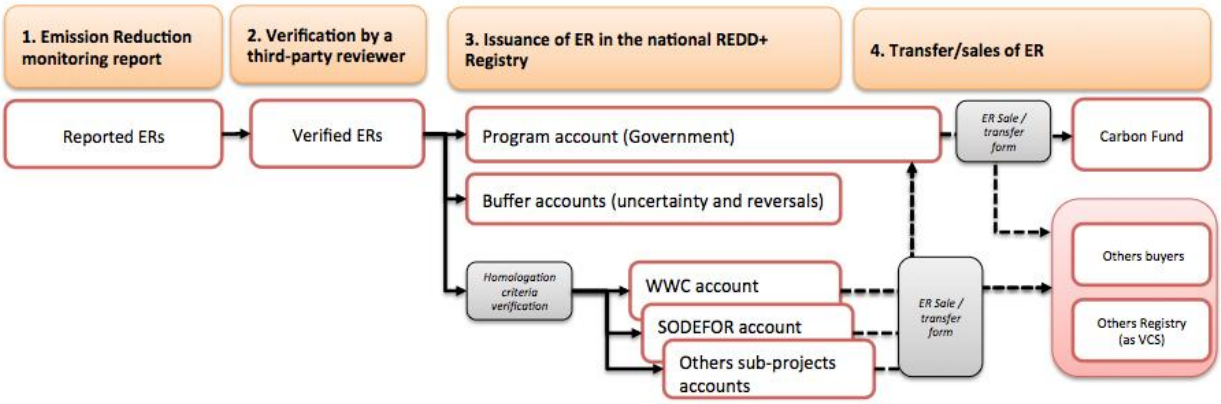


Figure 16: Issuance and transfer of Emission Reduction Credit of the Mai-Ndombe ER-Program through the National REDD+ Registry

20. ANNEXES

Annex 1 Summary of the financial plan

Financing plan		2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	
Items	Description	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10	TOTAL
Expected uses of funds												
Costs Related to the Administrative Oversight of the Program	*Cost of national technical unit in charge of homologation and compliance with national framework + Cost of program management unit*	381 000	825 999	931 000	886 500	846 450	810 405	777 965	748 768	722 491	698 842	7 629 420
Operational and Implementation Costs	*Costs of ER-Program measures (cf. Section 4.3)*	11 810 808	12 089 092	15 336 910	18 332 228	19 361 297	6 212 500	8 295 000	8 677 500	9 060 000	9 230 000	118 405 336
	Management and operating cost (30%) MOD & FIP suivi	2 857 350	2 857 350	3 809 800	4 762 250	4 762 250	-	1 700 000	1 700 000	1 700 000	1 700 000	25 849 000
	Sectorial activities											
	AS1. Agroforestry and improvement of cultivation techniques	797 500	797 500	1 063 333	1 329 167	1 329 167	680 000	680 000	680 000	680 000	680 000	8 716 667
	AS2. Perennial crops development in non-forest areas	780 000	780 000	1 040 000	1 300 000	1 300 000	510 000	510 000	510 000	510 000	510 000	7 750 000
	ES1. Assisted natural regeneration for charcoal production.	570 000	570 000	655 000	360 000	730 000	255 000	255 000	255 000	255 000	170 000	4 075 000
	ES2. Afforestation/Reforestation for charcoal production	600 000	600 000	800 000	1 000 000	1 000 000	340 000	340 000	340 000	340 000	340 000	5 700 000
	FS1. Reduced impact logging	138 285	276 569	414 854	553 138	829 708	-	-	-	-	-	2 212 554
	FS2. Conservation of local community forests	140 000	280 000	547 500	942 500	1 325 000	1 707 500	2 090 000	2 472 500	2 855 000	3 110 000	15 470 000
	FS3. Conservation concession	691 423	691 423	691 423	691 423	691 423	-	-	-	-	-	3 457 115
	FS4. Afforestation/Reforestation for lumber production	600 000	600 000	800 000	1 000 000	1 000 000	340 000	340 000	340 000	340 000	340 000	5 700 000
	Projet ERA/WWC	2 000 000	2 000 000	2 000 000	2 000 000	2 000 000	-	-	-	-	-	10 000 000
	Enabling activities											
	H1. Capacity-building of decentralized State services	107 400	107 400	143 200	179 000	179 000	255 000	255 000	255 000	255 000	255 000	1 991 000
	H2. Multi-level capacity-building and Sustainable Development Plans design	346 350	346 350	461 800	577 250	577 250	340 000	340 000	340 000	340 000	340 000	4 009 000
	H3. Implementation of collective and strategic facilities	747 500	747 500	996 667	1 245 833	1 245 833	340 000	340 000	340 000	340 000	340 000	6 683 333
	H4. Family planning	210 000	210 000	280 000	350 000	350 000	170 000	170 000	170 000	170 000	170 000	2 250 000
	AH1. Strengthening agricultural value chains	350 000	350 000	466 667	583 333	583 333	170 000	170 000	170 000	170 000	170 000	3 183 333
	EH1. Formalization and strengthening of the fuelwood sector	50 000	50 000	66 667	83 333	83 333	425 000	425 000	425 000	425 000	425 000	2 458 333
	FH1. Strengthening forest and wildlife law enforcement	270 000	270 000	360 000	450 000	450 000	255 000	255 000	255 000	255 000	255 000	3 075 000
	FH2.Legal compliance of industrial logging operations	225 000	225 000	300 000	375 000	375 000	-	-	-	-	-	1 500 000
	FH3. Development of community forestry.	225 000	225 000	300 000	375 000	375 000	255 000	255 000	255 000	255 000	255 000	2 775 000
	FH4. Support management of protected areas	105 000	105 000	140 000	175 000	175 000	170 000	170 000	170 000	170 000	170 000	1 550 000
Financing costs (e.g., interest payments on loans)	n/a	-	-	-	-	-	-	-	-	-	-	-
Costs related to development and operation of the Reference Level and Forest Monitoring System (including Validation and Verification Costs)	*Cost of all different MRV modules for ER generation and benefit sharing purposes*	20 000	464 925	20 000	446 244	20 000	528 172	20 000	590 262	20 000	643 427	2 773 030
Costs related to the Implementation of Benefit Sharing Plan and relevant Safeguard Plan(s)	*Allocation under the benefit sharing plan*	1 153 750	5 720 541	-	7 592 672	-	8 492 381	-	-	-	-	22 959 344
Costs related to the implementation of the feedback and grievance redress mechanism(s);	*Equipments, control field audit and capacity building*	187 640	187 640	187 640	187 640	187 640	138 640	138 640	138 640	138 640	138 640	1 631 400
Costs related to stakeholder consultations and information sharing	*Communication support production and dissemination, regular consultative workshop*	76 200	152 400	228 600	304 800	304 800	304 800	304 800	304 800	304 800	304 800	2 590 800
Total costs		13 629 398	19 440 597	16 704 150	27 750 085	20 720 187	16 486 898	9 536 405	10 459 970	10 245 931	11 015 709	155 989 330

Financing plan		2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	
Items	Description	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10	TOTAL
Expected sources of funds												
Secured Grant funding	*FIP PIREDD-Plateau*	2 130 000	2 130 000	2 840 000	3 550 000	3 550 000	-	-	-	-	-	14 200 000
	CAFEC USAID on Salonga and Lac Tumba Landscape	331 500	331 500	442 000	552 500	552 500	-	-	-	-	-	2 210 000
	KFW for Protected Area management on Salonga national park	90 000	90 000	120 000	150 000	150 000	-	-	-	-	-	600 000
	Project Carbon Map and Model financed by KFW	60 000	60 000	80 000	100 000	100 000	-	-	-	-	-	400 000
	Funding from FIP project supporting private sector in DRC (component 2a)	300 000	300 000	400 000	500 000	500 000	-	-	-	-	-	2 000 000
Private funds secured	*WWC private investment*	2 000 000	2 000 000	2 000 000	2 000 000	2 000 000	-	-	-	-	-	10 000 000
Private funds to be confirmed	*(Current status of interest)*	1 450 450	1 450 450	1 933 934	2 417 417	2 417 417						9 669 669
Grant to be financed	*PIREDD Mai-Ndombe - To be financed*	4 504 600	4 504 600	6 006 133	7 507 667	7 507 667	-	-	-	-	-	30 030 667
Revenue from REDD+ activities (e.g., sale of agricultural products)	*Non-carbon revenues*	-	2 526 863	13 245 658	22 582 176	27 285 346	29 087 141	31 685 994	42 856 235	41 584 442	58 702 484	269 556 339
Revenue from sale of Emission Reductions (contracted)	*n/a*	-										-
Revenue from sale of additional Emission Reductions (not yet contracted)	*ERPA with Carbon Fund*	9 750 000	-	23 400 000	-	29 250 000	-	35 100 000				97 500 000
Total sources		20 616 550	13 393 413	50 467 725	39 359 760	73 312 930	29 087 141	66 785 994	42 856 235	41 584 442	58 702 484	436 166 675
Net revenue before taxes (=total sources – total uses)		6 987 153	(6 047 184)	33 763 575	11 609 675	52 592 743	12 600 243	57 249 590	32 396 265	31 338 511	47 686 775	280 177 345
Net revenue w/o non-carbon revenue		6 987 153	(8 574 047)	20 517 917	(10 972 501)	25 307 397	(16 486 898)	25 563 596	(10 459 970)	(10 245 931)	(11 015 709)	10 621 006

Annex 2 Overview of the consensus of participatory self-assessment (February 2014)

No.	Criteria	Evaluation
1	Accountability and transparency	
2	Mandate and operational budget	
3	Mechanism for multisectoral coordination and cross-	
4	Technical supervision capacity	
5	Fund management capacity	
6	Mechanism for feedback and appeals	
7	Participation and commitment of major stakeholders	
8	Consultation process	
9	Information dissemination and access to information	
10	Use and disclosure of the results of consultations	
11	Assessment and analysis	
12	Ranking of favorable/unfavorable elements, direct and	
13	Linking these favorable/unfavorable elements and the	
14	Action plans to take into account the rights to natural	
15	Impact on forestry laws and policies	
16	Selection and prioritization of strategic options for	
17	Feasibility assessment	
18	Impacts of strategic options on sectoral policies in force	
19	Adoption and application of laws and regulations	
20	Implementation guidelines	
21	Benefit-sharing mechanism	
22	National REDD+ register and REDD+ monitoring system	
23	Analysis of issues relating to social and environmental	
24	The design of the REDD+ strategy based on impact	
25	Environmental and Social Management Framework	
26	Demonstration of the method	
27	Use of historical data and adaptation in the national	
28	Technical feasibility of the methodological approach	
29	Explanation of monitoring method	
30	Demonstration of the first phases of application	
31	Institutional arrangements and capacity	
32	Identification of aspects not connected with and social/	
33	Monitoring, reporting, and exchange of information	
34	Institutional arrangements and capacity	

Annex 3 Work Program for the Consolidation of the Preparation Phase for REDD+

Key elements preparation	Main activities	Results	Calendar	Budget (USD) and source
Component 1: Organization of preparation and consultation				
Institutional arrangements	• Revision of the decree establishing a steering committee for the REDD+ process • Clarification of the methods of cooperation between the steering committee and the national REDD+ fund	✓ The institutional and financial arrangements are operational	June 2015	20,000 (FCPF)
Complaint and appeals mechanism	• Study on defining the mechanism based on lessons learned and development of a plan for putting into operation the Mai-Ndombe emissions reduction program • Formalization with MOABI of support for the collection and monitoring of complaints • Reinforcement of the capacity of players	✓ The principles and responsibilities are defined at national level ✓ The mechanism is strengthened at the level of the Mai-Ndombe emission reduction program	July 2015 February 2016	200,000 (FCPF)
Decentralization of REDD+	• Training and creating awareness of REDD+ among key stakeholders and provincial governments • Development of provincial REDD+ strategies • Support in the formulation of REDD+ programs integrated in the oriental and equator provinces	✓ Provincial strategies are developed ✓ REDD+ integrated programs are formulated with the commitment of provincial players	December 2015 December 2015	200,000 (FCPF) PNUD
Information dissemination and access to information	• Publication of key documents on the REDD+ process on the website of the Ministry and/or on the National Register • Design of key messages on REDD+ in a broadly participatory process • Design of adapted communication materials	✓ All key documents are available online ✓ The key messages are developed ✓ Suitable supports are widely disseminated	Continues	280,000 (FCPF)
REDD+ reforms	• Support for the National Land Reform Commission (CONAREF) and its sub-committees for the implementation of land reform • Support for the Spatial Planning Support Unit (UAAT) and the development of the national planning strategy	✓ The reforms related to land use and management of natural resources are progressing	Continues	100,000 (FCPF) 180,000 (PNUD)
REDD+ strategy	• Capitalization of project experiences and REDD+ initiatives (including 6 REDD+ pilot projects funded by the CBFF) • Organization of a large national forum for the dissemination of lessons learned • Fund raising and alignment of the National Agricultural Investment Program	✓ Lessons learned lists are published and shared ✓ A monitoring framework for the national REDD+ is defined ✓ Financial resources available to implement the strategy	August 2015	110,000 (FCPF) 215,000 (BAD/CBFF

					)
Component 2: Preparation of the REDD+ strategy					
Legal and normative framework for REDD+ management	• Revision of the approval order to integrate the recommendations of the CGES and civil society • Monitoring of the reform of the Forestry Code and the application of environmental law to include aspects related to REDD+ • Strengthening of collaboration with parliamentarians through the partnership with Globe Ground • Training of the judiciary in the fight against corruption in REDD+	✓	Decree of approval and its annexes are reviewed and validated ✓ A training plan for the combating of corruption in REDD+ is prepared ✓ The process of revising the legal and regulatory framework, including the Forestry Code and the agricultural code, is progressing	June 2015	140,000 (FCPF)
Benefit-sharing mechanism	• Validation of options and mechanisms for benefit sharing at the level of the Mai-Ndombe emissions reduction program • Validation of directives at national level	✓	Guidelines validated at sub-national and national level	July 2015	150,000 (FCPF)
National Register	• Registry programming based on specifications • Reinforcement of the capacity of users	✓	Operational registry	December 2015	200,000 (FCPF)
Environmental and social management	• Description of the operational methods for the implementation of safeguard tools • Integration of CGES in the decrees implementing the framework law on the environment • Formation of national expertise for ESIS	✓ ✓	Safeguard instruments are operational instruments CGES integrated into the legal and regulatory framework	August 2015 December 2016	40,000 (FCPF)
Component 3: Reference emission levels/reference levels					
Reference level for emissions	• Finalization of the reference level at the level of the Mai-Ndombe emission reduction program • Preparation of a national reference level in line with the sub-national approach	✓ ✓	Reference level validated by the DRC and Carbon Fund Reference level presented to the COP-21	December 2015	200,000 (FCPF)
Component 4: Monitoring system of forests and safeguard measures					
SNSF	• Clarifications and formalization of responsibilities for the MNV of the Mai-Ndombe emission reduction program • Reinforcement of the DIAF to put into operation the MRV nationwide	✓ ✓	Operational MNV at the level of the Mai-Ndombe emission reduction program Operational MNV at national level	December 2015 December 2016	CBFF FAO
SIS	• Experimentation on monitoring tools • Finalization of the institutional arrangements for compiling and reporting of information • Development of the information system on the safeguards (SIS), in accordance with the provisions of the UNFCCC • Capacity reinforcement of players involved in the monitoring system	✓	Operational information system integrated into the registry	December 2015	100,000 (FCPF) 90,000 (UNEP)

Annex 4 ER Program Objectives and Indicators

Key objectives for 2020	Indicators (tbc)
1. CLIMATE: Achieving a reduction in emissions by 28 Mt CO_2 compared with the REL to face a rapid increase in pressure	▪ [Mt] reduction in CO2 emissions to achieve/be achieved ▪ Net emissions of greenhouse gases from deforestation and forest degradation
2. BIODIVERSITY: Maintain and improve the services of biodiversity and ecosystems	▪ Changing the surface of natural forests ▪ Changes in the abundance and distribution of species of target wildlife
3. RIGHTS: Legal and customary rights to lands, territories and resources are recognized, respected, and strengthened	▪ [%] of Indigenous Peoples and local/forest communities benefiting from land use and/or land rights recognized clearly and legally ▪ Number of private sector stakeholders with better land legislation concessions ▪ Level and quality of participation of communities and Indigenous Peoples (by type) in decision-making and monitoring ▪ Number of people trained in the FPIC process ▪ [ha] of territory mapped by participatory cartography and number of communities covered
4. MEANS OF SUBSISTENCE: REDD+ benefits are shared equitably and improve the long-term security of the means of subsistence and the well-being of stakeholders, with a particular focus on the most vulnerable groups.	▪ Amount and type of benefits (monetary and non-monetary) distributed for ecosystem services ▪ National poverty assessments show the relative improvements in areas where the program activities are implemented ▪ Increase productive employment linked to REDD+, including potentially vulnerable and marginalized persons
5. FINANCE AND GOVERNANCE: To mobilize immediate, sufficient and predictable resources in order to reward performance in the priority forested zones in an equitable, transparent, participatory and coordinated manner.	▪ Results of external evaluations of the ER program governance mechanisms and registry ▪ Resolution of complaints raised by the independent observer ▪ Funds received and used by the ER program, including transfers of funds from emission reductions and payments to reward the performance of carbon and non-carbon benefits ▪ The adoption of practices from learning activities

Annex 5 Engaging industrial logging concessions in the Mai Ndombe ER program

1/ State of play of industrial logging concessions in Mai Ndombe province

In 2014, only 11 concessions were engaged into logging operations. However, even among these, none had met the operating program established in the 4-year Management Plan, both in terms of areas and volumes. Absence of logging operation, or operation below the levels agreed by contract, often results in delays in the implementation of the social clauses with communities. Control missions over the past years in the Mai Ndombe province have identified numerous compliance issues, such as concessions exceeding their harvesting limits, harvesting outside of their permit areas, lacking management documentation or not fulfilling their social obligations.[49]

Table 48 Industrial logging concessions in the Maï-Ndombe province

Company	N° CCF	Area CCF (ha)
ITB	005/11	127 719
CIE DES BOIS	021/11	148 081
SODEFOR	034/11	194 346
SODEFOR	035/11	200 144
SODEFOR	038/11	173 921
SODEFOR	039/11	238 896
SIFORCO	040/11	194 636
SODEFOR	045/11	336 916
FOLAC	048/12	185 171
NBK SERVICES	049/14	79 730
TALA TINA	050/14	40 040
SOMICONGO	052/14	294 014
SCTP ex-ONATRA	055/14	121 214
RIBA CONGO	056/14	37 367
SODEFOR	061/14	239 858
SODEFOR	062/14	73 074
SODEFOR	063/14	287 309
SODEFOR	065/14	225 105
SODEFOR	Lolé	234 895
SODEFOR	Nkaw	120 281
Total		3 552 717

[49] OI FLEG, Rapport de mission de terrain n°2, décembre 2012

Table 49 Overview of logging operations in the Mai Ndombe province (situation in 2014

Overview of logging operations in 2014	Nb of concessions	Area (ha)	% of the Mai Ndombe area
Logging operations ongoing	6	1 395 621	39%
Logging operations delayed	5	406 070	11%
No logging operations[50]	9	1 751 026	49%
Total	20	3 552 717	100%

2 / Minimum REDD+ Compliance standard for forest concessions

The lack of compliance of industrial logging activities poses a potential risk to the environmental and social integrity of the Mai Ndombe ER program. To mitigate this risk, a minimum REDD+ compliance standard was developed, on the basis of most REDD+-relevant provisions of the forest legislation in the DRC. Compliance of logging concessions against this standard will be assessed on a yearly basis by the ER program management unit.

Forest concessionaires wishing to develop REDD + activities (e.g. reduced impact logging or conservation) and benefit from result-based payments will be required to have reached the threshold of the minimum REDD+ compliance standard.

This standard is based on 3 principles, with detailed criteria and indicators:

- Principle 1: forest concessionaires engaged in REDD+ projects or initiatives must be legally established in the DRC and hold the rights of access to the forest resources they value.
- Principle 2: forest concessionaires engaged in REDD+ projects or initiatives must demonstrate their commitment to sustainable forest management, promote environmental services, including through limiting the impact of logging operations on forest cover and enhance the preservation of biodiversity.
- Principle 3: forest concessionaires engaged in REDD+ projects or initiatives must ensure that the rights of local communities and workers are respected.

The choice of these three principles is underpinned by their direct relevance to REDD+ objectives, namely in terms of:

- Impacts on carbon emissions and the environmental integrity of the reference scenario,
- Impacts on the social-environmental safeguards.

This approach does not create a double standard for logging companies which remain fully liable with respect to the full scope of their legal obligations under DRC law.

[50] Including 2 forest titles which were not converted due to social conflicts with communities and where therefore logging operations are not allowed.

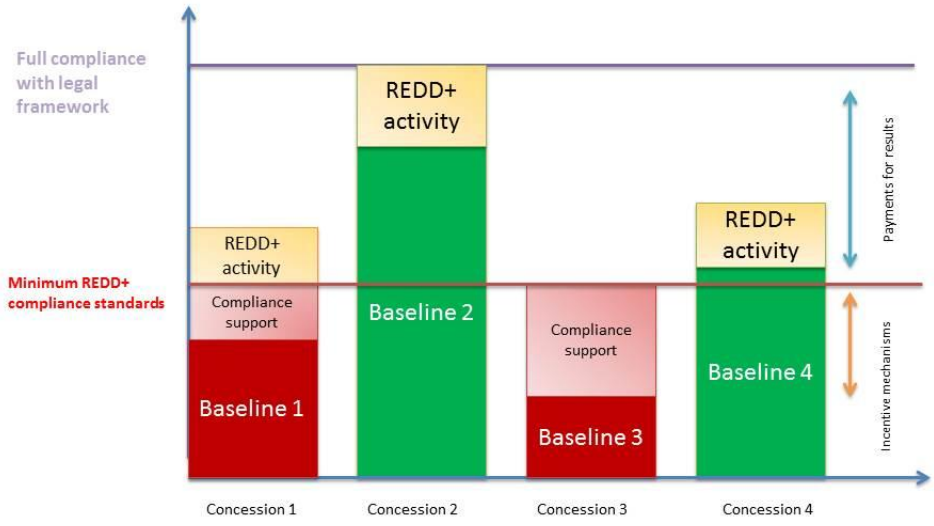


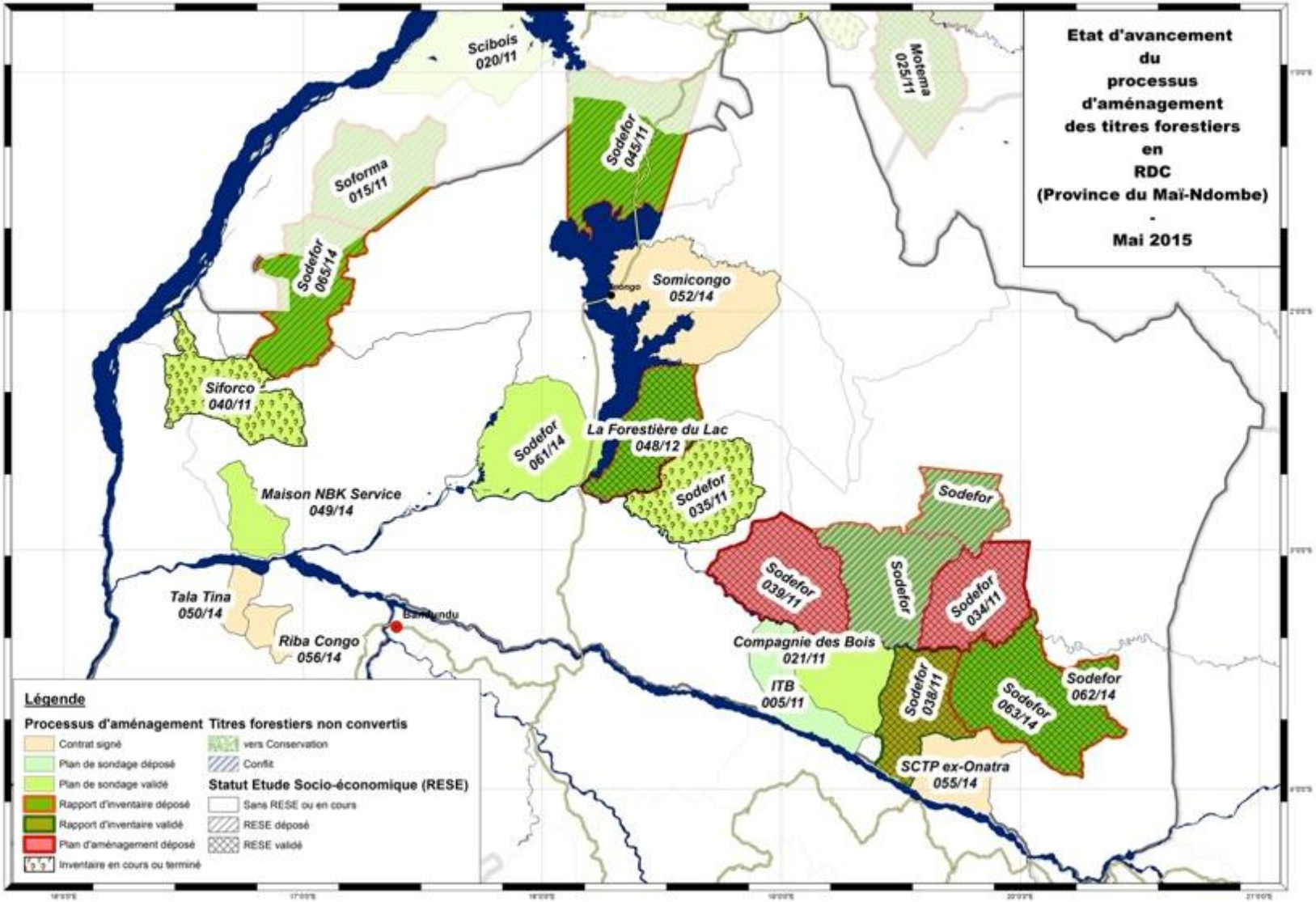
Figure 17 Situation of concessions with respect to the minimum REDD+ compliance standard

This standard was developed with a view to keeping it simple, step-wise and realistic to the current forest governance context in the DRC. Compliance requirements will increase in the course of the program in order to incentivize concessions to progressively improve their practices.

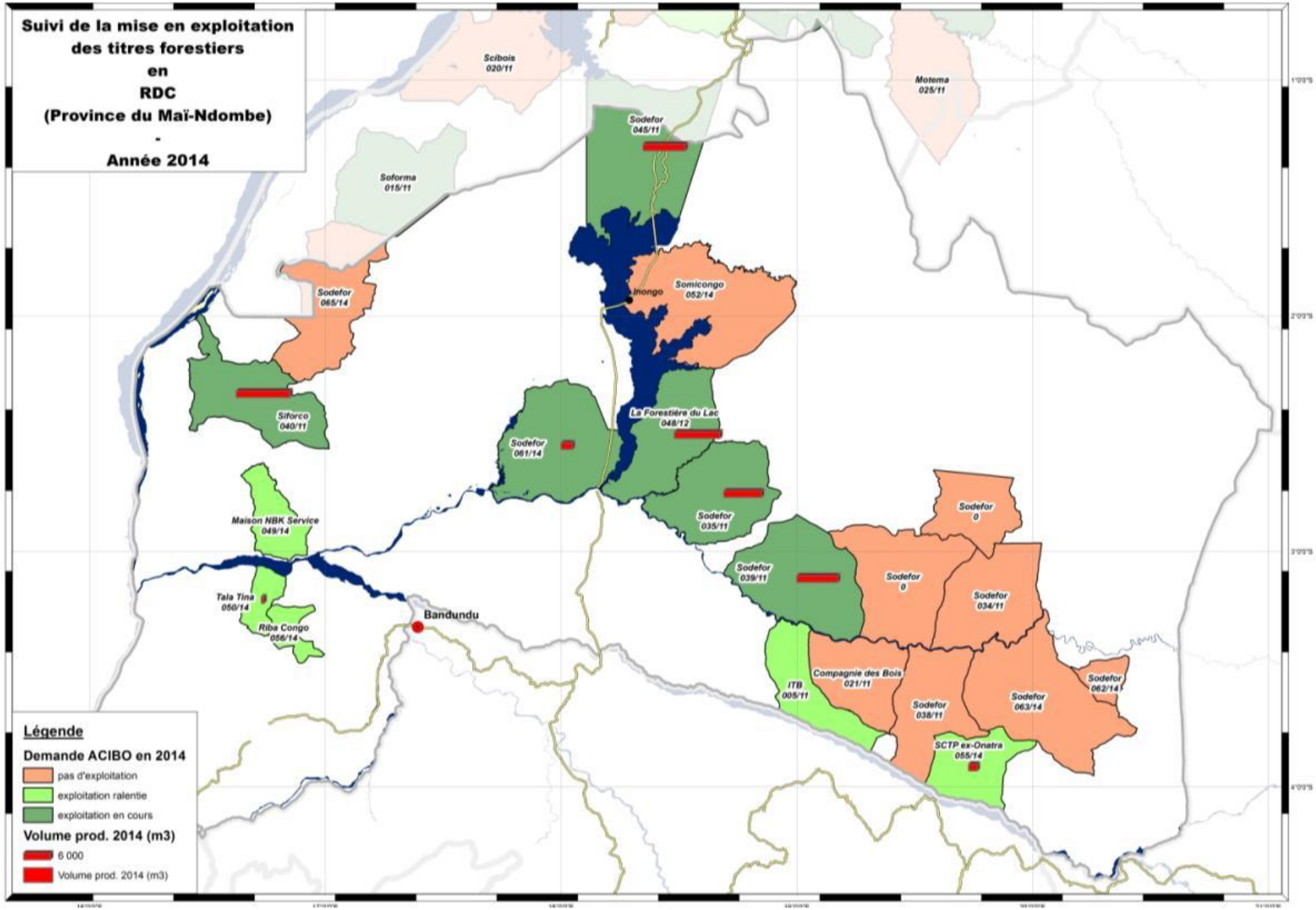
Logging companies wishing to engage in the Mai Ndombe program but not reaching the standard's threshold (see figure above) might be eligible to benefit from compliance support activities under the Mai Ndombe program.

Regular assessment of their progress will also be conducted as part of ER Program.

This approach is aimed at building trust between the Congolese State and the private sector, at improving the image of DRC timber industry operators who are committed to sustainable forest management and at ensuring the achievement of the environmental and social objectives of the program.



Map 8: Concession management process in the Mai Ndombe province. - May 2015 (Source : FRMi, 2015)



Map 9: Overview of logging operations in the Mai Ndombe province - 2014 (Source : FRMi, 2015)

Annex 6 Summary of Steps for Communication and Consultation within the Design of the ER Program

Dates et lieux	Atelier/ missions	Objectifs	Participants	Approches méthodologiques	Informations préalables détenues par les participants
2013 dans le district du Plateau	Missions du PIF	Information et consultation sur le Programme d'Investissement Forestier	L'ensemble des parties prenantes de la société civile, du secteur privé et de l'administration du district du Plateau à travers plusieurs ateliers à Bolobo et Kwamouth.	• contacts individualisés avec certains acteurs ciblés, • Session d'information avec les membres de la société civile, du secteur privé et de l'administration du district du Plateau • Atelier de consultation et renforcement des capacités et de sensibilisation avec les délégués des CL et des PA de Bolobo et de Kwamouth, • Notes et divers messages d'information sur l'évolution du programme PIF	• Le RPP était bien avant présenté aux différentes catégories des parties prenantes et avait annoncé le PIF ainsi que les projets pilotes intégrés comme exemples d'investissement anticipés de la REDD+,
Mai 2014, à Bandundu ville	Première édition de l'Université de la REDD+ au Bandundu	Faciliter la compréhension et l'ancrage de la REDD+ ainsi que de ses interactions avec le processus APV-FLEGT dans la province du Bandundu	Une centaine de délégués provenant de l'administration provinciale, de la CN-REDD/FIP, de la Commission technique FLEGT, des projets pilotes, des exploitants industriels et artisanaux, du Conseil Consultatif des forêts, de la société civile internationale, nationale et provinciale, du secteur privé, des Conseils agricoles ruraux de Gestion, des représentants des communautés locales et des populations autochtones ont pris part à ces assises.	• Le Point Focal REDD en province de Bandundu avait sillonné les districts de la province annonçant pour préparer les différentes couches à l'avènement de l'Université sur modèle des Universités internationales REDD de Kinshasa • Appel à candidatures pour la participation à l'Université Provinciale REDD+ • Sélection des candidats • Sessions d'ateliers de renforcement des capacités • Sessions d'information sur les avancées du Processus National REDD, • Partage du rapport de l'université à travers le Point Focal provincial ;	• Contenu résumé des rapports des universités Internationales REDD de Kinshasa, • messages multimédia d'annonce de la tenue de l'Université
Octobre, Novembre 2014 dans le district du Mai-Ndombe	Mission BioCFplus pour la conception du PIREDD Mai-Ndombe	Prendre la mesure des problèmes et de leur évolution en lien avec le développement économique, les conditions de vie, la production agricole, les infrastructures rurales, la défense de l'environnement, la déforestation et le changement climatique. Pour chacun de ces problèmes, des pistes de solutions, pratiques	Consultations dans une vingtaine de villages (environ 20 participants à chaque village) et quatre ateliers dans les chefs-lieux des territoires (entre 60 et 100 participants par atelier) de 3 à 4 jours réunissant l'ensemble des parties prenantes de la société civile, du secteur privé et de	• Contacts individualisés avec certaines parties prenantes ciblés, • Consultation par focus group dans chaque village • Ateliers de renforcement des capacités des parties prenantes(société civile, secteur privé et administration)	• message d'annonce de la mission par CN REDD à travers le point focal provincial, • informations sur les accords signés entre le Ministère de l'environnement et la Banque Mondiale pour le PIF avec PIREDD Plateau, • Explication répandu dans la province par le MECNDD sur

Dates et lieux	Atelier/ missions	Objectifs	Participants	Approches méthodologiques	Informations préalables détenues par les participants
		des projets en cours ou passés et priorités étaient évoquées et validées.	l'administration.		la possible extension du PIREDD dans le Mai Ndombe.
Octobre 2014	Atelier de suivi de la conception du programme RE	Evaluer l'état d'avancement des travaux de groupe dans le cadre de la phase de la conception de l'ERPD.Recueillir les avis mais surtout contributions des parties prenantes aux travaux en cours	Total de 46 personnes, issues de l'Administration publique ; des ONG nationales et internationales ; du Secteur privé ; des Bailleurs et Partenaires Techniques & Financiers.	• mission de préparation de l'atelier par la CN REDD et Point focal ; • Atelier d'évaluation de l'état d'avancement des travaux de la conception de l'ERPD ave l'administration publique, ONG nationales et internationale, secteur privé et PTF • Récolte des avis et considération sur le document conceptuel en vue des améliorations • partage de restitution des éléments clés du rapport de la mission avec des groupes ciblés stratégiques ;	• Information sur l'acceptation par la Banque Mondiale /FCPF de la note d'idée sur le ERPD
Janvier-Février 2015, Bandundu-ville	Mission d'information CNREDD-WWF	Informer sur la mission d'Identification des représentants des CL/PA lors des activités de la « Phase de Conception » du Programme RE de la Zone Juridictionnelle de Mai-Ndombe	Autorités politico administratives et société civile. Total participants pour les deux cibles : une quarantaine	• préparation de l'atelier par le Point focal ; • Session d'information sur la mission d'identification des représentants des CL/PA dans le cadre de la phase de conception de l'ERPD	• information partagée sur l'engagement de la CN REDD à rédiger avec le concours des parties prenantes l'ERPD
Janvier-Février 2015 dans les 8 territoires du Mai-Ndombe	Missions de la société civile	Information sur le programme en conception, identification des représentants désignés des communautés et peuples autochtones	12 facilitateurs venus de Kinshasa chargés d'identifier 38 représentants de CL/PA, respectivement 19 titulaires et 19 suppléants	• AMI pour soumissionner ; • passation de marché pour la réalisation de la mission à OCEAN ; • plusieurs séances de travail avec les différents groupes de travail de la CN REDD pour préparer la mission, • Mission d'identification des délégués des PA et CL pour prendre part à l'atelier national de lancement de la phase de conception du Programme de Mai-Ndombe, • séance de présentation des délégués désignés aux autorités territoires et signature des PV ;	• information partagée avec le groupe cible sur la nécessité d'impliquer les communautés locales et PA dans le processus de sensibilisation sur l'ERPD par le point focal REDD, • message de l'arrivée de la mission dans la Ville de Bandundu et civilités,
Février 2015, Bandundu-ville	Atelier de lancement de la conception du programme RE de Mai-Ndombe	Assurer l'ancrage communautaire et institutionnel de l'ER-Programme, faciliter l'appropriation et susciter l'engagement de toutes les parties prenantes intéressées, en particuliers les parties	Total participants : près de 250 personnes, , issues du gouvernement national et provincial, du parlement provincial, de l'Administration publique ; des ONG internationales, nationales, provinciales et locales ; du Secteur privé ; Bailleurs et PTF,	mission préparatoire par la CN REDD à Bandundu Ville ; • séance de travail/ civilités et partage des enjeux de l'activité avec les notables et autorités de la province ; • Session d'informations sur le processus de mise en œuvre de l'ER-PROGRAMME • Atelier de renforcement des capacités sur les outils de mise en œuvre du programme • partage du rapport synthèse de l'atelier par les	• information partagée sur l'engagement de la CN REDD à rédiger avec le concours des parties prenantes l'ERPD

Dates et lieux	Atelier/ missions	Objectifs	Participants	Approches méthodologiques	Informations préalables détenues par les participants
		prenantes provinciales	l'Administration provinciale ; des Organisations de la société civile provinciale, organisations des exploitants industriels et artisanaux.	délégués désignés ;	
Février 2015, Bandundu-ville	Atelier sur la communication sur la REDD+	Formation des radios communautaires et représentants désignés de la société civile, des communautés locales et peuples autochtones	Total participants : 20 journalistes et relais communautaires identifiées	• Sélection des journalistes des radios communautaires de la Province de Bandundu ayant l'environnement pour spécialité Sélection des relais communautaires délégués par les communautés locales des territoires de Bandundu • Conception de modules de formations sur la REDD+, le changement climatique, le Programme ERPD et la communication sur la REDD(PowerPoint)	• information de l'annonce de la tenue de l'atelier par les délégués de la CN REDD et par les délégués des communautaires et PA ;
Mai 2015, Kinshasa	Atelier technique de conception du programme de Mai-Ndombe	Atelier technique sur l'état d'avancent de la rédaction du programme ERPD Mai-Ndombe	Total de 35 personnes, issues de l'Administration publique ; des ONG nationales et internationales ; du Secteur privé ; des Bailleurs et PTF pendant 5 jours.	• séances préparatoires des différents groupes de travail de la CN REDD sur ERPD ; • contacts individualisés avec parties prenantes pour expliquer en profondeur le processus de rédaction (administration provinciales, notables,...) • tenue de l'atelier avec les groupes spécifiques et experts de Washington de la Banque ; • restitution des conclusions de l'état d'avancement de la rédaction ;	• information sur les sections de rédaction des différentes parties du cadre méthodologique de rédaction de l'ERPD • message d'annonce de la tenue de l'atelier la CN REDD ;
Mai 2015, Bandundu-ville	Atelier de renforcement des capacités des parties prenantes provinciales sur les sauvegardes	Formation de l'administration provinciale et représentants désignés de la société civile, des communautés locales et peuples autochtones	Total participants : près de 28 participants pendant 3 jours.	• mission préparatoire par le point focal REDD et WWF ; • Session d'information et de formation sur l'ER-PROGRAMME • rédaction participative d'une note synthèse en Lingala ; • séance de restitution à travers les territoires par les délégués désignés ;	• information sur les activités planifiées de renforcement des capacités des parties prenantes à l'ERPD ; • partage du rapport synthèse en français par internet ; • message d'annonce de la tenue de l'atelier la CN REDD ;
Octobre-Novembre 2015, Inongo	2ème Atelier de renforcement des capacités des parties prenantes provinciales sur les sauvegardes	Formation de l'administration provinciale et représentants désignés de la société civile, des communautés locales et peuples autochtones	Total participants : près de 104 participants pendant 4 jours.	• mission préparatoire par le point focal REDD et WWF ; • Session d'information et de formation sur l'ER-PROGRAMME • rédaction participative d'une note synthèse en Lingala ; • séance de restitution à travers les territoires par les délégués désignés ;	• information sur les activités planifiées de renforcement des capacités des parties prenantes à l'ERPD ; • partage du rapport synthèse en français par internet ; • message d'annonce de la tenue de l'atelier la CN REDD ;

Annex 7 Terms of Reference of the Program management unit

These terms of reference and methods of contract implementation will be presented in the coming months to Mai-Ndombe institutions in particular in order to be ratified by the provincial assembly and/or the program steering committee.

1. Roles of the Program management unit

The Program management unit, based in the capital of the province of Mai-Ndombe (Inongo), will be responsible for (i) the administrative and financial management, (ii) strategic and technical coordination, (iii) carbon and non-carbon reporting and (iv) the marketing program. The aim is for this function to be fully integrated into the provincial government in the medium term.

2. Organizational and Contractual Reports

- The Program management unit will be the executing agency of the program and will sign a service provider agreement with the government of DRC.
- The Program management unit will be hired by the government of DRC (through FIP Coordination Unit for example) on a competitive basis. It will be a firm or a consortium with multiple tracked and recognized skills in order to tackle the challenge of this innovative program.
- The ERPA could stipulate the Program management unit's responsibility in the implementation of the program. A portion of the Carbon Fund payments should be allocated directly to the Program management unit.
- The Program management unit will act under the control of the provincial government and the steering committee of the program made up of all stakeholders. Its plans and budget will be validated at least once a year by the steering committee.
- The Program management unit will ensure coordination and the contractual interface with the implementing agencies and operators (international and local NGOs, companies, cooperatives, etc.) to implement the program strategy, ensure monitoring and evaluation, as well as revenue sharing in accordance with the profit sharing plan that will be attached as an annex to the ERPA.
- The various sub-contracts will be prepared by the Program management unit, signed by the Province, then the payments will be executed by the Program management unit under the terms of the contracts.

3. Specific Functions and Tasks

Administrative and Financial Function.

a. Managing the administrative interface with the Carbon Fund;
b. Concluding and managing contracts with the various project intermediaries (local implementing agencies, project promoters and large nested project supporters);

c. Monitoring technical and financial assessment of the LEA and project supporters funded by the program;
d. Making payments for nested projects based on carbon results;
e. Checking by sampling proxy measures and making payments to beneficiaries (communities, dealers, companies) project performance;
f. Managing the program operating funds.

Technical and Strategic Function

a. Compiling the monitoring reports on emissions reduction and monitoring of safeguards and co-benefits, ensuring compliance methodological frameworks adopted and the technical interface with the auditors;
b. Developing partnerships with donors, government agencies, private stakeholders, and civil society to implement the strategy of the program and ensure proper alignment of private and public funding;
c. Supporting the government and the province to attract public and private investors and to sell the emission reduction credits generated.
d. Proposing strategic reinvestment plans for the program of working capital based on the sustainable development plans set up at territory level.

Annex 8 Execution agencies responsible for implementing the enabling activities for the program

Functions	Responsibilities	Implementing agencies (potential)	Types of contracts
Plateau local executing agency	Governance, territory planning, land and community investments	WWF (recruited by the FIP with direct agreement)	Delegated project management contract with UC-FIP
Mai-Ndombe local executing agency		International NGOs recruited in a competitive invitation to tender	Delegated project management contract with the Program management unit or UC-PIF
Specialized Operators	Family Planning	Local NGO in competitive invitation to tender	Delegated project management contract with the Program management unit or UC-PIF
	Support for the value chains of perennial crops	Company or NGO (Café Africa, Trias…)	Delegated project management contract with the Program management unit or UC-PIF
	Support for the Wood Energy Sector	(SNV)	Delegated project management contract with the Program management unit or UC-PIF
	Support in compliance and weak exploitation impact by concession holders	(FRM)	
	Support for the development of community forestry	International or national NGOs (GIZ…)	
State Services	Strengthening of forest and wildlife law enforcement	State services (environmental service squads, DCVI…)	Protocol of Agreement

Annex 9 Summary of responsibilities of the entities in relation to monitoring, evaluation and management of grievance and redress

Entities	Measurement and reporting of emission reductions (ER)	Monitoring of safeguards and non-carbon benefits	Management of complaints and appeals
Ministry of Environment	• Validation and certification of credits generated based on the national audit performed with the support of the DDD and DIAF • National MRV consistency verification	• Analysis of screening grids, approval of PGES • Conducts audits by samples, particularly in case of independent complaints or warnings • Establishes, if necessary, sanctions (reduction of credits generated	• Monitoring of the correct handling of complaints and actions, if necessary with a site visit
Program Steering Committee	• Validation of ER report	• Validating the monitoring report on safeguards and co-benefits	• Provincial analysis of complaints (transfer to the next level or to the legal system if applicable)
Program management unit	• Compilation of the monitoring report of ERs based on data provided by the operators • Satellite monitoring of deforestation/degradation and fires • Quality control of transmitted data	• Compilation the monitoring report on safeguards and co-benefits	• Provides information on related complaints • Monitors the provincial resolution of complaints
Implementing agencies	• Compilation of data from operators under its management • Support for field verification	• Filling screening grids, PGES proposal for projects under its responsibility • Monitoring of safeguards and co-benefits	• Provides information on related complaints • Monitors the local resolution of complaints
Project supporters	• Monitoring and reporting of activity indicators (ha reforested or used for grazing, reduced impact exploitation parameters, etc.)	• Filling screening grids and PGES proposal if necessary • Monitoring of prescribed safeguard measures	• Provides information on related complaints
Decentralized services	• Checking the activity indicators by conducting site visit	• Verification of the application of the safeguards measures by performing site visit • Monitoring of safeguards and co-benefits	• Monitors the effective implementation of corrective actions
Multi party local councils (CARG, CART)	•	• Monitoring of safeguards and co-benefits	• Local analysis of complaints (transfer to the next level or to the legal system if applicable)
Civil society/Local Observers	• Identification of stakeholders in deforestation and degradation	• Independent monitoring of the performance of project supporters	• Issuing of complaints • Monitoring and control of the mechanism and the implementation of decisions
Mandated independent observers	• Timely organization of field missions and creation of reports on the DD players by compiling information provided by local OSCs	• Timely organization of field missions and creation of reports on the implementation of SSE	• Timely organization of field missions and creation of reports on the management of complaints mechanisms
MOABI	• Providing a platform for compiling information • Training in the use of Moabi technology to collect field data and display it on an independent platform (cell phones, tablets, website) • Reinforcement of monitoring capacity of civil society and mandated independent Observers		

Annex 10 Principles of financial management procedures

A program procedure manual will be developed by ERPA but we are already able to summarize the main stages of disbursement of funds for payments for performance and investment.

Performance Payment Arrangements

i. The program results are measured by the various entities responsible for the monitoring and evaluation of the carbon performance (DIAF, project developers..)
ii. The Emissions Reduction Credits (ERC) monitoring report is compiled by the Program management unit, approved by the provincial government through its provincial steering committee and then uploaded to the registry for verification and validation by national entities (NC-REDD). This report outlines the performance of stakeholders integrated into the PES program (proxy or carbon) and associated payment orders. (These payment orders could have a threshold that requires validation by the provincial steering committee)
iii. The ERC monitoring report is sent by the Program management unit to the Administrator of the Carbon Fund which mandates independent verification.
iv. The payment of ERPA emission reduction credits are paid to the Program management unit (part payments may be paid directly to the central and provincial government)
v. The Program management unit distributes, directly or via technical partners, payments to different operators for performance depending on the payment orders of the monitoring report by the ERCs, after a favorable opinion by the NC-REDD, which monitors compliance with the backups.

Investment Arrangements

vi. The remaining funds are kept by the Program management unit for reinvestment and provision in case of financial risk. In the medium term, the remaining funds will be paid to the National REDD+ Fund and coud eventually be assigned partly to the Mai-Ndombe program.
vii. Periodically, the Program management unit, in consultation with all stakeholders, proposes an investment plan with the remaining balance. This plan is approved by the provincial steering committee before execution.
viii. The funds are administered by the Program management unit who contracts Local Execution Agencies (LEA) to conduct the enabling or sectoral activities.

Annex 11 Sources of Funding and Breakdown by Key Activity

Sources de financement (in M $ USD)												
Strate carbone	Activités clefs	FIP PIREDD-Plateau	*PIREDD - Mai-Ndombe*	CAFEC-S	CAFEC-LT	KFW-S	CMM	*Up Front FCPF*	FIP comp 2	Private investment secured	Private investment non-secured	Totals
UNDEF/ UNDEG	AS1. Agroforestry and improvement of cultivation technique	1,7	3,1	0,1	0,35		0,1	-				5,32
UNDEF/ UNDEG	AS2. Perennial crops development in non-forest areas	0	5,2									5,20
A/R	ES1. Assisted natural regeneration for charcoal production.	1,3	0,4		0,2							1,90
A/R	ES2. Afforestation/Reforestation for charcoal production		0,0					1,00	1,00		2,00	4,00
PDEG	FS1. Reduced impact logging		0,0	0	0		0,1				2,21	2,31
UNDEF/ UNDEG	FS2. Conservation of local community forests	1,2	1,2	0,1	0,2		0,1	-				2,80
PDEG	FS3. Conservation concession		0,0								3,46	3,46
A/R	FS4. Afforestation/Reforestation for lumber production		0,0					1,00	1,00		2,00	4,00
UNDEF/ UNDEG	Projet ERA/WWC		0,0							10,00		10,00
Habilitants	H1. Capacity-building of decentralized State services	0,412	0,3									0,72
	H2. Multi-level capacity-building and Sustainable Developme	0,649	1,7									2,31
	H3. Implementation of collective and strategic facilities	0,85	4,1									4,98
	H4. Family planning		1,4									1,40
	AH1. Strengthening agricultural value chains		2,3									2,33
	EH1. Formalization and strengthening of the fuelwood sector		0,3									0,33
	FH1. Strengthening forest and wildlife law enforcement		0,0	0,1	0,2			1,50				1,80
	FH2.Legal compliance of industrial logging operations		0,0					1,50				1,50
	FH3. Development of community forestry.		0,0					1,50				1,50
	FH4. Support management of protected areas		0,0	0,2	0,1	0,4						0,70
	Management and operating cost (30%) MOD & FIP suivi	8,089	10,0	0,21	0,45	0,2	0,1					19,05
	Total	14,2	30,0	0,7	1,5	0,6	0,4	6,5	2,0	10,0	9,7	75,6

Annex 12 Social and Environmental risks and mitigation analysis of the ER-Program

(WORK IN PROGRESS)

Pillar	Agriculture		
Activity	Risks	Mitigation measures	Implementation
AS1. Agroforestry and improvement of cultivation techniques	Increased land conflict due to valorisation of lands which were previously unused (savannahs).	- Participatory mapping work/ local land-use plan in order to identify agricultural development zones; - Support given to CARGs and conflict prevention and resolution mechanisms; - Agricultural support given to rural households through targeted structures.	Designated Local Executing Agencies (LEA) and NGOs.
	Increased agricultural production from households which increases demand for rural labour including women and children.	- Support of processing and conservation of agricultural products; - Support for collective discussion of gender issues in agricultural production.	Designated LEAs and NGOs.
	Increasing agricultural production, according to Mai Ndombe community delegates, will not only focus interest on Mai Ndombe, with probable increase of crop thefts, especially in riverside fields of more populated areas and those near roads, but may also increase commercial traffic and its negative consequences.	- Support of High Intensity Labour Force activities, providing more employment opportunities for local unemployed youth; - Increasing monitoring measures in villages facing potential illegal intruders.	Designated LEAs and NGOs; local population.
AS2. Perennial crops development in non-forest areas (coffee, cocoa, palm oil and rubber)	If fallow lands or rehabilitated former concessions are depleted, there is a risk of new buyers moving out to primary forests in search of higher yields, this would endanger the program.	- Awareness raising among perennial crop farmers to adhere to the ER Program performance contract; - Program support of this activity will be entirely conditional on not clearing new fields within forests; - Development of agricultural registries while following the rural territorial planning master plans at the provincial level.	National Ministry of Agriculture and Ministry of Environment in collaboration with territorial planning and LEAs.
	- New farmers of perennial crops offer employment as socio-economic assets; - Employee dependence on agricultural employers poses the risk of a new model of agricultural production creating "employee vs. agricultural	- Include clauses, in the ER program contracts with agricultural producers, which promote plots of family agriculture under their supervision; - Support for development of land-tenure partnerships between agricultural producers and local populations.	Designated LEAs and NGOs

	labour force" conflict, rather than creating independent employment or households production model		
	Fluctuations in carbon markets could compromise continued intervention efforts in perennial crops and make agents vulnerable to unemployment.	- Support stakeholders under ER Program performance-based contracts to maintain positive emissions reduction results; - Support on site processing of agricultural products within the ER Program or its surroundings; - Promote marketing of perennial cultures; - Statistical database management of agricultural data to promote agricultural advocacy.	ER Program Steering Committee and Program management unit
AH1. Strengthening agricultural value chains	- Supporting value chains may lead to increased production, without necessarily having an end market, and a consequent decrease of agricultural prices at the local level.	- ER Program support of planning of agricultural service roads; - Support rural entrepreneurship for sale of agricultural products	LEAs and NGOs designated for the task.
Pillar	Energy		
Activity	Risks or negative impacts	Mitigation measures	Implementation
ES1. Assisted natural Assisted natural regeneration for charcoal production.	Assisted natural regeneration of savannahs for the production of charcoal could create interest in timber as usually occurs in primary forests, with the negative effect of disappearance of biodiversity and certain plants, notable NTFPs which had begun to regrow.	- Reinforcement of the application of environmental control law; - Capacity-buiding for CLDs and other structures targeted by the local communities and Indigenous Peoples in order to guarantee environmental education to households.	Administration of the Ministry of Environment and Agriculture in MN province.
	Reduction of pastureland for herds as burning of savannah will be ceased under ordinary circumstances.	- Creation of a participatory pastureland management plans in local communities and Indigenous Peoples regions; - EIC support.	Designated LEAs and NGOs.
ES2. Afforestation/ Reforestation for charcoal production	Growth of charcoal making activities following the flourishing of the wood market may cause the DGI and other tax authorities to increase taxation of agricultural activities relating to wood and firewood management.	- Simplification of the nomenclature of taxes related to the ER Program; - Supporting CARGs and other agricultural conflict prevention and resolution mechanisms.	Designated LEAs and NGOs.
EH1. Formalization and strengthening of the fuelwood	Increased wood demand from towns poses the risk of inciting premature deforestation of fields and savannahs in regeneration, and cut short waiting periods for young	- Capacity building of CLDs and other target structures of the local communities and Indigenous Peoples, to ensure durable and rational management of afforestation areas.	Designated LEAs and NGOs.

sector	afforestation areas.		
	Laxity of existing wood sector control mechanisms, causing certified timber to be extremely expensive compared to illegal timber.	- Offer of fair motivational package to agents affected by the program.	Program Management, Administration of the Ministry of Environment and Agriculture in MN province.
Pillar	Forest		
Activity	Risks or negative impacts	Mitigation measures	Implementation
FS1. Reduced impact logging	Industrial logging operations would be discouraged from participating in the ER Program if the general carbon and non-carbon results of other actors reduced their income from the program, while normal logging was more lucrative.	- Intensive support of awareness-raising and supporting of planned activities aiming to maintain predicted results; - Support of MRV; - Popularisation of compliance systems for loggers, aiming to serve as a self-evaluation tool before the MRV and OIREDD.	ER Program Steering Committee and Management Committee.
	Disturbance of biodiversity/ relocation of certain animal species, following industrial logging despite being low-impact.	Close accompaniment of forest management agents in their efforts to apply The Law.	Program Management, environmental administration.
	Absence of local product processing companies does not stimulate local communities and Indigenous Peoples to respect forest logging laws.	Encouragement of timber industries to set up processing units and professional timber sector training schools in the ER Program area.	Steering Committee, all the Administrations of Environment Ministries, EPSP, agriculture, youth, etc. in MN Province.
FS2. Conservation of local community forests	Risk of only taking aspects of the timber industry into account in community forestry, while NTFPs are also more lucrative.	Supporting identification and development of the value chains of target NTFPs.	Steering Committee, designated LEAs and NGOs.
	Community forest conservation areas will profoundly affect the living areas of the local communities and Indigenous Peoples.	Accompanying the installation of local development plan in community forestry targeted areas.	Designated LEAs and NGOs.
	Heightening of opposition between civil society and the MECNDD regarding supporting ETDs rather than local communities and Indigenous Peoples in community forestry.	Promotion of joint consultation of stakeholders on application and vulgarization of the decree on communities forests concession measures.	Steering Committee, designated LEAs and NGOs.

FS3. Conservation concession	A five year period to test the ER Program is potentially too short to ensure that loggers choose the conservation concession option as, in case of weak performance, the option of returning to square one would become very complicated.	Involvement of the MECNDD in legal facilities besides producers' management plans.	Program Management, Central Administration of the Environment Ministry.
FS4. Afforestation/ Reforestation for lumber production	Afforestation/ reforestation with forest species is too slow to ensure sustainable forest management periods less than 25 years, which may discourage reforestation.	- Participatory diversification of species used for reforestation (fruit trees, trees with NTFP value, etc.) in target areas; - Development of socio-economic alternatives offering means of subsistence during the plantation growth.	Designated LEAs and NGOs.
FH1. Strengthening forest and wildlife law enforcement	Increased envy and bad sentiment towards forest management agents.	- Development of specific code of security and conduct for forest management agents. - Reinforcement of early alert and intervention system in the case of irregular or reluctant actors.	Program Management, Administration of the Environment Ministry.
FH3. Development of community forestry.	Risk of conflict between the ETDs, partisans of comprehensive conservation and the actors involved in community forestry.	Promotion of joint consultation of stakeholders on application and vulgarization of the decree on communities forests concession measures.	Steering Committee, designated LEAs and NGOs.
Pillar	Governance, Demography, Land-Use and Land-Tenure Planning		
Activity	Risks or negative impacts	Mitigation measures	Implementation
H2. Multi-level capacity-building and Sustainable Development Plans design	Reduction of community and/or Indigenous Peoples extension area through PDDs.	PDDs will be approved according to criteria guaranteeing that: (i) continuity of community development spaces is assured (as in the case of forest concessions); (ii) that sacred or cultural sites are respected and preserved.	Designated LEAs and NGOs.
	Risk of denigration of sacred areas by ER Program actors giving the impression that PDDs provide an opportunity to easily acquire sacred and cultural spaces.		Designated LEAs and NGOs.
H3. Implementation of collective and strategic facilities	Risk of non-sustainability of collective projects if they are not collectively managed.	- Strengthening of social engagement surrounding collective ownership of the program and collective and individual participation. - Civic education regarding respect of collective assets and communities.	Designated LEAs and NGOs.
H4. Family planning	Communities tend to believe that the ER Program intends to promote "birth control" at the local level to the benefit of immigration of distant neighbours.	Strengthening communication and ownership of the program.	Designated LEAs and NGOs.

Annex 13 Equations used for the calculation of the REL UNDEF

$$a_{p,m} = \frac{A_m}{n_m}$$ Equation (7)

Where:

$a_{p,m}$ = Representative sample area for stratum m

A_m = Area of stratum m

n_m = Number of samples per stratum

$$S_{m,p} = \sum_{i=1}^{pd} \left(a_{p,m_i}\right)$$ Equation (8)

Where:

pd = Number of samples deforested in Dense forest (DF->NF)

$S_{m,p}$ = Area of Dense forest deforested

$$S_{m,s} = \sum_{i=1}^{sd} \left(a_{p,m_i}\right)$$ Equation (9)

Where:

sd = Number of samples deforested in secondary forest (SF->NF)

$S_{m,s}$ = Area of secondary forest deforested

$$PE_m = \frac{S_{m,p}\left(EF_p\right) \cdot \left(\frac{44}{12}\right)}{y}$$ Equation (10)

Where:

PE_m Emissions from primary deforestation (DF->NF), per year, in tCO2

EF_p

Dense forest deforestation emission factor (in tC/ha)

$$SE_m = \frac{S_{m,s}(EF_s) \cdot \left(\frac{44}{12}\right)}{y}$$ Equation (11)

Where:

SE_m

Emissions from deforestation of secondary forest (SF->NF), per year, in tCO2

EF_s

Secondary forest deforestation emission factor (in tC/ha)

$$SE_m = \frac{S_{m,s}(EF_s) \cdot \left(\frac{44}{12}\right)}{y}$$ Equation (12)

Where:

SE_m

Emissions from deforestation of secondary forest (SF->NF), per year, in tCO2

EF_s

Secondary forest deforestation emission factor (in tC/ha)

$$REL_{UNDEF,tCO2e} = \sum_{m=1}^{t}(PE_m + SE_m)$$ Equation (13)

Where:

$REL_{UNDEF,tCO2e}$

Total emissions from deforestation in tCO2, per year, for t strata

$$REL_{UNDEF,\%} = \frac{\sum_{m=1}^{t}\left(S_{m,p} + S_{m,s}\right)}{\sum_{m=1}^{t}(A_m)} \cdot (100)$$ Equation (14)

Where:

$REL_{UNDEF,\%}$

Total deforestation rate per year, in %/yr

Annex 14 Equations used for the calculation of the REL UNDEG

$$S_m = \sum_{i=1}^{f} \left(a_{p,m_i}\right)$$ Equation (15)

Where:

S_m Area degraded (un-ameliorated) per stratum, in ha;

f Number of samples degraded (exhibits state change from DF->SF)

$$S_{adj,m} = S_m - bd - gr$$ Equation (16)

Where:

$S_{adj,m}$ Area degraded (ameliorated) per stratum, in ha;

bd Area calculated as bad degradation

gr Area calculated as good re-growth

$$ED_m = S_{adj,m}\left(EF_p - EF_s\right) \cdot \left(\frac{44}{12}\right)$$ Equation (17)

Where:

ED_m Total ameliorated emissions from degradation per stratum, in tCO2

EF_p Dense forest deforestation emission factor, in tC, per year

EF_s = Secondary deforestation emission factor, in tC, per year

$$REL_{UNDEG,tCO2e} = \sum_{m=1}^{t} (ED_m)$$ Equation (18)

Where:

t Number of strata in the ER Program

$REL_{UNDEG,tCO2e}$ Total emissions from degradation per year (in tCO2/year)

$$REL_{UNDEG,\%} = \sum_{m=1}^{t} \left(\frac{S_{adj,m}}{A_m} \right)$$ Equation (19)

Where:

$REL_{UNDEG,\%}$ Total rate of degradation, in % per year

Annex 15 Equations used for the calculation of carbon stock changes during the program period as a result of A/R activities

The change in carbon stocks during the program period occurring in the selected carbon pools, in year t is calculated as follows:

$$C_{ACTUAL} = B_{TREE} x CF_{TREE} x \, {}^{44}/_{12} \qquad \text{Equation (20)}$$

Where:

B_{TREE} = Tree biomass in the tree biomass estimation, in t.d.m

CF_{TREE} = Carbon fraction of tree biomass, in t C/t.d.m.

The mean tree biomass is determined based on the total A/R area and the mean tree biomass per hectare:

$$B_{TREE} = A x b_{TREE} x \, {}^{44}/_{12} \qquad \text{Equation (21)}$$

Where:

b_{TREE} = Mean tree biomass, in t d.m per ha.

A = Afforestation / Reforestation area, in ha.

The mean tree biomass is determined based on the mean tree biomass of all strata considering their overall share:

$$b_{TREE} = \sum_{i=1}^{M} w_i \, x b_{TREE,i} \qquad \text{Equation (22)}$$

Where:

$b_{TREE,i}$ = Mean tree biomass per stratum, in t.d.m per ha.

w_i = Ratio of the area stratum to the si, of areas of tree biomass estimation strata (i.e. $w_i = A_i/A$), dimensionless

Annex 16 Equations used for the calculation of the REL PDEG

The average annual REL is calculated as follows:

$$REL_{avg-ann,PDEG,hist} = \frac{\sum_{y=1}^{11} E_{PDEG,y|REL}}{\sum y} \qquad \text{Equation (23)}$$

Where

$REL_{avg-ann,PD}$ ıe average annual historical reference emission level for planned degradation over the reference period, in tCO_2

$E_{PDEG,y|REL}$ the emissions from planned degradation in year y during the reference period, in tCO_2

y 1,2, 3…11 years

Total baseline emissions are calculated as follows:

$$REL_{PDEG,hist} = \sum_{y=1}^{11} E_{PDEG,y|REL} \qquad \text{Equation (24)}$$

Where

$REL_{PDEG,hist}$ ıe historical reference emission level for planned degradation over the reference period, in tCO_2

$E_{PDEG,y|REL}$ the emissions from planned degradation in year y during the reference period, in tCO_2

y 3…11 years

Annual emissions for the reference period are then calculated as follows:

$$E_{PDEG,y,|REL} = E_{INF,y|REL} + E_{TF,y|REL} + E_{HWP,y|REL} - R_{REG,y|REL} \qquad \text{Equation (25)}$$

Where

$E_{PDEG,y|REL}$ the emissions from planned degradation in year y during the reference period, in tCO_2

$E_{INF,y|REL}$ the emissions from forestry infrastructure in year y during the reference period, in tCO_2

$E_{TF,y|REL}$ the emissions from tree felling in year y during the reference period, in tCO_2

$E_{HWP,y|REL}$ the emissions from harvested wood products in year y during the reference period, in tCO_2

$R_{REG,y|REL}$ the removals from forest regrowth in year y during the reference period, in tCO_2

y 3…11 years

Emissions from forestry infrastructure

The type of forestry infrastructure may vary from forest concession to forest concession. As such, only the applicable categories (permanent, primary, secondary and sub-canopy roads, skidtrails and log landings) should be applied. To give an example: Field research has revealed that in smaller concessions (e.g. NBK), no real forest roads are build. Rather, skidtrail-like roads are cut directly to the felling sites, where the logs are then directly loaded onto trucks. For such concessions, a separate road category is introduced (sub-canopy roads) as all other forestry infrastructure is not applicable. In other concessions (e.g. SIFORCO), no separate log landings are cleared, but logs are temporarily stored at roadside. Here, no emissions from log landings are calculated.

Annual emissions from forestry infrastructure are calculated as follows:

$$E_{INF,y|REL} = E_{PmR,y,|REL} + E_{PR,y,|REL} + E_{SR,y|REL} + E_{SCR,y|REL} + E_{SKID,y|REL} + E_{LL,y|REL} \quad \text{Equation (26)}$$

Where

$E_{INF,y|REL}$ the emissions from forestry infrastructure in year y during the reference period, in tCO_2

$E_{PmR,y,|REL}$ the emissions from clearing of permanent roads in year y during the reference period, in tCO_2

$E_{PR,y,|REL}$ the emissions from clearing of primary roads in year y during the reference period, in tCO_2

$E_{SR,y|REL}$ the emissions from clearing of secondary roads in year y during the reference period,

in tCO_2

$E_{SCR,y|REL}$ the emissions from clearing of sub-canopy roads in year y during the reference period, in tCO_2

$E_{SKID,y|REL}$ the emissions from opening of skid trails in year y during the reference period, in tCO_2

$E_{LL,y|REL}$ the emissions from clearing of log landings in year y during the reference period, in tCO_2

y 3…11 years

Permanent roads

Permanent roads are usually existing roads in between towns/villages that may cross a concession area. Where available, forest concessionaires use these roads to access the exploitation area. Usually, they have to be reopened as they have been out of use (for vehicles) for some time. The biomass cleared on these permanent roads is lower than in the residual forest stand cleared for new primary and secondary roads, which is reflected in the formula below.

Emissions from permanent roads are calculated as follows

$$E_{PmR,y,|REL} = ((A_{h,y|REL} * \left(\frac{W_{PmR|REL} * L_{PmR|REL}}{10{,}000}\right) * C_{stock-AGB_{trees,DBH<20}}) + (A_{h,y|REL} * \left(\frac{W_{SS-PmR|REL} * L_{PmR|REL}}{10{,}000}\right) * (C_{stock-AGB_{trees,DBH>30}} * (1 - P_{trees,DBH>30|REL})))) * (1+RSR) * \frac{44}{12}$$ Equation (27)

Where

$E_{PmR,y|REL}$ the emissions from clearing of permanent roads in year y during the reference period, in tCO_2

$A_{h,y|REL}$ ıe area harvested in year y during the reference period, in ha

$W_{PmR|REL}$ ıe average width of permanent roads, in m

$L_{PmR|REL}$ ıe average length of permanent roads per unit area of exploited concession area, in m/ha

$C_{stock-AGB_{trees,DBH<20}}$ ıe average carbon stock in above ground biomass of trees with a DBH <20 cm per unit area of exploited concession area, in tC/ha

RSR ıe root-shoot-ratio value, dimensionless

$W_{SS-PmR\|REL}$	e average width of solar strips along permanent roads, in m
$C_{stock-AGB_{trees,DBH>30}}$	e average carbon stock in above ground biomass of trees with a DBH >30 cm per unit area of exploited concession area, in tC/ha
$P_{trees,DBH>30\|REL}$	e fraction of trees with a DBH>30 cm remaining on solar strips per unit area of exploited concession area, in %
Y	3…11 years

Primary roads

Emissions from primary roads are calculated as follows

$$E_{PR,y,\|REL} = ((A_{h,y\|REL} * \left(\frac{W_{PR\|REL} * L_{PR\|REL}}{10{,}000}\right) * C_{stock-AGB}) + (A_{h,y\|REL} * \left(\frac{W_{SS-PR\|REL} * L_{PR\|REL}}{10{,}000}\right) * (C_{stock-AGB_{trees,DBH>30}} * (1 - P_{trees,DBH>30\|REL})))) * (1+RSR) * \frac{44}{12}$$

Equation (28)

Where

$E_{PR,y\|REL}$	the emissions from clearing of primary roads in year y during the reference period, in tCO_2
$A_{h,y\|REL}$	e area harvested in year y during the reference period, in ha
$W_{PR\|REL}$	e average width of primary roads, in m
$L_{PR\|REL}$	e average length of primary roads per unit area of exploited concession area, in m/ha
$C_{stock-AGB}$	e average carbon stock in above ground biomass per unit area of exploited concession area, in tC/ha
RSR	e root-shoot-ratio value, dimensionless
$W_{SS-PR\|REL}$	e average width of solar strips along primary roads, in m
$C_{stock-AGB_{trees,DBH>30}}$	e average carbon stock in above ground biomass of trees with a DBH >30 cm per unit area of exploited concession area, in tC/ha
$P_{trees,DBH>30\|REL}$	e fraction of trees with a DBH>30 cm remaining on solar strips per unit area of exploited concession area, in %
y	3…11 years

Secondary roads

Emissions from secondary roads are calculated as follows

$$E_{SR,y,|REL} = ((A_{h,y|REL} * \left(\frac{W_{SR|REL} * L_{SR|REL}}{10{,}000}\right) * C_{stock-AGB}) + (A_{h,y|REL} * \left(\frac{W_{SS-SR|REL} * L_{SR|REL}}{10{,}000}\right) * (C_{stock-AGB_{trees,DBH>30}} * (1 - P_{trees,DBH>30|REL})))) * (1+RSR) * \frac{44}{12}$$ Equation (29)

Where

$E_{SR,y\|REL}$	the emissions from clearing of secondary roads in year y during the reference period, in tCO_2
$A_{h,y\|REL}$	ıe area harvested in year y during the reference period, in ha
$W_{SR\|REL}$	ıe average width of secondary roads, in m
$L_{SR\|REL}$	ıe average length of secondary roads per unit area of exploited concession area, in m/ha
$C_{stock-AGB}$	ıe average carbon stock in above ground biomass per unit area of exploited concession area, in tC/ha
RSR	ıe root-shoot-ratio value, dimensionless
$W_{SS-SR\|REL}$	ıe average width of solar strips along secondary roads, in m
$C_{stock-AGB_{trees,DBH>30}}$	ıe average carbon stock in above ground biomass of trees with a DBH >30 cm per unit area of exploited concession area, in tC/ha
$P_{trees,DBH>30\|REL}$	ıe fraction of trees with a DBH>30 cm remaining on solar strips per unit area of exploited concession area, in %
y	3…11 years

Sub-canopy roads

Sub-canopy roads are in fact more like skidtrails, i.e. they do not have any solar strips cut alongside the actual roadstrip. However, the biomass cleared on these small roads is higher than on skidtrails, as trees up to a DBH of 50 cm are cut.

Emissions from sub-canopy roads are calculated as follows

$$E_{SCR,y,|REL} = A_{h,y|REL} * \left(\frac{W_{SCR|REL} * L_{SCR|REL}}{10{,}000}\right) * C_{stock-AGB_{trees,DBH<50}} * (1+RSR) * \frac{44}{12}$$ Equation (30)

Where

$E_{SCR,y|REL}$	the emissions from clearing of sub-canopy roads in year y of the reference period, in tCO_2
$A_{h,y|REL}$	e area harvested in year y during the reference period, in ha
$W_{SCR|REL}$	e average width of sub-canopy roads, in m
$L_{SCR|REL}$	e average length of sub-canopy roads per unit area of exploited concession area, in m/ha
$C_{stock-AGB_{trees,DBH<30}}$	e average carbon stock in above ground biomass of trees with a DBH <50 cm per unit area of exploited concession area, in tC/ha
RSR	e root-shoot-ratio value, dimensionless
y	3…11 years

Skidtrails

Emissions from skid trails are calculated as follows

$$E_{SKID,y,|REL} = A_{h,y|REL} * \left(\frac{W_{SKID|REL} * L_{SKID|REL}}{10{,}000}\right) * C_{stock-AGB_{trees,DBH<20}} * (1+RSR) * \frac{44}{12}$$ Equation (31)

Where

$E_{SKID,y|REL}$	the emissions from clearing of skid trails in year y of the reference period, in tCO_2
$A_{h,y|REL}$	e area harvested in year y during the reference period, in ha

$W_{SKID\|REL}$	e average width of skidtrails, in m
$L_{SKID\|REL}$	e average length of skidtrails per unit area of exploited concession area, in m/ha
$C_{stock-AGB_{trees,DBH<20}}$	e average carbon stock in above ground biomass of trees with a DBH <20 cm per unit area of exploited concession area, in tC/ha
RSR	e root-shoot-ratio value, dimensionless
y	3…11 years

Log landings

Emissions from log landings are calculated as follows:

$$E_{SR,y,|REL} = ((A_{h,y|REL} * \left(\frac{A_{LL|REL} * N_{LL|REL}}{10{,}000}\right) * C_{stock-AGB}) * (1+RSR) * \frac{44}{12}$$ Equation (32)

Where

$E_{LL,y|REL}$	the emissions from clearing of log landings in year y during the reference period, in tCO_2
$A_{h,y|REL}$	e area harvested in year y during the reference period, in ha
$A_{LL|REL}$	e average area of log landings, in m²
$N_{LL|REL}$	e average number of log landings per unit area of exploited concession area, in N°/ha
$C_{stock-AGB}$	e average carbon stock in above ground biomass per unit area of exploited concession area, in tC/ha
RSR	e root-shoot-ratio value, dimensionless
y	3…11 years

Emissions from tree felling

Emissions from tree felling are calculated as follows:

$$E_{TF,y|REL} = E_{LS,y|REL} + E_{RSD,y|REL} + E_{AT,y|REL}$$ Equation (33)

Where

$E_{TF,y|REL}$	the emissions from tree felling in year y of the reference period, in tCO_2
$E_{LS,y|REL}$	the emissions from logging slash (stumps, crown residues) in year y of the reference period, in tCO_2
$E_{RSD,y|REL}$	the emissions from residual stand damage in year y of the reference period, in tCO_2
$E_{AT,y|REL}$	the emissions from abandoned timber in year y of the reference period, in tCO_2
y	3…11 years

Emissions from harvested timber (merchantable volume)

Actual emissions from harvested timber are calculated in the harvested wood products section. However, emissions from harvested timber also need to be calculated to calculate residual stand damage and abandoned timber. Consequently, the formula is presented here.

Emissions from harvested timber are calculated as follows:

$$E_{HT,y,|REL} = V_{h,y|REL} * WD * CF * \frac{44}{12}$$ Equation (34)

Where

$E_{HT,y,|REL}$	the emissions from harvested timber in year y of the reference period, in tCO_2
$V_{h,y|REL}$	e volume harvested in year y of the reference period, in m^3
WD	e average wood density of harvested trees, in t/m^3
CF	e carbon fraction in woody biomass, in tC/t
y	3…11 years

Emissions from logging slash

Emissions from logging slash are calculated as follows:

$$E_{LS,y,|REL} = (V_{h,y|REL} * WD * BEF * (1 + RSR) * CF * \frac{44}{12}) - E_{HT,y,|REL}$$ Equation (35)

Where

$E_{LS,y,|REL}$	the emissions from logging slash in year y of the reference period, in tCO_2
$V_{h,y|REL}$	e volume harvested in year y of the reference period, in m^3
WD	e average wood density of harvested trees, in t/m^3
BEF	e biomass expansion factor, dimensionless
RSR	e root-shoot-ratio value, dimensionless
CF	e carbon fraction in woody biomass, in tC/t
$E_{HT,y,|REL}$	the emissions from harvested timber in year y of the reference period, in tCO_2
y	3…11 years

Emissions from residual stand damage

Emissions from residual stand damage are calculated as follows:

$$E_{RSD,y,|REL} = E_{HT,y,|REL} * F_{RSD|REL} * (1 + RSR)$$ Equation (36)

Where

$E_{RSD,y,|REL}$	the emissions from residual stand damage in year y of the reference period, in tCO_2
$E_{HT,y,|REL}$	the emissions from harvested timber in year y of the reference period, in tCO_2

$F_{RSD\|REL}$	ıe residual stand damage factor, dimensionless
RSR	ıe root-shoot-ratio value, dimensionless
y	3…11 years

Emissions from abandoned timber

Emissions from abandoned timber are calculated as follows:

$$E_{AT,y,|REL} = E_{HT,y,|REL} * BEF * (1 + RSR) * F_{AT|REL}$$ Equation (37)

Where

$E_{AT,y,|REL}$	the emissions from abandoned timber in year y of the reference period, in tCO_2
$E_{HT,y,|REL}$	the emissions from harvested timber in year y of the reference period, in tCO_2
BEF	ıe biomass expansion factor, dimensionless
RSR	ıe root-shoot-ratio value, dimensionless
$F_{AT|REL}$	ıe factor for abandoned timber, dimensionless
y	3…11 years

Emissions from harvested wood products

Emissions from harvested wood products are calculated as follows:

$$E_{HWP,y,|REL} = E_{HWP,iah,y,|REL} + E_{HWP,3-100,y|REL}$$ Equation (38)

Where

$E_{HWP,y,|REL}$	the emissions from harvested wood products which are emitted in year y of the reference period, in tCO_2
$E_{HWP,iah,y,|REL}$	the emissions from harvested wood products emitted immediately after harvest in year y of the reference period, in tCO_2
$E_{HWP,3-100,y|REL}$	the emissions from harvested wood products released between years 3-100

for wood products produced in year y of the reference period, in

y 3…11 years

Emissions from harvested wood products emitted immediately after harvest

Emissions from harvested wood products emitted immediately after harvest are calculated as follows:

$$E_{HWP,iah,y|REL} = \left(E_{HT,y|REL} * P_{OIRW|REL} * (WW_{OIRW|REL} + SLF_{OIRW|REL})\right) + (E_{HT,y|REL} * P_{SW|REL} * (WW_{SW|REL} + SLF_{SW|REL})) + (E_{HT,y|REL} * P_{WbP|REL} * (WW_{WbP|REL} + SLF_{WbP|REL}))$$ Equation (39)

Where

$E_{HWP,iah,y,|REL}$ the emissions from harvested wood products emitted immediately after harvest in year y of the reference period, in tCO_2

$E_{HT,y|REL}$ the emissions from harvested timber in year y of the reference period, in tCO_2

$P_{OIRW|REL}$ e proportion of other industrial roundwood out of total wood products, in %

$WW_{OIRW|REL}$ e fraction of wood waste from other industrial roundwood products, in %

$SLF_{OIRW|REL}$ e fraction of short-lived fractions in other industrial roundwood products, in %

$P_{SW|REL}$ e proportion of sawnwood out of total wood products, in %

$WW_{SW|REL}$ e fraction of wood waste from sawnwood products, in %

$SLF_{SW|REL}$ e fraction of short-lived fractions in sawnwood products, in %

$P_{WbP|REL}$ e proportion of wood-based panels out of total wood products, in %

$WW_{WbP|REL}$ e fraction of wood waste from wood-based panels products, in %

$SLF_{WbP|REL}$ e fraction of short-lived fractions in wood-based panels products, in %

y 3…11 years

Carbon in harvested wood products that is not emitted immediately after harvest

Carbon in harvested wood products that is not emitted immediately after harvest is calculated as follows:

$$C_{HWP,y|REL} = E_{HT,y|REL} - E_{HWP,iah,y,|REL}$$ Equation (40)

Where

$C_{HWP,y|REL}$ ne carbon in harvested wood products produced in year y of the reference period that is not emitted immediately after harvest, in tCO_2

$E_{HT,y|REL}$ the emissions from harvested timber in year y of the reference period, in tCO_2

$E_{HWP,iah,y,|REL}$ the emissions from harvested wood products emitted immediately after harvest in year y of the reference period, in

y 3…11 years

Emissions from harvested wood products released between years 3-100

Emissions from harvested wood products released between years 3-100 are calculated as follows:

$$E_{HWP,3-100,y|REL} = (C_{HWP,y|REL} * P_{OIRW|REL} * AOF_{OIRW|REL}) + (C_{HWP,y|REL} * P_{SW|REL} * AOF_{SW|REL}) + (C_{HWP,y|REL} * P_{WbP|REL} * AOF_{WbP|REL})$$ Equation (41)

Where

$E_{HWP,3-100,y|REL}$ the emissions from harvested wood products produced in year y of the reference period that are released between years 3-100, in tCO_2

$C_{HWP,y|REL}$ ne carbon in harvested wood products produced in year y of the reference period that is not emitted immediately after harvest, in tCO_2

$P_{OIRW|REL}$ e proportion of other industrial roundwood out of total wood products, in %

$AOF_{OIRW|REL}$ he fraction of additional oxidized fractions in other industrial roundwood products, in %

$P_{SW|REL}$ e proportion of sawnwood out of total wood products, in %

$AOF_{SW|REL}$ is the fraction of additional oxidized fractions in sawnwood products, in %

$P_{WbP|REL}$ ıe proportion of wood-based panels out of total wood products, in %

$AOF_{WbP|REL}$ ıe fraction of additional oxidized fractions in wood-based panels products, in %

y 3…11 years

Removals from forest regrowth

Unlike emissions which are only calculated once per harvesting area, removals from forest regrowth logically continue to be calculated until the end of the accounting period for every harvesting area where logging has occurred since the start of the ER Program.

Removals from forest regrowth are calculated as follows:

$$R_{T,FR|REL} = \sum_{y=1}^{11} R_{FR,yREL} \qquad \text{Equation (42)}$$

Where

$R_{T,FR|REL}$ the total removals from forest regrowth during the reference period, in tCO_2

$R_{FR,yREL}$ the removals from forest regrowth in year y of the reference period, in tCO_2

y 3…11 years

Removals from forest regrowth are then calculated as follows:

$$R_{FR,y|REL} = R_{PR,y|REL} + R_{SR,y|REL} + R_{SS-PR+SR,y|REL} + R_{SmR,y|REL} + R_{SKID,y|REL} + R_{LL,y|REL} + R_{F\ ,y|REL} \qquad \text{Equation (43)}$$

Where

$R_{FR,yREL}$ the removals from forest regrowth in year y of the reference period, in tCO_2

$R_{PR,y|REL}$ the removals from forest regrowth on primary roads in year y of the reference period, in tCO_2

$R_{SR,y|REL}$ the removals from forest regrowth on secondary roads in year y of the reference period, in tCO_2

$R_{SS-PR+SR,y|RE}$ the removals from forest regrowth on solar strips along permanent, primary and secondary roads in year y of the reference period, in tCO_2

$R_{SmR,y|REL}$ the removals from forest regrowth on sub-canopy roads in year y of the reference period, in tCO_2

$R_{SKID,y|REL}$ the removals from forest regrowth on skidtrails in year y of the reference period, in tCO_2

$R_{LL,y|REL}$ the removals from forest regrowth on log landings in year y of the reference period, in tCO_2

$R_{FS,y|REL}$ the removals from forest regrowth at felling sites in year y of the reference period, in tCO_2

y 3…11 years

Removals from forest regrowth on permanent roads

The period of use of permanent roads by concessionaires is highly variable. Further, permanent roads will stay in use by people, though regrowth will occur if the road is not frequently used by vehicles. As permanent roads account for only 9.8% of all roads in our analysis and most permanent roads opened during the reference period remained in use over the reference period, no regrowth is calculated for permanent roads.

Removals from forest regrowth on primary roads

Removals from forest regrowth on primary roads are calculated as follows:

Please note that removals for regrowth on primary roads start only in year 6 after construction, as primary roads are used for an average time period of 5 years.

$$R_{PR,y|REL} = A_{t,h,start-ref-period+5,y|REL} * \left(\frac{W_{PR|REL} * L_{PR|REL}}{10{,}000}\right) * AAI * CF * \frac{44}{12} \qquad \text{Equation (44)}$$

Where

$R_{PR,yREL}$ the removals from forest regrowth on primary roads in year y of the reference period, in tCO_2

$A_{t,h,start-ref-period+5,y|REL}$ the total area harvested since year 6 of the reference period in year y of the reference

period, in ha

$W_{PR|REL}$ e average width of primary roads, in m

$L_{PR|REL}$ e average length of primary roads per unit area of exploited concession area, in m/ha

AAI e average annual increment, in t/ha/y

CF e carbon fraction in woody biomass, in tC/t

y 3…6 years

Removals from forest regrowth on secondary roads

Removals from forest regrowth on secondary roads are calculated as follows:

Please note that removals for regrowth on secondary roads start only in year 3 after construction, as secondary roads are used for an average time period of 2 years.

$$R_{SR,y|REL} = A_{t,h,start-ref-period+2,y|REL} * \left(\frac{W_{SR|REL} * L_{SR|REL}}{10{,}000}\right) * AAI * CF * \frac{44}{12} \qquad \text{Equation (45)}$$

Where

$R_{SR,y|REL}$ the removals from forest regrowth on secondary roads in year y of the reference period, in tCO_2

$A_{t,h,start-ref-period+2,y|REL}$ e total area harvested since year 3 of the reference period in year y of the reference period, in ha

$W_{SR|REL}$ is the average width of secondary roads, in m

$L_{SR|REL}$ e average length of secondary roads per unit area of exploited concession area, in m/ha

AAI e average annual increment, in t/ha/y

CF e carbon fraction in woody biomass, in tC/t

y 3…9 years

Removals from forest regrowth on solar strips along permanent, primary and secondary roads

Removals from forest regrowth on solar strips along primary and secondary roads are calculated as follows:

$$R_{SS-PR+SR,y|REL} = A_{t,h,start-ref-period,y|REL} * \left(\left(\frac{W_{SS-PR|REL} * L_{PR|REL}}{10{,}000}\right) + \left(\frac{W_{SS-SR|REL} * L_{SR|REL}}{10{,}000}\right) + \left(\frac{W_{SS-PermR|REL} * L_{PermR|REL}}{10{,}000}\right)\right) * AAI * CF * \frac{44}{12}$$

Equation (46)

Where

$R_{SS-PR+SR,y\|RE}$	the removals from forest regrowth on solar strips along primary and secondary roads in year y of the reference period, in tCO_2
$A_{t,h,start-ref-period,y\|REL}$	e total area harvested since the start of the reference period in year y of the reference period, in ha
$W_{SS-PR\|REL}$	is the average width of solar strips along primary roads, in m
$L_{PR\|REL}$	e average length of primary roads per unit area of exploited concession area, in m/ha
$W_{SS-SR\|REL}$	e average width of solar strips along secondary roads, in m
$L_{SR\|REL}$	ıe average length of secondary roads per unit area of exploited concession area, in m/ha
$W_{SS-PermR\|REL}$	e average width of solar strips along permanent roads, in m
$L_{PermR\|REL}$	ıe average length of permanent roads per unit area of exploited concession area, in m/ha
AAI	e average annual increment, in t/ha/y
CF	e carbon fraction in woody biomass, in tC/t
y	3…11 years

Removals from forest regrowth on sub-canopy roads

Removals from forest regrowth on sub-canopy roads are calculated as follows:

$$R_{SmR,y|REL} = A_{t,h,start-ref-period,y|REL} * \left(\frac{W_{SmR|REL} * L_{SmR|REL}}{10{,}000}\right) * AAI * CF * \frac{44}{12} \qquad \text{Equation (47)}$$

Where

$R_{SmR,y|REL}$ the removals from forest regrowth on sub-canopy roads in year y of the reference period, in tCO_2

$A_{t,h,start-ref-period,y|REL}$ e total area harvested since the start of the reference period in year y of the reference period, in ha

$W_{SmR|REL}$ is the average width of sub-canopy roads, in m

$L_{SmR|REL}$ ıe average length of sub-canopy roads per unit area of exploited concession area, in m/ha

AAI e average annual increment, in t/ha/y

CF e carbon fraction in woody biomass, in tC/t

y 1,2,3…11 years

Removals from forest regrowth on skidtrails

Removals from forest regrowth on skid trails are calculated as follows:

$$R_{SKID,y|REL} = A_{t,h,start-ref-perio\ \ ,y|REL} * \left(\frac{W_{SKID|REL} * L_{SKID|REL}}{10{,}000}\right) * AAI * CF * \frac{44}{12} \qquad \text{Equation (48)}$$

Where

$R_{SKID,y|REL}$ the removals from forest regrowth on skidtrails in year y of the reference period, in tCO_2

$A_{t,h,start-ref-period,y|REL}$ e total area harvested since the start of the reference period in year y of the reference period, in ha

$W_{SKID|REL}$ e average width of skidtails, in m

$L_{SKID|REL}$ e average length of skidtrails per unit area of exploited concession area, in m/ha

AAI e average annual increment, in t/ha/y

CF e carbon fraction in woody biomass, in tC/t

y 3…11 years

Removals from forest regrowth on log landings

Removals from forest regrowth on log landings are calculated as follows:

$$R_{LL,y|REL} = A_{t,h,start-ref-period,y|REL} * \left(\frac{A_{LL|REL} * N_{LL|REL}}{10{,}000}\right) * AAI * CF * \frac{44}{12} \qquad \text{Equation (49)}$$

Where

$R_{LL,y|REL}$ the removals from forest regrowth on log landings in year y of the reference period, in tCO_2

$A_{t,h,start-ref-period,y|REL}$ e total area harvested since the start of the reference period in year y of the reference period, in ha

$A_{LL|REL}$ e average area of log landings, in m²

$N_{LL|REL}$ he average number of log landings per unit area of exploited concession area, dimensionless

AAI e average annual increment, in t/ha/y

CF e carbon fraction in woody biomass, in tC/t

y 3…11 years

Removals from forest regrowth at felling sites

Removals from forest regrowth at felling sites are calculated as follows:

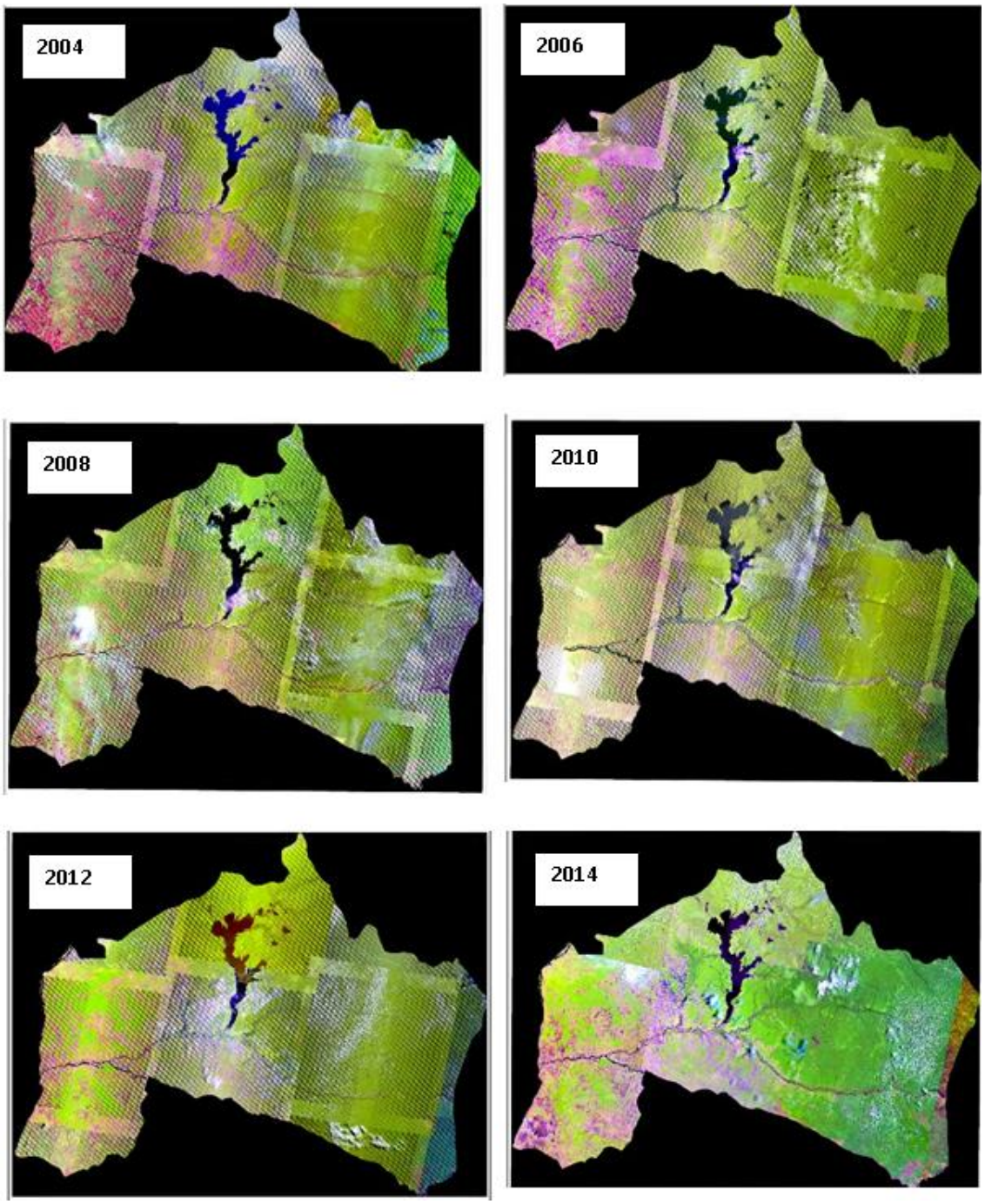
$$R_{FS,y|REL} = A_{t,h,start-ref-period,y|REL} * \left(\frac{A_{FS|REL} * \frac{V_{h,y|REL}}{V_{tree} * N_{trees,FS|REL}}}{10{,}000} \right) * AAI * CF * \frac{44}{12}$$ Equation (50)

Where

$R_{FS,y\|REL}$	the removals from forest regrowth at felling sites in year y of the reference period, in tCO_2
$A_{t,h,start-ref-period,y\|REL}$	e total area harvested since the start of the reference period in year y of the reference period, in ha
$A_{FS\|REL}$	e average area of felling sites, in m²
V_{tree}	e average volume per harvested tree, in m³
$V_{h,y\|REL}$	e volume harvested in year y of the reference period, in m³
$N_{trees,FS\|REL}$	e average number of trees per felling sites, N°/felling site
AAI	e average annual increment, in t/ha/y
CF	e carbon fraction in woody biomass, in tC/t
y	3…11 years

Annex 17 Imagery used for REL UNDEF and REL UNDEG Calculation

Figure 18: Mosaicked Imagery used for the REL Calculation



Path	Row	Filename	Year	Date Acquired	Sensor/Instr.	
2004						
178	62	LE71780622004133ASN01	2004	12-May	Landsat ETM+	7
178	63	LE71780632004133ASN01	2004	12-May	Landsat ETM+	7
179	61	LE71790612004268ASN01	2004	24-Sep	Landsat ETM+	7
179	62	LE71790622004204ASN01	2004	22-Jul	Landsat ETM+	7
179	63	LE71790632004204ASN01	2004	22-Jul	Landsat ETM+	7
180	61	LE71800612004195ASN01	2004	13-Jul	Landsat ETM+	7
180	62	LE71800622004195ASN01	2004	13-Jul	Landsat ETM+	7
181	61	LE71810612004026ASN01	2004	26-Jan	Landsat ETM+	7
181	62	LE71810622004170ASN01	2004	18-Jun	Landsat ETM+	7
181	63	LE71810632004170ASN01	2004	18-Jun	Landsat ETM+	7
2006						
178	62	LE71780622006106ASN00	2006	16-Apr	Landsat ETM+	7
178	63	LE71780632006074ASN00	2006	15-Mar	Landsat ETM+	7
179	61	LE71790612006033ASN00	2006	2-Feb	Landsat ETM+	7
179	62	LE71790622006017ASN00	2006	17-Jan	Landsat ETM+	7
179	63	LE71790632006257ASN00	2006	14-Sep	Landsat ETM+	7
180	61	LE71800612006024ASN00	2006	24-Jan	Landsat ETM+	7
180	62	LE71800622006024ASN01	2006	24-Jan	Landsat ETM+	7
181	61	LE71810612006175ASN00	2006	24-Jun	Landsat ETM+	7
181	62	LE71810622006191ASN00	2006	10-Jul	Landsat ETM+	7
181	63	LE71810632006159ASN00	2006	8-Jun	Landsat ETM+	7
2008						
178	62	LE71780622008064ASN00	2008	4-Mar	Landsat ETM+	7
178	63	LE71780632008064ASN00	2008	4-Mar	Landsat ETM+	7
179	61	LE71790612008167ASN00	2008	15-Jun	Landsat ETM+	7
179	62	LE71790622008183ASN00	2008	1-Jul	Landsat ETM+	7
179	63	LE71790632008167ASN00	2008	15-Jun	Landsat ETM+	7
180	61	LE71800612008270ASN00	2008	26-Sep	Landsat ETM+	7
180	62	LE71800622008270ASN00	2008	26-Sep	Landsat ETM+	7
181	61	LE71810612008165ASN00	2008	13-Jun	Landsat ETM+	7
181	62	LE71810622008181ASN00	2008	29-Jun	Landsat ETM+	7
181	63	LE71810632008181ASN00	2008	29-Jun	Landsat ETM+	7
2010						
178	62	LE71780622010229ASN00	2010	17-Aug	Landsat ETM+	7
178	63	LE71780632010069ASN00	2010	10-Mar	Landsat ETM+	7
179	61	LE71790612010140ASN00	2010	20-May	Landsat ETM+	7
179	62	LE71790622010140ASN00	2010	20-May	Landsat ETM+	7
179	63	LE71790632010140ASN00	2010	20-May	Landsat ETM+	7
180	61	LE71800612010131ASN00	2010	11-May	Landsat ETM+	7
180	62	LE71800622010115ASN00	2010	25-Apr	Landsat ETM+	7
181	61	LE71810612010090ASN00	2010	31-Mar	Landsat ETM+	7
181	62	LE71810622010090ASN00	2010	31-Mar	Landsat ETM+	7
181	63	LE71810632010138ASN00	2010	18-Mar	Landsat ETM+	7
2012						
178	62	LE71780622012315ASN00	2012	10-Nov	Landsat ETM+	7
178	63	LE71780632012203ASN00	2012	21-Jul	Landsat ETM+	7
179	61	LE71790612012082ASN00	2012	22-Mar	Landsat ETM+	7
179	62	LE71790622012274ASN00	2012	30-Sep	Landsat ETM+	7
179	63	LE71790632012178ASN00	2012	26-Jun	Landsat ETM+	7
180	61	LE71800612012025ASN00	2012	25-Jan	Landsat ETM+	7
180	62	LE71800622012057ASN00	2012	26-Feb	Landsat ETM+	7
181	61	LE71810612012192ASN00	2012	10-Jul	Landsat ETM+	7
181	62	LE71810622012240ASN00	2012	27-Aug	Landsat ETM+	7
181	63	LE71810632012320ASN00	2012	15-Nov	Landsat ETM+	7
2014						
178	62	LC81780622014216LGN00	2014	4-Aug	Landsat 8 OLI	
178	63	LC81780632014184LGN00	2014	3-Jul	Landsat 8 OLI	
179	61	LC81790612014271LGN00	2014	28-Sep	Landsat 8 OLI	
179	62	LC81790622014255LGN00	2014	12-Sep	Landsat 8 OLI	
179	63	LC81790632014255LGN00	2014	12-Sep	Landsat 8 OLI	
180	61	LC81800612014278LGN00	2014	5-Oct	Landsat 8 OLI	
180	62	LC81800622014278LGN00	2014	5-Oct	Landsat 8 OLI	
181	61	LC81810612014237LGN00	2014	25-Aug	Landsat 8 OLI	
181	62	LC81810622014221LGN00	2014	9-Aug	Landsat 8 OLI	
181	63	LC81810632014237LGN00	2014	25-Aug	Landsat 8 OLI	

Annex 18 OSFAC Capacity Building Exercise

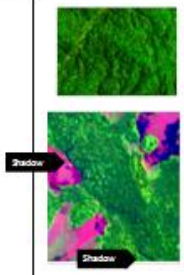
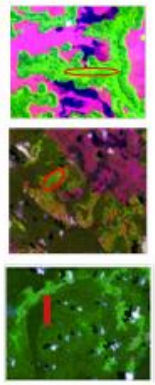
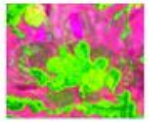
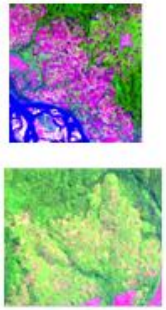
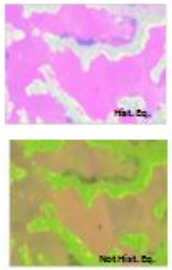
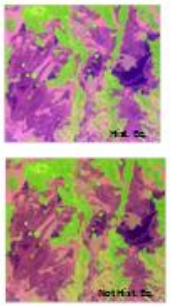
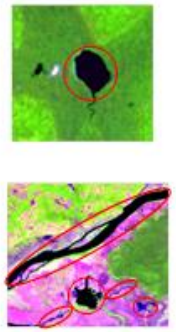
The following table provides names and qualifications of experts which conducted the UNDEF/UNDEG change detection.

Table 50: Analyst Roster for sample classification exercise – Mai Ndombe ER-Program

Name	Family (Post)-Name	First (Given) Name	Qualifications
MAKONGA	MILOLO	Lise-Olga	IngénieurAgronome (BSc)
NKAMBU	MATOKO	Grace	IngénieurAgronome (BSc)
NGALULA	KANKONDE	Judith	IngénieurAgronome
MABIBI	LUVAMBUKU	Pitshou	Ingénieur Agronome en Eaux et Forêts (BSc)
MALONGA	NKUNKU	Bardely	IngénieurAgronome (BSc)
LIKONGA	LOLEKE	Serge	IngénieurAgronome (BSc)
NKITUAHANGA	YENAMAU	Arsène	IngénieurAgronome (BSc)
KAKOBA	KATULUISHI	Paul	IngénieurAgronome
BANGELESA	FEFE	Freddy	IngénieurAgronome (BSc)
IKAMA	MATSILI	Farel	IngénieurAgronome (BSc)
EBENGO	MWAMPONGO	Dav	IngénieurAgronome (BSc)
MIALA	MIANSA	Timothée	IngénieurAgronome

Analysts in the training session (left) and on the final day of training (right) about to start classification

Figure 19: Classification "Dashboard" provided to the analyst team as a reference for choosing land cover classes

IPCC LC Classes	Primary Forest	Secondary Forest	Grassland	Cropland	Bare Soil	Burn Scar	Wetland / Water	Settlement	Other
Type	Forest	Forest	Non Forest	Non Forest	Non Forest	Non Forest	Non Forest	Non Forest	Non Forest
COLOR (Typical)	Dark Green to Medium Green	Yellowish, Light Green	Bluish Green (Teal), Slightly Brown	Mixture of Red / Purple and Bright Green	Light Red/Purple	Darker to lighter Purple		Purple/grey representing villages, structures, etc	Black (No image) White (Clouds) Black (Shadow)
TEXTURE	*Irregular pattern of rough vegetation (Smooth)	Variable roughness (irregular pattern)	Smooth	Mosaic/ Patchy, *Rows of crops, fields visible	Smooth	Smooth	Smoother	Rough / Patchy	
CONTEXT / ATTRIBUTES	* Tends to exist in large patches * Appears taller (look for edge shadows)	* Tends to be surrounded/ near Primary forest * Often Surrounds or is in mosaic with Non Forest * Histogram equalising helps to draw out Secondary forest (delineate from Primary forest) * Progression from Primary Forest to Secondary forest, Non forest	* Also Tends to be large patterns * Smooth * Very distinct boundaries * Can be anything from light Green to Greyish Green	* Rows of Crops planted often visible * Tends to be surrounded by Secondary forest or fallow soil * Mosaic of planted / fallow fields visible			* Often difficult to identify (Ask Yuni/ Jeremy/ JR if trouble) * Can exist as standing water or marshland * Tends to be near large water bodies (river/lake) * Also includes water bodies (rivers, lake, etc)	* Obvious evidence of human activity * Near roads * Clustered * Tends to contain areas of non-forest and buildings (Greyish/Purplish in color)	
EXAMPLES									

Annex 19 Complementary Information on the UNDEF/UNDEG Accuracy Assessment

This annex provides information on the location of samples for accuracy assessment of UNDEF/UNDEG, as identified and evaluated by DIAF. The analysis covers Landsat maps for 2004, 2008 and 2014. This is complemented by the results of the accuracy assessment for the years 2004, 2008 and 2014.

Figure 20: Accuracy Evaluation of UNDEF/UNDEG Results (Landsat 2004)

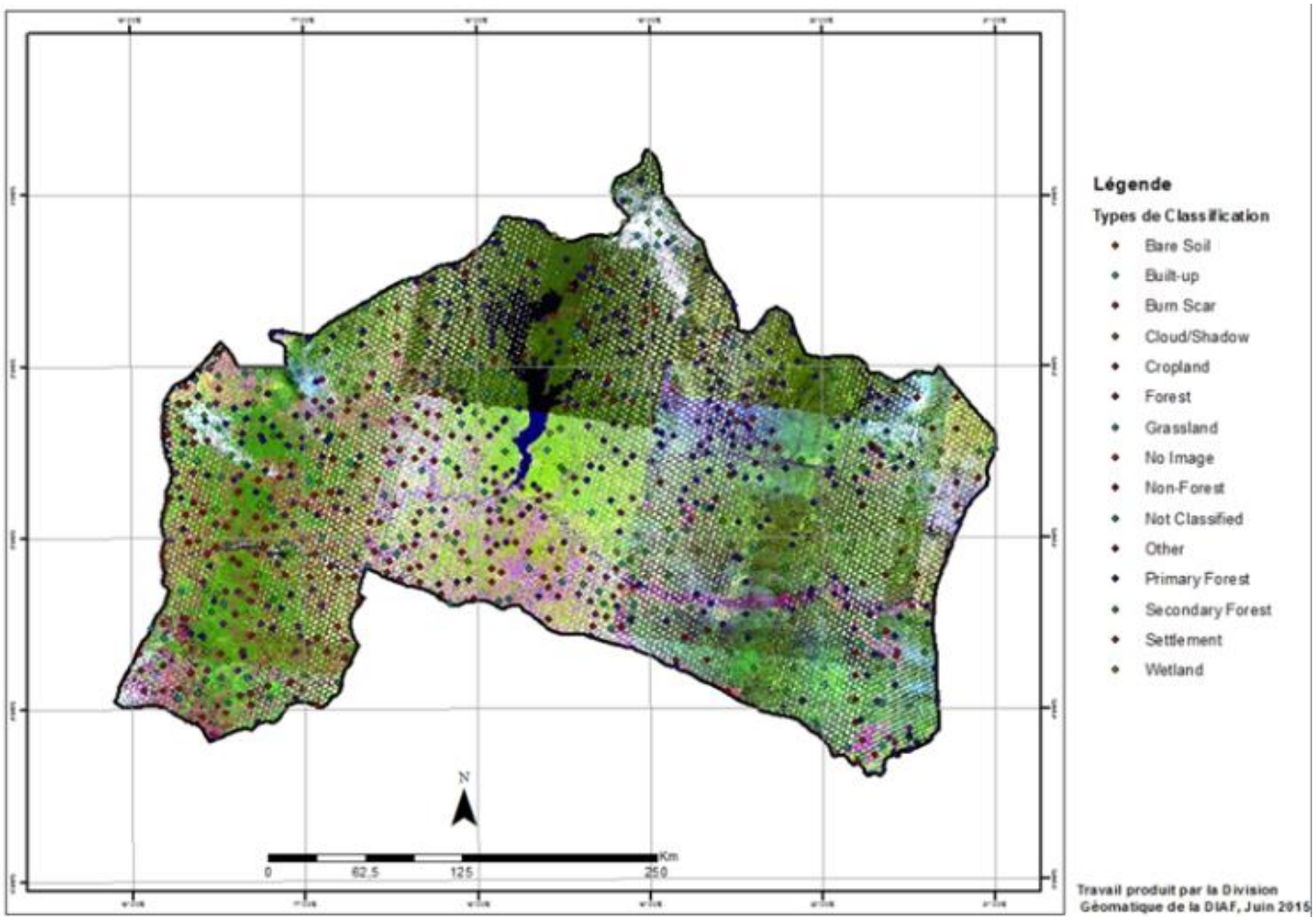


Figure 21: Accuracy Evaluation of UNDEF/UNDEG Results (Landsat 2008)

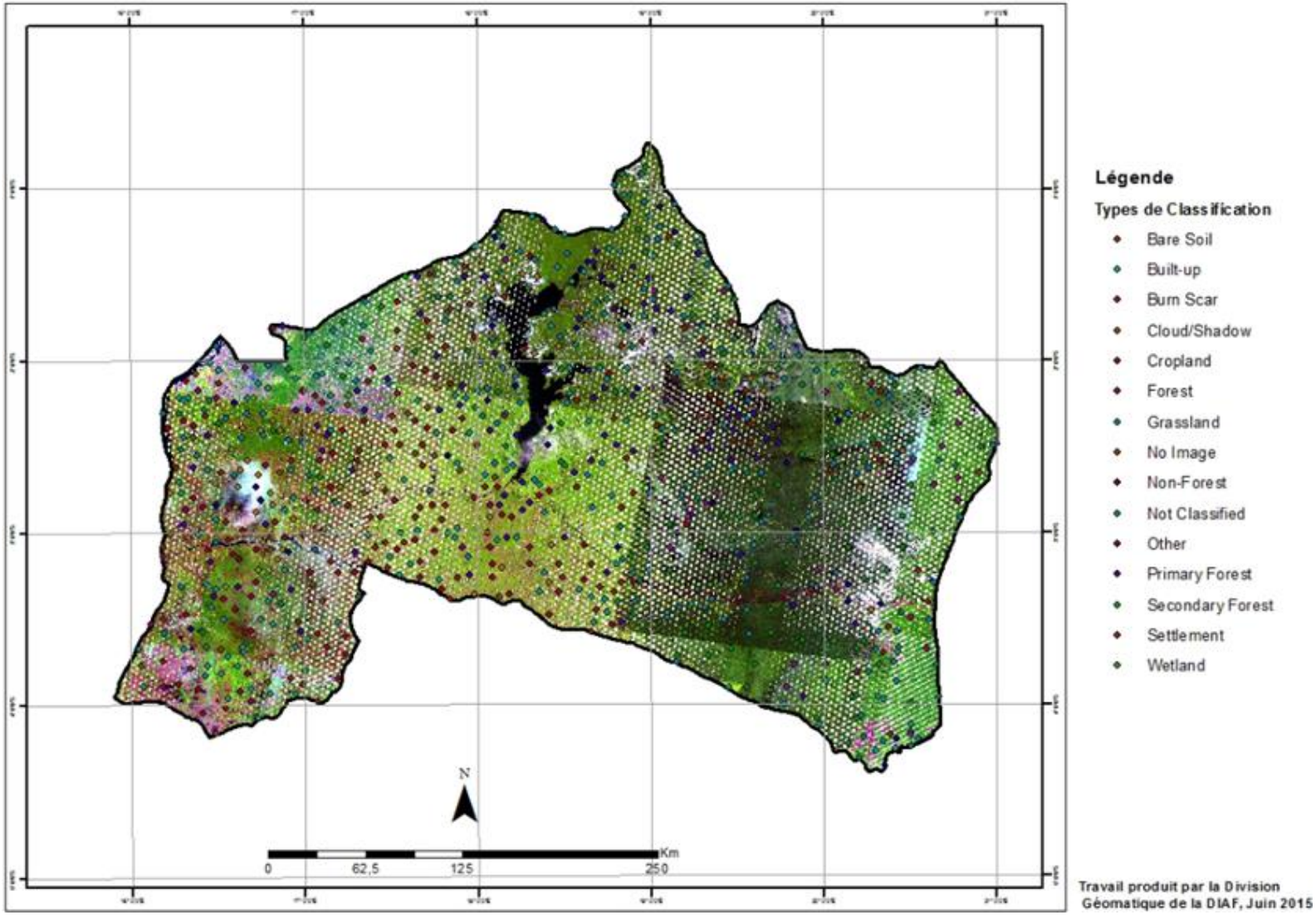
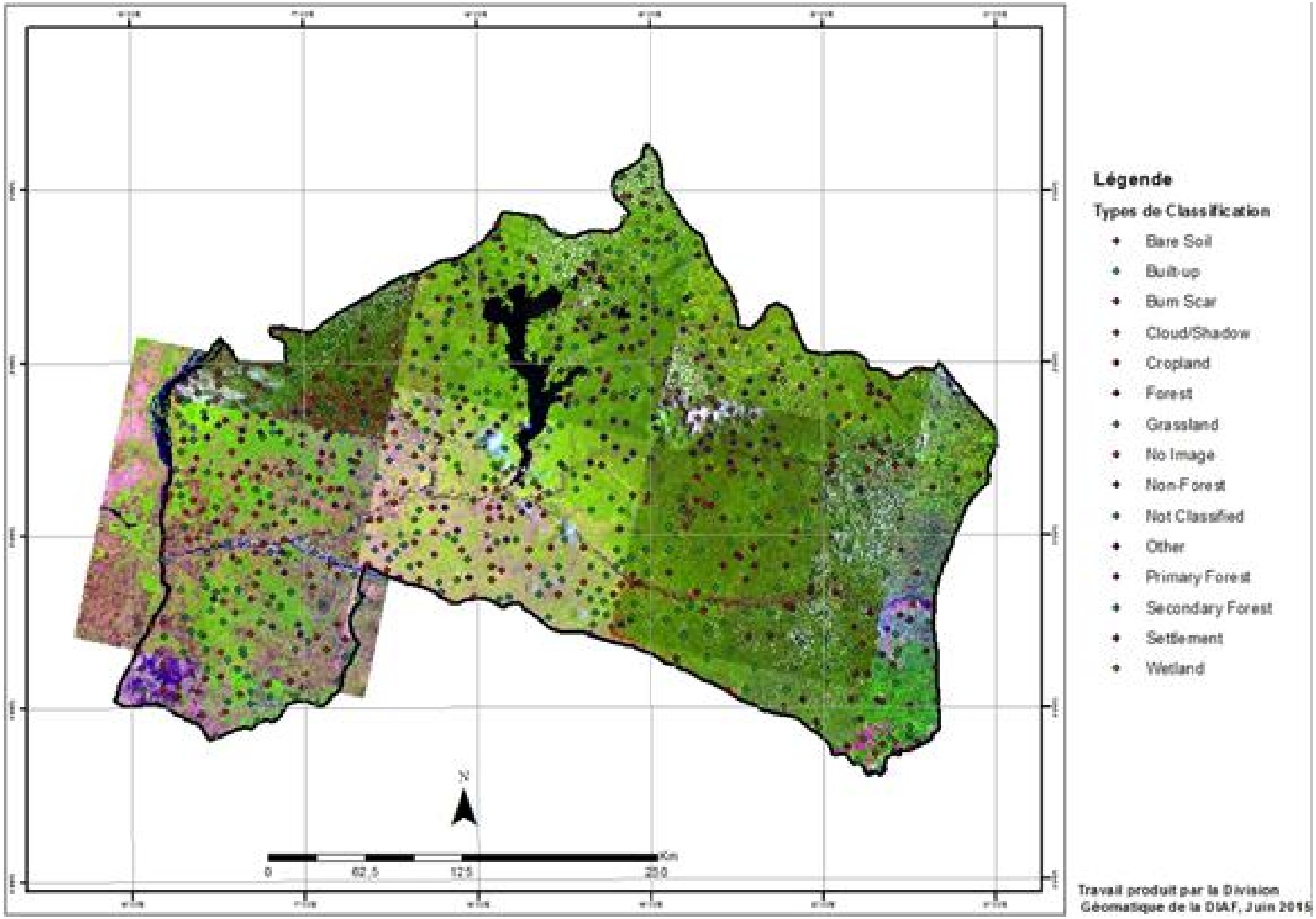


Figure 22: Accuracy Evaluation of UNDEF/UNDEG Results (Landsat 2014)



The following tables provide information on the accuracy assemsnt of the UNDEF/UNDEG results for the years 2014, 2008 and 2004.

Figure 23: UNDEF/UNDEG Accuracy Assessment Landsat 2014

		Résultats DIAF														
		Aut	Bld	Cult	Eau	F	FP	FS	N/A	NF	Nug	Svn	Vil	*Total*	%	Area_Ha
Résultat WWC	Aut	0	0	0	0	0	1	0	0	0	0	0	0	1	0%	193,4
	Bld	0	0	0	0	0	0	0	0	0	0	0	0	0	0%	0,0
	Cult	0	0	29	0	0	3	5	0	0	0	4	0	41	71%	53,2
	Eau	0	0	0	8	0	0	0	0	0	0	0	0	8	100%	14,7
	F	0	0	0	0	0	0	0	0	0	0	0	0	0	0%	0,0
	FP	2	0	0	0	0	282	12	0	0	5	2	0	303	93%	316,7
	FS	0	0	1	0	0	40	162	0	0	6	3	1	213	76%	178,7
	N/A	0	0	0	0	0	0	0	0	0	0	0	0	0	0%	0,0
	NF	0	0	0	0	0	0	0	0	0	0	0	0	0	0%	0,0
	Nug	1	0	0	0	0	9	4	0	0	79	2	1	96	82%	44,1
	Svn	1	0	2	1	0	2	6	0	0	1	171	1	185	92%	159,5
	Vil	0	0	1	0	0	0	0	0	0	0	0	1	2	50%	0,0
	Total	4	0	33	9	0	337	189	0	0	91	182	4	849		960,2
		0%	0%	88%	89%	0%	84%	86%	0%	0%	87%	94%	25%		86%	

Figure 24: UNDEF/UNDEG Accuracy Assessment Landsat 2008

		Résultats DIAF														
		Aut	Bld	Cult	Eau	F	FP	FS	N/A	NF	Nug	Svn	Vil	*Total*	%	Area_Ha
Résultat WWC	Aut	158	0	0	0	0	15	2	0	0	3	1	0	179	88%	193,4
	Bld	0	0	0	0	0	0	0	0	0	0	0	0	0	0%	0,0
	Cult	0	0	5	0	0	6	2	0	0	0	2	0	15	33%	53,2
	Eau	0	0	0	6	0	1	0	0	0	1	0	0	8	75%	14,7
	F	0	0	0	0	0	0	0	0	0	0	0	0	0	0%	0,0
	FP	6	0	0	1	0	230	18	0	0	1	1	0	257	89%	316,7
	FS	2	0	2	0	0	11	115	0	0	2	3	1	136	85%	178,7
	N/A	0	0	0	0	0	0	0	0	0	0	0	0	0	0%	0,0
	NF	0	0	0	0	0	0	0	0	0	0	0	0	0	0%	0,0
	Nug	2	0	0	2	0	16	0	0	0	86	1	0	107	80%	44,1

	Svn	3	0	0	0	0	5	6	0	0	1	129	0	144	90%	159,5
	Vil	1	0	0	0	0	0	0	0	0	0	1	1	3	33%	0,0
	Total	172	0	7	9	0	284	143	0	0	94	138	2	849		960,2
		92%	0%	71%	67%	0%	81%	80%	0%	0%	91%	93%	50%		86%	

Figure 25: UNDEF/UNDEG Accuracy Assessment Landsat 2004

		Résultats DIAF														
		Aut	Bld	Cult	Eau	F	FP	FS	N/A	NF	Nug	Svn	Vil	*Total*	%	Area_Ha
Résultat WWC	Aut	*152*	*0*	*0*	*0*	*0*	*11*	*3*	*0*	*0*	*1*	*3*	*0*	*170*	*89%*	*193,4*
	Bld	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0%*	*0,0*
	Cult	*0*	*0*	*18*	*0*	*0*	*22*	*3*	*0*	*0*	*0*	*1*	*1*	*45*	*40%*	*53,2*
	Eau	*0*	*0*	*0*	*13*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*13*	*100%*	*14,7*
	F	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0%*	*0,0*
	FP	*1*	*0*	*3*	*0*	*0*	*263*	*11*	*0*	*0*	*2*	*0*	*0*	*280*	*94%*	*316,7*
	FS	*3*	*0*	*5*	*0*	*0*	*49*	*103*	*0*	*0*	*0*	*0*	*0*	*160*	*64%*	*178,7*
	N/A	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0%*	*0,0*
	NF	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0%*	*0,0*
	Nug	*3*	*0*	*0*	*0*	*0*	*4*	*2*	*0*	*0*	*29*	*1*	*0*	*39*	*74%*	*44,1*
	Svn	*1*	*0*	*0*	*0*	*0*	*3*	*5*	*0*	*0*	*0*	*132*	*1*	*142*	*93%*	*159,5*
	Vil	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0%*	*0,0*
	Total	*160*	*0*	*26*	*13*	*0*	*352*	*127*	*0*	*0*	*32*	*137*	*2*	*849*		*960,2*
		95%	*0%*	*69%*	*100%*	*0%*	*75%*	*81%*	*0%*	*0%*	*91%*	*96%*	*0%*		*84%*	

Annex 20 Wildlife Works Sampling Approach Analyst Training Manual

Analyst Training Manual

Version 1.9 - mise à jour le 06.02.2015

Wildlife Works / ERA Congo

Manuel de formation sur la collecte des données du niveau de référence des émissions Déforestation non planifiée (REL_{UNDEF}) du Program de réduction à Mai Ndombe

1. Introduction

Bienvenue à l'équipe du programme de réduction de Mai-Ndombe chargée de la collecte de données! Nous vous félicitations pour votre emploi chez ERA Congo/ WWC... vous avez été choisis pour aider à une tâche extrêmement importante. Ce qui suit est une brève description de ce que vous allez faire, et surtout pourquoi vous le ferez. Encore une fois, vous êtes les bienvenus à l'équipe, et que vos efforts soient couronnés de succès!!

2. Le Programme de réduction à Mai Ndombe

Le Programme de réduction des émissions à Mai Ndombe (ER-Program) est un effort au niveau international pour protéger une grande partie du domaine forestier du Bassin du Congo, tout en fournissant simultanément l'emploi et les moyens de subsistance alternatifs vitaux pour les communautés locales qui vivent dans et autour de ces mêmes forêts. Ce programme fourni un exemple, à grande échelle, de «la déforestation évitée», un nouveau paradigme internationale dont le but est de fournir des financements pour la protection des forêts et de la biodiversité à travers un finance bilatéral et multilatéral. Ce nouveau concept vise à construire, à partir des efforts d'aides précédents de la communauté internationale, en mettant l'accent plus sur l'importance de la protection des forêts, plutôt que leurs destruction, ce dernier étant malheureusement, jusqu'à nos jours, un cas commun à beaucoup de pays en développement. Le Programme de réduction à Mai Ndombe est l'un des premiers et le plus important en son genre, et ouvrira la voie aux autres pays qui voudront réaliser des réductions des émissions à grande échelle, tout en soutenant leurs communautés forestières rurales et de ce fait, permettant l'atténuement du réchauffement et du changement climatique. Etant donné qu'il y a plusieurs pays qui sont, au niveau international, en train de participer à la fois à la protection et au financement de ces efforts, l'espoir est que ce programmes de rémunération au rendement (payé-par-performance) constitueront un modèle normal pour assurer un écoulement budgétaire important entre Nord et Sud.

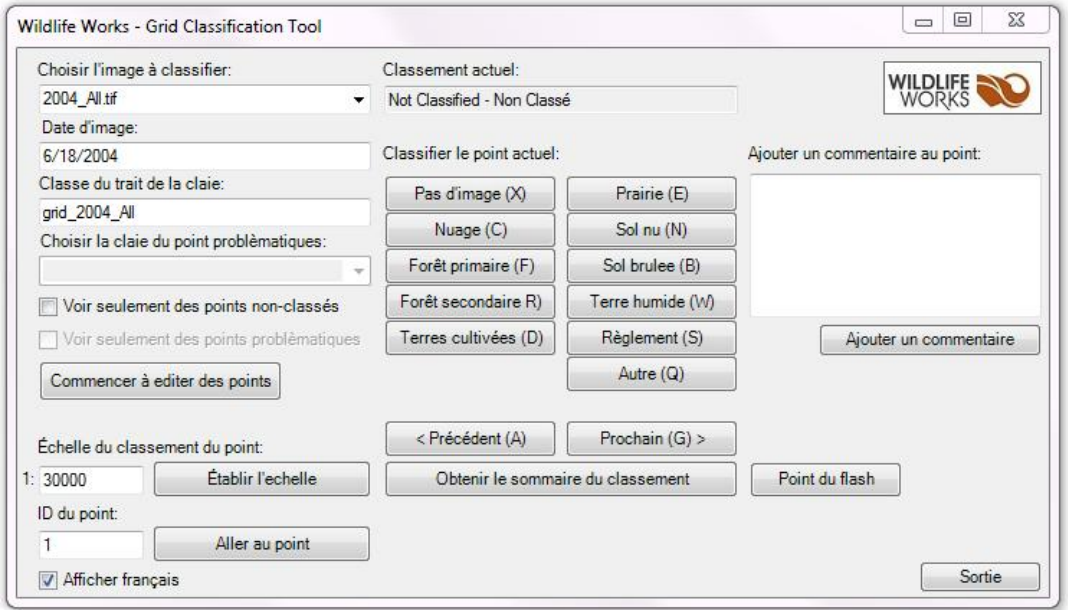
3. Comment mesurer le niveau de référence des émissions (REL)

Tout système de rémunération au rendement (payé-par-performance) requiert à ce qu'on établisse un niveau de référence d'émissions (REL), aussi appelée "ligne de base" sur laquelle la performance est mesurée. Si les émissions globales dépassent la ligne de base, le programme est jugé défaillant et ne

bénéficie d'aucun financement. Toutefois, si les émissions sont en fait en dessous de la ligne de base, les crédits dégagés sont réparti aux promoteurs du programme. Ces crédits peuvent ensuite être vendus sur le marché international de réduction, à travers des accords bilatéraux et multilatéraux avec d'autres pays, pour financer le programme lui-même et les communautés vivant dans et autour de la forêt. Votre travail consiste à nous aider à mesurer ce REL (ligne de base). Nous allons calculer le niveau de la déforestation qui a eu lieu dans la province Mai Ndombe au cours des 10-15 dernières années. Ce taux sera utilisé comme base de référence pour la zone du programme qui est soumis à la déforestation non planifiée (en dehors des zones de concessions d'exploitation légale). Votre travail est donc essentiel à la réussite de ce Programme de réduction à Mai Ndombe. Nous vous remercions pour vos efforts, et nous espérons que vous apprécierez ce travail si important!

Identification de la couverture terrestre

Pour mesurer le niveau de référence (REL), nous devons comprendre comment la couverture terrestre change au fil du temps. Nous allons employer les différentes classes de la couverture terrestre identifiées par le panel international sur l'évolution du climat (GIEC) se trouvant dans leurs lignes directrices pour une bonne pratique. Ces classes de couverture du sol sont:



Wildlife Works Outil de Collecte de Données. C'est un « Add-in » ArcGIS.

- Dense forest - Forêt primaire
- Secondary Forest - Forêt secondaire
- Cropland - Terres Cultivées
- Grassland - Prairies
- Wetlands - Terre Humide
- Settlement – Peuplement

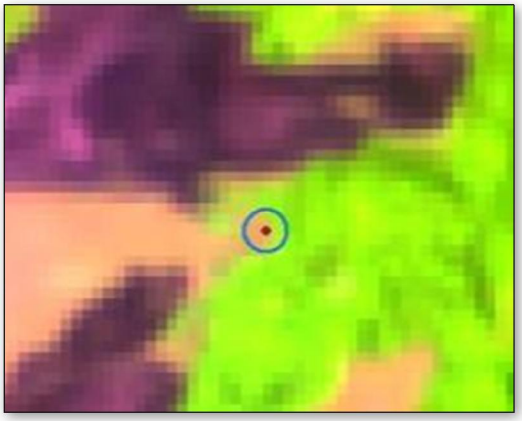
Nous avons également inclus les sous-classes suivantes représentant des caractéristiques communes à la couverture de terre:

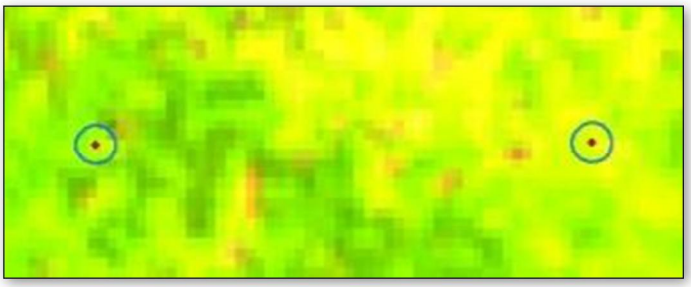
- Cloud / shadow – Nuage / Ombre
- BurnScar – Sol Brulée
- BareSoil – Sol Nu
- Other – Autre
- No Image – Pas d'Image

Vous aurez à utiliser l'outil d'identification Wildlife Works pour effectuer la classification un groupe de points qui sont superposés sur des images recueillies pendant la période de la référence historique (10-15 ans avant nos jours). Avec cet outil, vous serez en mesure de naviguer entre les points, de faire le zoom avant et arrière (choisir échelle de l'image), de flasher le point central (pour distinguer le point que vous identifiez de tous les autres) et quelques autres tâches importantes pour votre travail. Pour obtenir des instructions détaillées sur la façon d'utiliser l'outil de collecte de données, s'il vous plaît se référer aux documents protocolaires de WWC pour la classification.

4. Classification des échantillons se référant au contexte environnant

Vous sélectionnez manuellement une classe pour chaque point d'échantillon en utilisant l'outil ci-dessus. Cependant, vous devez prendre soin de vous assurer de choisir la classe de la couverture terrestre pour chaque point échantillon sur la base des deux pixels voisins tournant radialement dans chaque direction menant vers l'extérieur à partir du pixel sur lequel l'échantillon directement tombe. Pour les images Landsat, ce qui correspond à un tampon-cadre de 60m qui devrait être utilisé pour classer chaque échantillon (par exemple, l'échantillon doit être classé selon sa région radiale immédiate





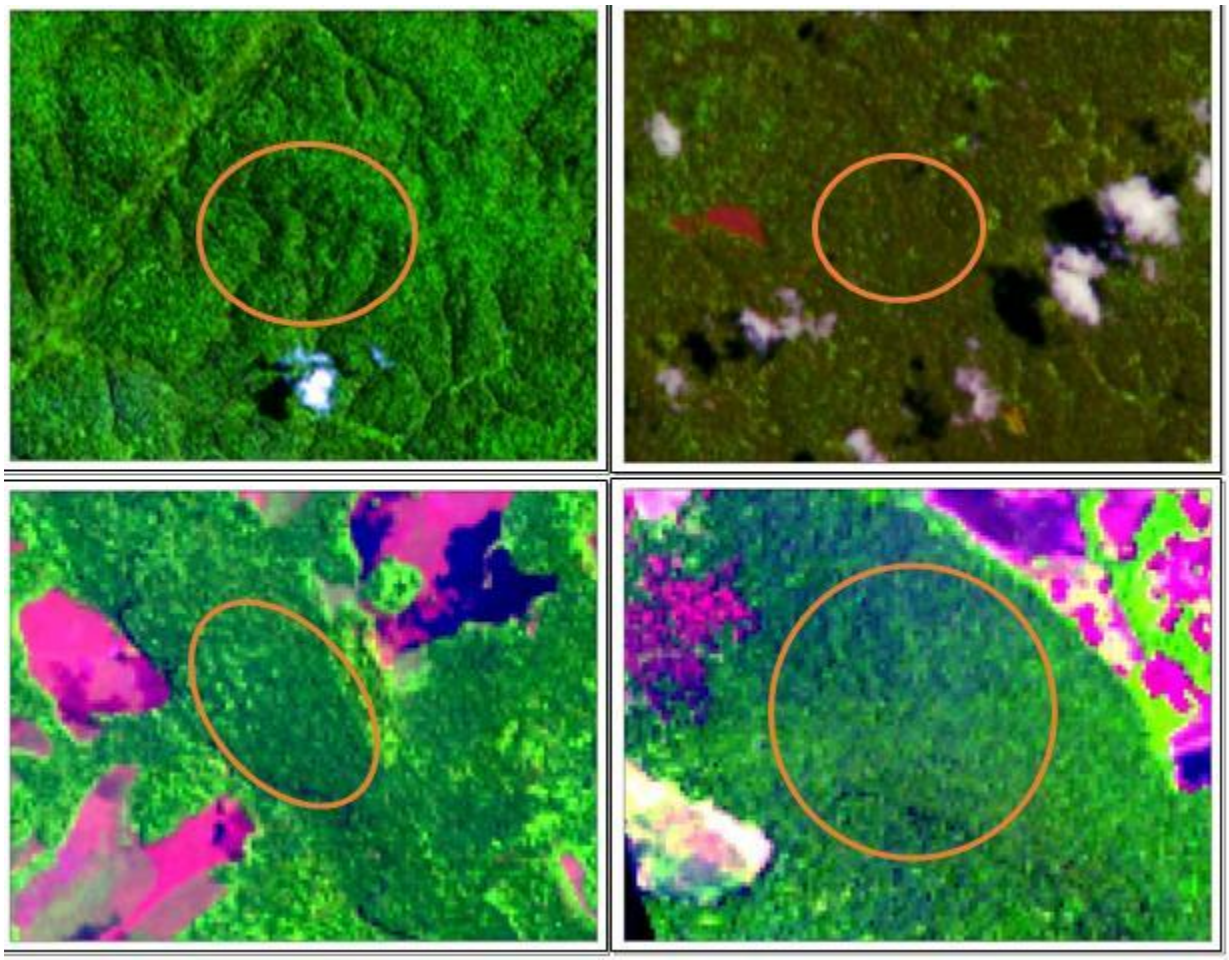
de 2 pixels, non pas le pixel isolé sur lequel l'échantillon tombe). L'expérience nous a enseigné que ce contexte radial de 60 m doit être pris en compte dans la décision de classement. Si vous observez le seul pixel dans l'échantillon, et ignorer tous les pixels voisins, il y a beaucoup de chances que la précision de la classification soit erronée, car un seul pixel ne contient pas suffisamment d'informations pour identifier définitivement une seule classe de la couverture terrestre. En cas des problèmes ou questions sur l'utilisation du contexte environnant pour classer les points d'échantillon s'il vous plaît demander à Yuni, Jeremy, Eric, Jean-Paul ou Prof. Bwangoy.

Exemples d'identification de l'échantillon utilisant le tampon-cadre de 60 m

a. Identifier Forêt primaire

Une forêt primaire décrit l'état qu'aurait eu la forêt du Congo en cas d'absence d'une quelconque influence humaine. Souvent on assimile affectueusement la forêt primaire du bassin du Congo à la «forêt de brocolis », car elle ressemble aux légumes qu'on appelle 'brocoli' vue d'en-haut. Actuellement, la majeure partie de bassin du Congo a connu une influence humaine tellement importante qu'il ne reste pas grand-chose de forêt primaire à Mai Ndombe. Une grande partie de cette forêt est maintenant, ou a été, une fois, dégradée, mais il ya encore quelques éclats visible de forêt primaire dans certaines zones. S'il vous plaît voir les exemples ci-dessous.

L'identification d'une forêt primaire dans l'imagerie de résolution moyenne tels que Landsat est relativement simple. Comme vous pouvez le voir dans l'exemple ci-dessous, il a tendance à paraitre vert foncé, en utilisant soit la combinaison des bandes de vraies couleurs ou des fausses couleurs (pour plus d'informations sur les combinaisons de bande et l'identification de la couverture terrestre, s'il vous plaît voir l'annexe A). La principale caractéristique qui distingue la forêt primaire des autres types de forêts est sa texture. Il a tendance à paraitre "brute" càd, frappant à l'œil comparativement à la végétation basse comme les prairies et les zones arbustives. Généralement, elle se différencie de la forêt secondaire par sa cohérence. La forêt primaire est plus cohérente (en raison de la canopée élevée) que la forêt secondaire, laquelle, selon le niveau de dégradation, peut me paraître plus inégale ou sporadique.



Exemples de forêt primaire

b. Identifier Forêt secondaire

Laforêt secondaire est la plus commune soit peut-être la classe de la couverture terrestre la plus difficile à isoler dans un régime de forêt dense humide comme le Bassin du Congo. Elle est définie selon le caractère élevé du niveau de dégradation (dans ce programme, la forêt secondaire est définie comme toute forêt ayant une couverture de canopée de plus de 30% et quelque part en dessous de 75-80%). Pour le déterminer c'est en observant plusieurs attributs de l'imagerie qui tendent à identifier et à délimiter les forêts secondaires par rapport aux autres forêts et végétation. Les caractéristiques suivantes sont communes à la forêt secondaire, et peuvent être utilisées comme lignes directrices d'identification:

- Tendance à apparaître plus «légère» en couleur que la forêt primaire (c'est à dire des tâches vertes pâle entourées de vertes foncées)
- Après l'égalisation d'histogramme (voir l'annexe A), apparait à quelques endroits une forêt secondaire fortement dégradée, laquelle allant d'un vert très pâle à la couleur jaune.
- La texture peut paraitre plus irrégulière ou inégale, en particulier pour la forêt secondaire lourdement dégradée.

Exemples de forêt secondaire

Image haute résolution (Bing Maps) dans « Truecolor »
« FalseColor » (à gauche) et « FalseColor » avec égalisation d'histogramme (à droite)

c. Cultures (agriculture, cultures Mosaïque)

Une grande partie de la surface cultivée dans la région de Mai Ndombe est détenue par de petits fermiers et des agriculteurs qui pratiquent l'agriculture non mécanisée. Parlant des terres cultivées on remarque le traçage des lignes droites (par exemple, en forme carrés ou rectangles) qui délimitent les champs de cultures et les terrains en jachère. Les surfaces cultivées ont tendance à exister de cultures plantées en forme d'une mosaïque de cultures ou des terrains en jachères/abandonnés, présentant, d'une manière inégale, des endroits en couleur vert vif (végétation) et violet/rouge (les jachères/sols nus). Des modèles distincts (représentant des rangées de cultures plantées) sont associés à des terres cultivées, ce qui le rend relativement facile à repérer. La terres cultivée a aussi tendance à se constituer en groupes, et sont rarement placées dans l'isolement.

Exemples Cultures / cultures Mosaïques

Image haute résolution (Bing Maps) dans « Truecolor »
« FalseColor » avec égalisation d'histogramme (à gauche) et « TrueColor » (à droite)

d. Prairies / Savane

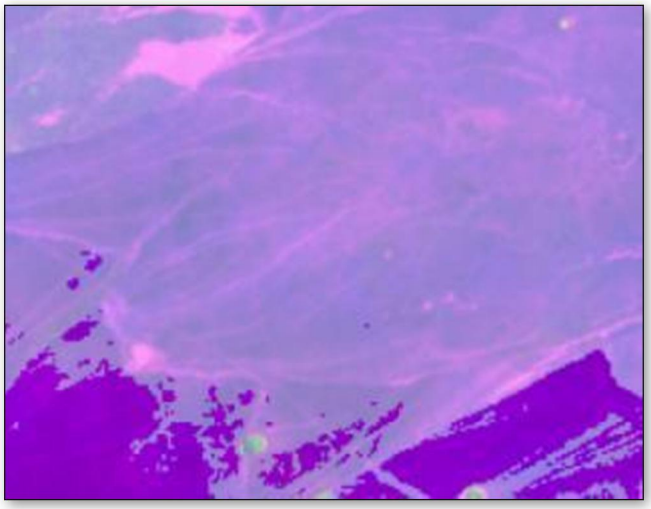
Bien que l'on puisse retrouver des prairies/savanes dans la région de Mai Ndombe, cependant il existe aujourd'hui très peu des savanes "naturelles" dans la forêt du Congo. La plupart des prairies identifiées actuellement ont été des forêts autrefois mais qui ont été déboisées à un moment. Cela dit, les zones de prairies sont principalement identifiées par leur texture lisse (par opposition à la texture plus rugueuse associée à la forêt). On situerait la prairie quelque part entre la couleur grise et gris-verte. Il ya vraiment

pas des très grandes zones de prairies/savanes dans le Mai Ndombe, par conséquent, on les observe souvent sous forme de petites parcelles disséminées dans le paysage.

Exemples Prairies / Savane

Image haute résolution (Bing Maps) dans « Truecolor »
« FalseColor » avec égalisation d'histogramme (à gauche) et « TrueColor » (à droite)

e. Les Zones Humides



Nous définirons les zones humides, dans le cadre de ce projet, toute zone inondée soit d'une manière permanente ou saisonnière, par des pluies, ainsi que tout endroit jugé également non-forêt. Cela comprend les zones de marais et de prairies inondées. Cependant, il n'inclut pas les zones forestières qui sont inondées, qui, dans le cadre de ce projet devraient être classées comme forêt primaire ou secondaire. Les zones humides et de prairies partagent souvent les mêmes attributs, car ils représentent toutes les deux les caractéristiques non-forêts et se caractérisent par leur texture lisse et de couleur grisâtre verte (vert mat).

Exemples Zones Humides

Image haute résolution (Bing Maps) dans « Truecolor »

« FalseColor » avec égalisation d'histogramme (à gauche) et « TrueColor » (à droite)

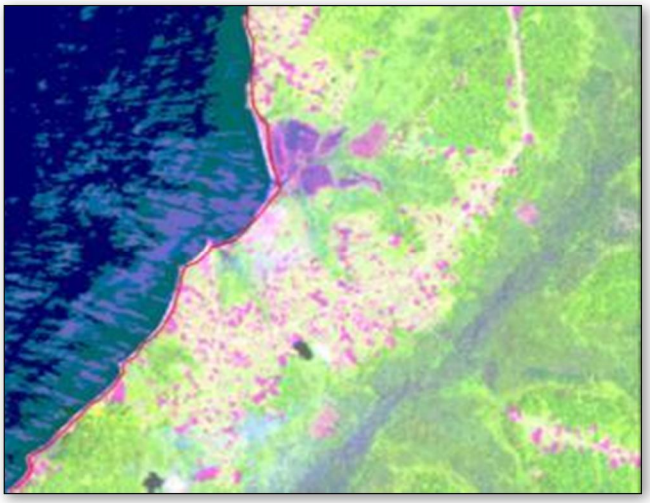
f. Structure de Peuplement

Une structure de peuplement est définie comme étant les lieux où vivent des personnes. Ca peut être des petits villages, villes ou une ville aussi grande que Kinshasa. Il doit y avoir des preuves qu'il y a un groupement des domiciles des personnes, c.-à-d mosaïque urbaine (maisons, des cabanes, des routes disposées dans une grille, etc.). Un domaine agricole isolé ou une structure isolée éloignée de toute autre activité humaine ne devrait pas être définis comme une structure de peuplement. Un peuplement apparaît souvent comme une mosaïque de petits domaines agricoles, des structures d'habitation, routes et autres espaces utilisés par les villageois à des fins diverses. Les zones de peuplement sont entièrement créées et maintenus par l'activité humaine.

Exemples Structure de peuplement

Image haute résolution (Bing Maps) dans « Truecolor »

« FalseColor » avec égalisation d'histogramme (à gauche) et « TrueColor » (à droite)



g. Nuage / Ombre

Les nuages/ou l'ombre repérées sur le terrain sont fréquents dans les écosystèmes tropicaux humides tels que le bassin du Congo. Vous rencontrerez probablement de nombreux cas de zones nuageuses et d'ombre. L'algorithme de modèle suppose que les nuages et les ombres sont correctement classés comme «nuage/ombre». Il est extrêmement important de savoir qu'il ne faut pas essayer de deviner la couverture terrestre à travers un nuage ou une ombre. Au cas où le prélèvement d'un échantillon tomberait sur un nuage ou une ombre, et que le sol n'est pas visible à travers ce nuage/ombre, pour ce cas choisissez simplement l'option «nuage/ombre» et ensuite passer à l'échantillon suivant. Habituellement l'aspect du nuage est soit blanc lumineux soit blanc bleuâtre, tandis que l'ombre d'un nuage est généralement de gris foncé à noir. Chaque nuage doit avoir une ombre… ainsi, les ombres pourront être facilement identifiées (ces ombres devraient être près de, et ayant la même forme de leur nuage respectif).

Exemples Nuage / Ombre

« TrueColor » (à gauche) et « FalseColor » avec égalisation d'histogramme (à droite)

h. Cicatrice de Brûlure

Les cicatrices de brûlures sont très fréquentes dans le bassin du Congo, aux endroits où l'on pratique la petite agriculture tout en utilisant les techniques de l'agriculture sur brûlis. Les agriculteurs brûlent régulièrement les arbres afin de dégager les domaines de l'agriculture, laissant derrière des cicatrices qui sont très faciles à identifier dans les images de télédétection. Dans une image de fausse couleur (FalseColor), les cicatrices de brûlure apparaissent comme violet très foncé ou noir, et on les retrouve souvent au milieu d'une portion de terre nue. On peut distinguer les cicatrices de brûlures assez facilement du sol nu par leur obscurité relative… les cicatrices de brûlure sont beaucoup plus sombre que tout autre élément de la couverture terrestre, sauf peut-être l'ombre d'un nuage.

Exemples Cicatrice de Brûlure

« Truecolor »

« FalseColor » (à gauche) et « FalseColor avec égalisation d'histogramme » (à droite)

i. Sol Nu

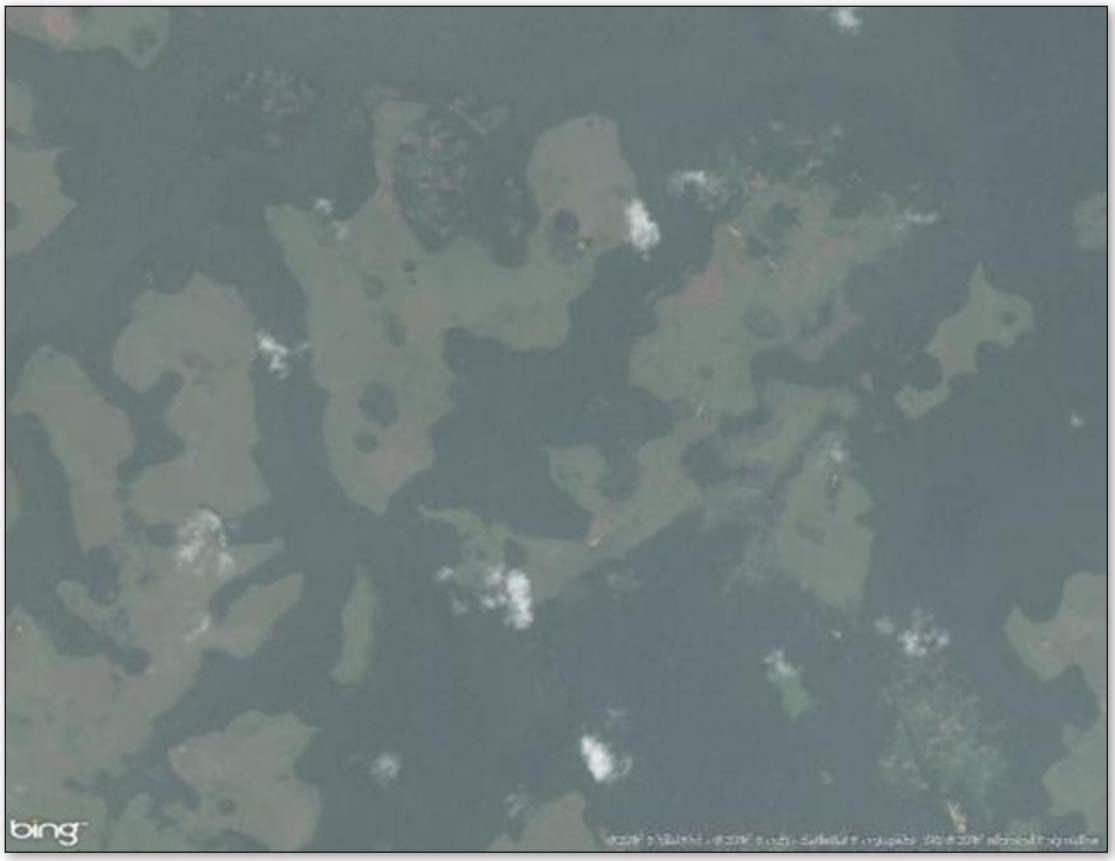
Le sol nu, il se peut que ça soit la caractéristique de la couverture terrestre la plus simple à identifier dans un écosystème tropical humide. Elle peut être presque universellement identifiée par sa couleur distinctive lorsqu'elle est affichée dans une combinaison de bande de fausses couleurs (voir l'annexe A ci-dessous). Dans fausse couleur (FalseColor), le sol nu est de couleur vive rougeâtre (parfois violet rougeâtre si la brulure est récente). Les portions de terre nue sont presque toujours d'origine humaine (il existe très peu de cas des terrains naturellement nu dans le bassin du Congo).

Exemples de Sol Nu

Image haute résolution (Bing Maps) dans « Truecolor »
« FalseColor » avec égalisation d'histogramme (à gauche) et « TrueColor » (à droite)

j. Autre

La catégorie «autre» est réservée pour les zones qui ne correspondent à aucune des catégories décrites



précédemment. Les exemples communs incluent:

- Scan-Off line (SLC-off) rayures dans les images Landsat (voir à gauche ci-dessous)
- Les zones hors de l'image (fond voir à droit ci-dessous)
- Les erreurs de données

Remarque: La classe «autre» n'est utilisée que pour les trois exemples donnés ci-dessus. Ne pas utiliser la catégorie «autre» si vous doutez d'une couverture terrestre données. Solliciter plutôt une aide. Toutes les zones qui sont visibles sur une image seront intégrées dans une des classes de couverture terrestre décrite précédemment dans le présent document.

«Autres» Exemples

Les zones en-dehors de l'image (gauche) et les rayures SLC-off (droit)

Amélioration de l'image et afficher des images en utilisant différentes combinaisons de bande

L'imagerie satellitaire peut être consultée de différentes façons afin de créer des images en couleur spécifiquement adaptées pour identifier les caractéristiques d'intérêt. Une méthode est qu'il faut arranger les «bandes» des images dans différentes combinaisons. Certaines combinaisons rendent plus facile à distinguer la végétation par rapport aux autres caractéristiques tandis que d'autres permettent l'identification de l'humidité ou même du sol nu. Une fois que les bandes sont disposées pour former une image en couleur, alors on emploiera 'amélioration de l'image' pour améliorer d'avantages les caractéristiques d'intérêt.

« Truecolor » (3,2,1)

Vraie couleur "Truecolor" est une façon de voir les images comme l'œil humain les verrait. En d'autres termes, TrueColor affiche des images dans son état naturel. Truecolor peut être utile pour comparer par rapport à d'autres combinaisons de bandes (comme FalseColor), mais en aucun cas il accentue les types de végétation. Les couleurs sont souvent en sourdine et peuvent se fondre ensemble, par conséquent, on ferait bien attention lors de la visualisation d'images dans une combinaison de bande de truecolor. Il est souvent avantageux de basculer entre les vraies couleurs et les fausses couleurs 'FalseColor' lorsque l'on tente d'identifier des caractéristiques particulières ou des classes de couverture du sol (par exemple de la forêt marécageuse). Voici la même image que celle présentée ci-dessus, mais dans Truecolor. Notez les différences qu'il ya dans les différentes correctifs de la couverture de terres ainsi que la comparaison de ces correctifs à la fois en vraies couleurs et en fausse couleur 'FalseColor'.

Vraie couleur « Truecolor » {3,2,1} détails

Dans l'image Truecolor ci-dessous, noter la couleur relativement uniforme de la forêt. Il ya de légères différences en vert qui peuvent être remarquée, mais en général, il est difficile de distinguer la forêt primaire de la forêt secondaire. Les plaques de sol nu vu dans le coin inférieur droit de l'image sont perceptibles, et apparaissent brun-vert, comme ils le feraient à l'œil nu. En raison du fait que les différents types de végétation photosynthétique tendent à se fondre ensemble dans une image TrueColor, fausse couleur 'FalseColor' est préférable lors de la classification des phénomènes tels que la dégradation et la déforestation des forêts. Dans un écosystème tropical humide comme le Bassin du Congo, les zones de déforestation peuvent être identifiées en raison de leur contraste avec la végétation environnante.

Image « Truecolor » (3,2,1)

« Falsecolor » (5,4,3)

Plusieurs analystes de télédétection préfèrent voir les images dans "FalseColor" lors de l'identification de différents types de végétation. L'identification des forêts est particulièrement bien adaptée dans le FalseColor. FalseColor désigne une combinaison particulière de bande qui accentue l'activité photosynthétique (plantes) et permet de distinguer la couverture des terres avec végétation de celle qui n'a pas une végétation. Comme expliqué ci-dessous, le type de FalseColor vous allez utiliser est celui qui affiche la végétation dans les tons de vert, alors que le sol nu apparaît en rouge ou violet foncé, ou même noir, en fonction de la couleur de la terre elle-même. Les zones urbaines sont également facilement identifiés par leur teinte pourpre-gris et leur contraste avec la végétation qui les entoure.

« Falsecolor » {5,4,3} détails

Voici quelques exemples de zones de végétation mixte et des plaques de sol nu, ainsi que quelques plaques à divers stades de la transition. Notez les zones verdâtres qui représentent une végétation saine et aussi les zones violet rougeâtre qui représentent le sol nu. Les domaines de forêt en transition peuvent apparaître parfois comme violet/rouge (sol nu) vert grisâtre (prairies), jaune (forêts fortement

dégradées lorsqu'on les examine sous l'égalisation d'histogramme), vert clair (forêt légèrement dégradée) ou vert foncé (forêt primaire).

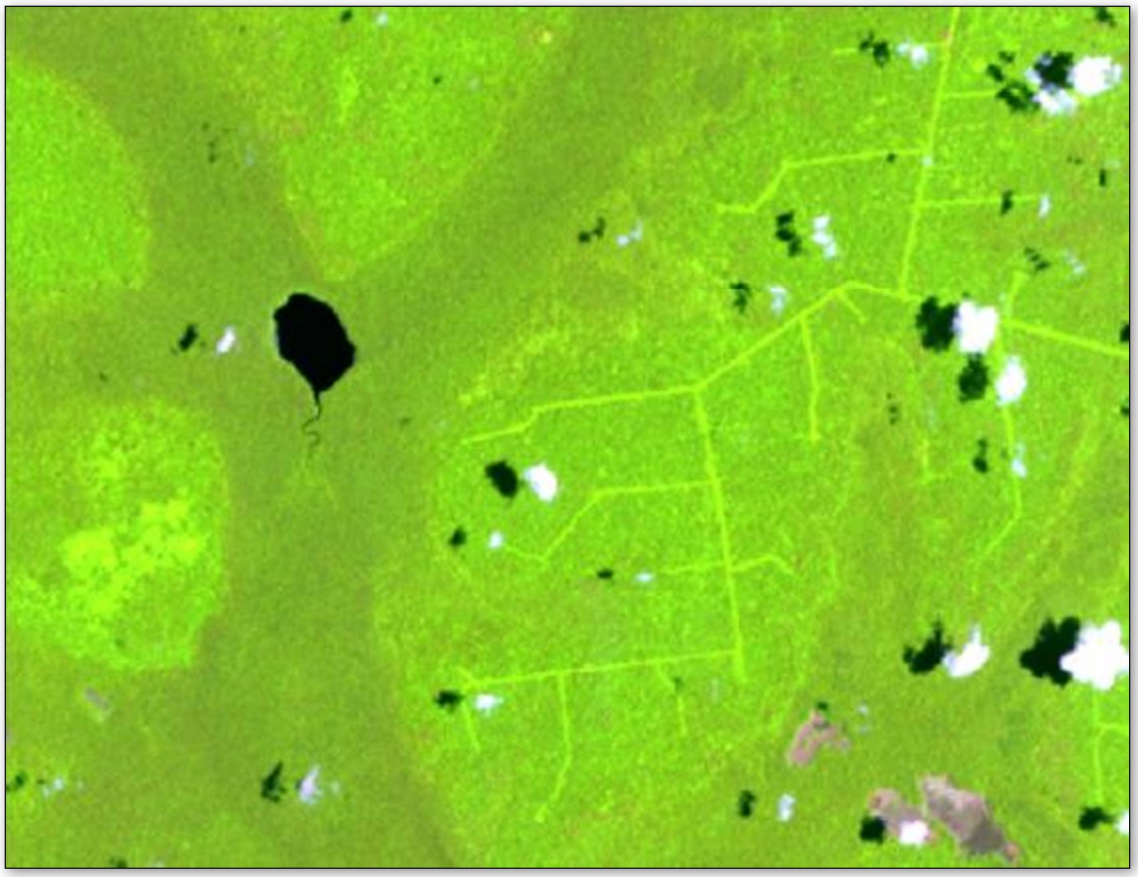


Image « FalseColor » (5,4,3)

Égalisation d'Histogramme

L'égalisation d'histogramme est une technique d'amélioration d'image qui fonctionne bien pour identifier les caractéristiques de la couverture terrestre dans la forêt du Bassin du Congo. Par exemple, il est beaucoup plus facile de discerner l'humidité sur une image provenant d'un histogramme pondérée (égalisée) que d'ailleurs. De même, la dégradation des forêts est accentuée dans une image pondérée de l'histogramme. Au moment où dans une image TrueColor (voir ci-dessous), la forêt secondaire/dégradée peut seulement paraitre un peu moins vert que la forêt primaire (le cas échéant), une fois que l'image est pondérée dans l'histogramme, la dégradation apparaît dans des couleurs jaunes lumineux (et parfois autres). Il convient de noter que l'égalisation d'histogramme est simplement une façon différente d'améliorer l'apparence de l'imagerie. Il ne change pas la valeur de données sous-jacente des pixels individuels.

Comment Histogramme égalisation dans ArcMap

Dans ArcGIS, égalisation d'histogramme peut être effectuée en utilisant la fenêtre d'analyse d'images (voir ci-dessous). Votre image d'intérêt peut être choisie dans la liste des images. Ensuite, dans la section

Affichage, sélectionnez " histogramme Egaliser ". Vous devriez voir votre image change visiblement. Voila! Votre image est maintenant renforcée…

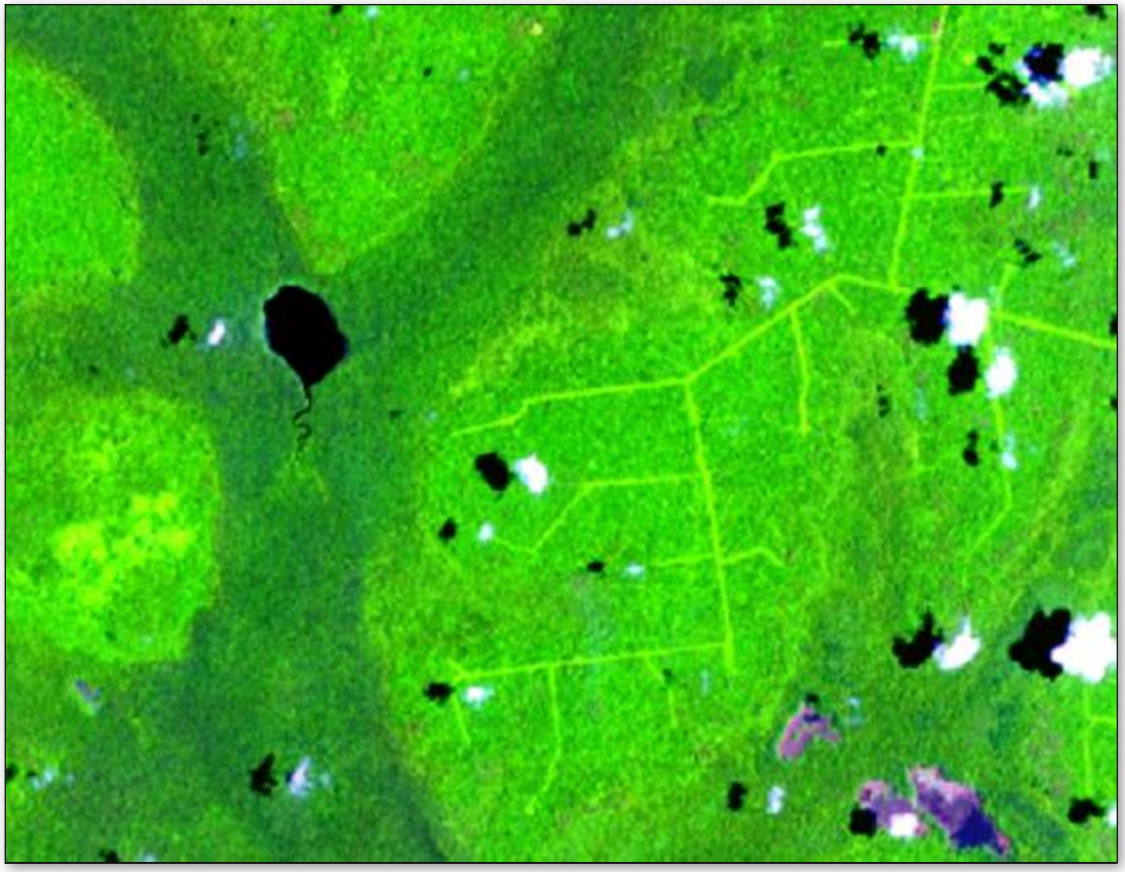


Image égalisationd'histogramme (« FalseColor »)

Annex 21 Activity data for Unplanned Deforestation and 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):	Total area per year due to forest-state transitions between Dense Forest (DF) and Non-Forest (NF) between 2004 and 2014. Parameter is called primary deforestation.
Explanation for which sources or sinks the parameter is used:	Parameter is used to measure deforestation.
Data unit (e.g. ha/yr):	ha/yr
Value for the parameter:	39,769 *(non-adjusted value)*
Source of data:	Data source is samples systematically overlaid on historical remote sensing imagery. Imagery is collected for 10 Landsat tiles cover the Mai Ndombe ER Program area for the years 2004, 2006, 2008, 2010, 2012 and 2014. Landsat 7 ETM+ and Landsat 8 OLI images are used (see additional image details in Section 0 above). Imagery is mosaicked and color-corrected (see Section 0 above).
Spatial level (local, regional, national or international):	Imagery covers the entire ER Program area (10 Landsat tiles) for the 6 epochs in the historical reference period (2004, 2006, 2008, 2010, 2012 and 2014). Imagery spatial resolution is medium (30m x 30m pixels).
Discussion of key uncertainties for this parameter:	Uncertainty for primary deforestation stems primarily from errors made in manual classification of Landsat imagery. The vast majority of these errors are eliminated through the anomalous point amelioration process, described above in Section 12.1.
Estimation of accuracy, precision, and/or confidence level, as applicable and an explanation of assumptions/methodology in the estimation:	34.0% relative uncertainty (U) at 90% confidence

Description of the parameter including the time period covered:	Total area per year due to forest-state transitions between Secondary Forest (SF) and Non-Forest (NF) between 2004 and 2014. Parameter is called secondary deforestation.
Explanation for which sources or sinks the parameter is used:	Parameter is used to measure deforestation.
Data unit (e.g. ha/yr):	ha/yr

Value for the parameter:	114,406 *(non-adjusted value)*
Source of data:	Data source is samples systematically overlaid on historical remote sensing imagery. Imagery is collected for 10 Landsat tiles cover the Mai Ndombe ER Program area for the years 2004, 2006, 2008, 2010, 2012 and 2014. Landsat 7 ETM+ and Landsat 8 OLI images are used (see additional image details in Section 0 above). Imagery is mosaicked and color-corrected (see Section 0 above).
Spatial level (local, regional, national or international):	Imagery covers the entire ER Program area (10 Landsat tiles) for the 6 epochs in the historical reference period (2004, 2006, 2008, 2010, 2012 and 2014). Imagery spatial resolution is medium (30m x 30m pixels).
Discussion of key uncertainties for this parameter:	Uncertainty for secondary deforestation stems primarily from errors made in manual classification of Landsat imagery. The vast majority of these errors are eliminated through the anomalous point amelioration process, described above in Section 12.1.
Estimation of accuracy, precision, and/or confidence level, as applicable and an explanation of assumptions/methodology in the estimation:	28% relative uncertainty (U) at 90% confidence

Description of the parameter including the time period covered:	Total area per year due to forest-state transitions between Dense forest (DF) and Secondary Forest (SF) between 2004 and 2014. Parameter is called degradation.
Explanation for which sources or sinks the parameter is used:	Parameter is used to measure degradation.
Data unit (e.g. ha/yr):	ha/yr
Value for the parameter:	263,506 *(non-adjusted value)*
Source of data:	Data source is samples systematically overlaid on historical remote sensing imagery. Imagery is collected for 10 Landsat tiles cover the Mai Ndombe ER Program area for the years 2004, 2006, 2008, 2010, 2012 and 2014. Landsat 7 ETM+ and Landsat 8 OLI images are used (see additional image details in Section 0 above). Imagery is mosaicked and color-corrected (see Section 0 above).
Spatial level (local, regional, national or international):	Imagery covers the entire ER Program area (10 Landsat tiles) for the 6 epochs in the historical reference period (2004, 2006, 2008, 2010, 2012 and 2014). Imagery spatial resolution is medium (30m x 30m pixels).
Discussion of key uncertainties	Uncertainty for degradation stems primarily from errors made in manual classification of Landsat imagery. The vast majority of these

for this parameter:	errors are eliminated through the anomalous point amelioration process, described above in Section 12.1.
Estimation of accuracy, precision, and/or confidence level, as applicable and an explanation of assumptions/methodology in the estimation:	23% relative uncertainty (U) at 90% confidence

Description of the parameter including the time period covered:	Total area per year due to forest-state transitions between Secondary Forest (SF) and Dense forest (DF) between 2004 and 2014. Parameter is called primary regrowth.
Explanation for which sources or sinks the parameter is used:	Parameter is *subtracted* from the degradation calculation.
Data unit (e.g. ha/yr):	ha/yr
Value for the parameter:	80,628 *(non-adjusted value)*
Source of data:	Data source is samples systematically overlaid on historical remote sensing imagery. Imagery is collected for 10 Landsat tiles cover the Mai Ndombe ER Program area for the years 2004, 2006, 2008, 2010, 2012 and 2014. Landsat 7 ETM+ and Landsat 8 OLI images are used (see additional image details in Section 0 above). Imagery is mosaicked and color-corrected (see Section 0 above).
Spatial level (local, regional, national or international):	Imagery covers the entire ER Program area (10 Landsat tiles) for the 6 epochs in the historical reference period (2004, 2006, 2008, 2010, 2012 and 2014). Imagery spatial resolution is medium (30m x 30m pixels).
Discussion of key uncertainties for this parameter:	Uncertainty for regrowth 1 stems primarily from errors made in manual classification of Landsat imagery. The vast majority of these errors are eliminated through the anomalous point amelioration process, described above in Section 12.1.
Estimation of accuracy, precision, and/or confidence level, as applicable and an explanation of assumptions/methodology in the estimation:	43% relative uncertainty (U) at 90% confidence

Description of the parameter including the time period covered:	Total area per year due to forest-state transitions between Non-Forest (NF) and Secondary forest (SF) between 2004 and 2014. Parameter is called secondary regrowth

Explanation for which sources or sinks the parameter is used:	Parameter is *subtracted* from the degradation calculation.
Data unit (e.g. ha/yr):	ha/yr
Value for the parameter:	17,667 *(non-adjusted value)*
Source of data:	Data source is samples systematically overlaid on historical remote sensing imagery. Imagery is collected for 10 Landsat tiles cover the Mai Ndombe ER Program area for the years 2004, 2006, 2008, 2010, 2012 and 2014. Landsat 7 ETM+ and Landsat 8 OLI images are used (see additional image details in Section 0 above). Imagery is mosaicked and color-corrected (see Section 0 above).
Spatial level (local, regional, national or international):	Imagery covers the entire ER Program area (10 Landsat tiles) for the 6 epochs in the historical reference period (2004, 2006, 2008, 2010, 2012 and 2014). Imagery spatial resolution is medium (30m x 30m pixels).
Discussion of key uncertainties for this parameter:	Uncertainty for regrowth 2 stems primarily from errors made in manual classification of Landsat imagery and in particular differences in the strict definition of secondary forest (canopy cover) and interpretation of Landsat pixels. The majority of these errors are eliminated through the anomalous point amelioration process, described above in Section 12.1.
Estimation of accuracy, precision, and/or confidence level, as applicable and an explanation of assumptions/methodology in the estimation:	101% relative uncertainty (U) at 90% confidence

Annex 22 Emission factors for Unplanned Deforestation and Degradation

Description of the parameter including the forest class if applicable:	The primary deforestation emission factor, EF_p, accounts for the carbon stock difference between dense forest (DF) and residual Non-forest (NF).
Data unit (e.g. t CO_2/ha):	tC/ha
Value for the parameter:	157,29
Source of data:	PROJECT "CARBON MAP AND MODEL (CM&M)". S. Saatchi, V. Meyer, A. Xu, A. Ferraz, Y. Yan, A. Fricker. Institute of the Environment and Sustainability, University of California, Los Angeles. 2015.
Spatial level (local, regional, national or international):	Regional (Mai Ndombe Province)
Discussion of key uncertainties for this parameter:	Primary uncertainties from the calculation of emission factors lie in the regression of LiDAR estimates of canopy height to above ground biomass. Two regressions are used in this study (canopy height to ground-measured biomass and LiDAR canopy height to Landsat reflectance. This can introduce error in areas which biomass has not been measured directly due to reflectance errors and also errors in the correlation of LiDAR-measured height with ground-measured biomass. Further evaluation of LiDAR-measured canopy height and ground-measured biomass are planned in order to minimize the above-mentioned regression errors.
Estimation of accuracy, precision, and/or confidence level, as applicable and an explanation of assumptions/methodology in the estimation:	15,88% relative uncertainty (U) at 90% confidence Source: IPCC 2006 Vol.1, Chap. 3; Equation 3.1 - "Combining Uncertainties" - Approach 1 –*Multiplication*.

Description of the parameter including the forest class if applicable:	The secondary deforestation emission factor, EF_s, accounts for the carbon stock difference between Secondary Forest (SF) and residual Non-forest (NF).
Data unit (e.g. t CO_2/ha):	tC/ha
Value for the parameter:	84,72
Source of data:	PROJECT "CARBON MAP AND MODEL (CM&M)". S. Saatchi, V. Meyer, A. Xu, A. Ferraz, Y. Yan, A. Fricker. Institute of the Environment and Sustainability, University of California, Los Angeles. 2015.
Spatial level (local, regional,	Regional (Mai Ndombe Province)

national or international):	
Discussion of key uncertainties for this parameter:	Primary uncertainties from the calculation of emission factors lie in the regression of LiDAR estimates of canopy height to above ground biomass. Two regressions are used in this study (canopy height to ground-measured biomass and LiDAR canopy height to Landsat reflectance. This can introduce error in areas which biomass has not been measured directly due to reflectance errors and also errors in the correlation of LiDAR-measured height with ground-measured biomass. Further evaluation of LiDAR-measured canopy height and ground-measured biomass are planned in order to minimize the above-mentioned regression errors.
Estimation of accuracy, precision, and/or confidence level, as applicable and an explanation of assumptions/methodology in the estimation:	16,45% relative uncertainty (U) at 90% confidence Source: IPCC 2006 Vol.1, Chap. 3; Equation 3.1 - "Combining Uncertainties" - Approach 1 –*Multiplication*.

Description of the parameter including the forest class if applicable:	The unplanned degradation emission factor, EF_{UNDEG}, accounts for the carbon stock difference between Dense forest (DF) and Secondary Forest (SF)
Data unit (e.g. t CO_2/ha):	tC/ha
Value for the parameter:	72,57
Source of data:	PROJECT "CARBON MAP AND MODEL (CM&M)". S. Saatchi, V. Meyer, A. Xu, A. Ferraz, Y. Yan, A. Fricker. Institute of the Environment and Sustainability, University of California, Los Angeles. 2015.
Spatial level (local, regional, national or international):	
Discussion of key uncertainties for this parameter:	Errors for the degradation emission factor are taken from the uncertainties calculated for the Primary and Secondary EFs (see above).
Estimation of accuracy, precision, and/or confidence level, as applicable and an explanation of assumptions/methodology in the estimation:	34,8% relative uncertainty (U) at 90% confidence Source: IPCC 2006 Vol.1, Chap. 3; Equation 3.2 - "Combining Uncertainties" - Approach 1 – Addition and Subtraction. The total combined error for the degradation emission factor is therefore calculated as the difference between the Dense forest EF (EFp) and the Secondary Forest EF (EFs).

Annex 23 Activity data for Planned Degradation

Description of the parameter including the time period covered:	Area harvested in year y during the reference period For years 2004-2014
Explanation for which sources or sinks the parameter is used:	Planned forest degradation
Data unit (e.g. ha/yr):	Ha
Value for the parameter:	See 20150827_REL_MaiNdombe_ExcelTool_AjustementConservatif.xlsx
Source of data:	1. Georeferenced polygons provided by forestry concessionaires adjusted by actual harvesting area determined from logging road detection 2. Where no georeferenced polygons were available, areas were digitized in ArcGIS based on detected logging roads. 3. Where no roads were detected but (low-intensity semi industrial) logging) was known to have happened, the area was calculated based on an average harvesting intensity
Spatial level (local, regional, national or international):	Local
Discussion of key uncertainties for this parameter:	In all three cases, calculation of the annual harvesting area is deemed conservative.
Estimation of accuracy, precision, and/or confidence level, as applicable and an explanation of assumptions/methodology in the estimation:	Confidence interval of ±10% at the 90% confidence level. Source: Expert judgement by FRM Explanation: Harvesting areas are reported by (some) concessionaires on a quarterly basis. The accuracy of the reported areas can range widely and some companies have not reported harvested areas regularly. In case of implausible results or where no areas were reported, the areas was digitized based on the logging road network. The accuracy of this approach is less than the reported data from a well-run company and is estimated at +/- 10%.

Description of the parameter including the time period covered:	Area harvested in year y during program period For years 2017-2021
Explanation for which sources or sinks the parameter is used:	Planned forest degradation (adjusted)
Data unit (e.g. ha/yr):	ha
Value for the parameter:	See 20150827_REL_MaiNdombe_ExcelTool_AjustementConservatif.xlsx
Source of data:	Based on (interim) forest management plans (see adjustment section)
Spatial level (local, regional, national or international):	Local
Discussion of key uncertainties for this parameter:	The harvestable area in the (interim) forest management plans is based on sound forest inventories and within legal limits. However, logging is subject to

	market demand and may thus vary. Consequently we have increased the confidence interval of the value used.
Estimation of accuracy, precision, and/or confidence level, as applicable and an explanation of assumptions/methodology in the estimation:	Confidence interval of ±50% at the 90% confidence level. Source: Expert judgement by FRM

Description of the parameter including the time period covered:	Average width of permanent roads
Explanation for which sources or sinks the parameter is used (:	Planned forest degradation
Data unit (e.g. ha/yr):	M
Value for the parameter:	See 20150827_REL_MaiNdombe_ExcelTool_AjustementConservatif.xlsx
Source of data:	Field data Based on 50 measurements in 2013, 2014 and 2015 across 3 forestry concessions in Mai-Ndombe Width was systematically measured at an interval of 200 metres using a measuring tape, always rounding down to the next decimetre.
Spatial level (local, regional, national or international):	Local/subnational (Mai Ndombe)
Discussion of key uncertainties for this parameter:	None
Estimation of accuracy, precision, and/or confidence level, as applicable and an explanation of assumptions/methodology in the estimation:	Confidence interval of ±0.34 - 0.47 at the 90% confidence level Source: Calculated based on sampled data.

Description of the parameter including the time period covered:	Average length of permanent roads per unit area of exploited concession area for the reference period 2004-2014
Explanation for which sources or sinks the parameter is used:	Planned forest degradation
Data unit (e.g. ha/yr):	m/ha
Value for the parameter:	See 20150827_REL_MaiNdombe_ExcelTool_AjustementConservatif.xlsx
Source of data:	• Landsat 7 (ETM+) and Landsat 8 (OLI/TIRS) • Name and dates of images are presented in the table below

	181/61	181/62	180/61	180/62	179/62	179/63
2002	12/05/2002	12/05/2002	09/08/2002	05/05/2002	04/05/2002	14/05/2002
2003	24/02/2003	08/02/2003		05/03/2003	14/03/2003 et 17/05/2003	
2004				13/07/2004		22/07/2004
2005			05/01/2005 et 16/07/2005	02/09/2005		
2006	10/07/2006				02/02/2006	14/06/2006
2007		02/01/2007	29/12/2007	29/12/2007	12/05/2007	
2008				26/09/2008	01/07/2008	
2009	07/01/2009	07/01/2009	29/09/2009	05/03/2009	25/11/2009	02/06/2009
2010	18/05/2010	06/08/2010		03/01/2010		
2011				01/07/2011		
2012	11/08/2012	27/08/2012	25/01/2012	30/04/2012	30/09/2012	02/06/2009
2013	18/05/2013	07/03/2013				
2014	29/11/2014	31/12/2014	08/12/2014	05/10/2014	12/09/2014	12/09/2014

- Using bands 4, 5 and 7 (Landsat 7) or 5, 6 and 7 (Landsat 8), forestry roads were digitized and classified into permanent roads (between 2 villages), primary roads (long single roads) and secondary roads (smaller branching roads).
- Length per unit area was then calculated by dividing road length by annual harvesting area

Spatial level (local, regional, national or international):	Subnational (Mai-Ndombe)
Discussion of key uncertainties for this	Sample size (see below)

parameter:	Actual measurements (see above)
Estimation of accuracy, precision, and/or confidence level, as applicable and an explanation of assumptions/methodology in the estimation:	Confidence interval of ±5% at the 90% confidence level: Source: Expert judgement by FRM. Explanation: The accuracy of digitization of the logging roads is given by the resolution of the satellite imagery, in this case Landsat (30m). Assuming that the GIS operator erroneously digitized the road segment at the beginning and at the end, the measurement error amounts to 60m. Permanent roads are usually several kilometres long and so a confidence interval of 5% is deemed conservative.

Description of the parameter including the time period covered:	Average width of solar strips along permanent roads
Explanation for which sources or sinks the parameter is used:	Planned forest degradation
Data unit (e.g. ha/yr):	m
Value for the parameter:	See 20150827_REL_MaiNdombe_ExcelTool_AjustementConservatif.xlsx
Source of data:	Field data Based on 100 measurements in 2013, 2014 and 2015 across 3 forestry concessions in Mai-Ndombe Width was systematically measured at an interval of 200 metres using a measuring tape, always rounding down to the next decimetre (see field data collection protocol in Annex X).
Spatial level (local, regional, national or international):	Local/subnational (Mai Ndombe)
Discussion of key uncertainties for this parameter:	Sample size (see below) Actual e.g. end of the solar strip hard to detect on older roads because of regrowth. Field data collection protocol was designed to be conservative measurements (see above).
Estimation of accuracy, precision, and/or confidence level, as applicable and an explanation of assumptions/methodology in the estimation:	Confidence interval of ±0.80 - 4-81 (depending on concession) at the 90% confidence level Source: Calculated based on sampled data.

Description of the parameter including the time period covered:	Fraction of trees with a DBH>30 cm remaining on solar strips per unit area of exploited concession area
Explanation for which sources or sinks the parameter is used:	Planned forest degradation
Data unit (e.g. ha/yr):	%
Value for the parameter:	0

Source of data:	Expert's estimation
Spatial level (local, regional, national or international):	Local/subnational (Mai Ndombe)
Discussion of key uncertainties for this parameter:	n.a.
Estimation of accuracy, precision, and/or confidence level, as applicable and an explanation of assumptions/methodology in the estimation:	n.a. as value is set to zero for all concessions (may change in the programme scenario).

Description of the parameter including the time period covered:	Average width of primary roads
Explanation for which sources or sinks the parameter is used:	Planned forest degradation
Data unit (e.g. ha/yr):	M
Value for the parameter:	See 20150827_REL_MaiNdombe_ExcelTool_AjustementConservatif.xlsx
Source of data:	Field data Based on 50 measurements in 2013, 2014 and 2015 across 3 forestry concessions in Mai-Ndombe Width was systematically measured at an interval of 200 metres using a measuring tape, always rounding down to the next decimetre.
Spatial level (local, regional, national or international):	Local/sub-national (Mai Ndombe)
Discussion of key uncertainties for this parameter:	Sample size (see below) Actual measurements (see above)
Estimation of accuracy, precision, and/or confidence level, as applicable and an explanation of assumptions/methodology in the estimation:	Confidence interval of ±0.34-0.47 at the 90% confidence level. Source: Calculated based on sampled data.

Description of the parameter including the time period covered:	Average length of primary roads per unit area of exploited concession area for the reference period 2004-2014
Explanation for which sources or sinks the parameter is used:	Planned forest degradation
Data unit (e.g. ha/yr):	m/ha
Value for the parameter:	See 20150827_REL_MaiNdombe_ExcelTool_AjustementConservatif.xlsx
Source of data:	• Landsat 7 (ETM+) and Landsat 8 (OLI/TIRS) • Name and dates of images are presented in the table below

	181/61	181/62	180/61	180/62	179/62	179/63
2002	12/05/2002	12/05/2002	09/08/2002	05/05/2002	04/05/2002	14/05/2002
2003	24/02/2003	08/02/2003		05/03/2003	14/03/2003 et 17/05/2003	
2004				13/07/2004		22/07/2004
2005			05/01/2005 et 16/07/2005	02/09/2005		
2006	10/07/2006				02/02/2006	14/06/2006
2007		02/01/2007	29/12/2007	29/12/2007	12/05/2007	
2008				26/09/2008	01/07/2008	
2009	07/01/2009	07/01/2009	29/09/2009	05/03/2009	25/11/2009	02/06/2009
2010	18/05/2010	06/08/2010		03/01/2010		
2011				01/07/2011		
2012	11/08/2012	27/08/2012	25/01/2012	30/04/2012	30/09/2012	02/06/2009
2013	18/05/2013	07/03/2013				
2014	29/11/2014	31/12/2014	08/12/2014	05/10/2014	12/09/2014	12/09/2014

- Using bands 4, 5 and 7 (Landsat 7) or 5, 6 and 7 (Landsat 8), forestry roads were digitized and classified into permanent roads (between 2 villages), primary roads (long single roads) and secondary roads (smaller branching roads).
- Length per unit area was then calculated by dividing road length by annual harvesting area

Spatial level (local, regional, national or international):	Subnational (Mai-Ndombe)
Discussion of key uncertainties for this parameter:	Resolution of Landsat imagery
Estimation of accuracy, precision, and/or confidence level, as applicable and an explanation of assumptions/methodology in the estimation:	Confidence interval of ±5% at the 90% confidence level. Source: Expert judgement by FRM. Explanation: The accuracy of digitization of the logging roads is given by the resolution of the satellite imagery, in this case Landsat (30m). Assuming that the GIS operator erroneously digitized the road segment at the beginning and at the end, the measurement error amounts to 60m. Permanent roads are usually several kilometres long and so a confidence interval of 5% is deemed conservative.

Description of the parameter including the time period	Average width of solar strips along primary roads

covered:	
Explanation for which sources or sinks the parameter is used:	Planned forest degradation
Data unit (e.g. ha/yr):	m
Value for the parameter:	See 20150827_REL_MaiNdombe_ExcelTool_AjustementConservatif.xlsx
Source of data:	Field data Based on 100 measurements in 2013, 2014 and 2015 across 3 forestry concessions in Mai-Ndombe Width was systematically measured at an interval of 200 metres using a measuring tape, always rounding down to the next decimetre.
Spatial level (local, regional, national or international):	Local/sub-national (Mai Ndombe)
Discussion of key uncertainties for this parameter:	Sample size (see below) Actual e.g. end of the solar strip hard to detect on older roads because of regrowth. Field data collection protocol was designed to be conservative measurements (see above).
Estimation of accuracy, precision, and/or confidence level, as applicable and an explanation of assumptions/methodology in the estimation:	Confidence interval of ±0.80-4.91 (depending on concession) at the 90% confidence level. Source: Calculated based on sampled data.

Description of the parameter including the time period covered:	Average width of secondary roads
Explanation for which sources or sinks the parameter is used:	Planned forest degradation
Data unit (e.g. ha/yr):	m
Value for the parameter:	See 20150827_REL_MaiNdombe_ExcelTool_AjustementConservatif.xlsx
Source of data:	Field data Based on 50 measurements in 2013, 2014 and 2015 across 3 forestry concessions in Mai-Ndombe Width was systematically measured at an interval of 200 metres using a measuring tape, always rounding down to the next decimetre.
Spatial level (local, regional, national or international):	Local/sub-national (Mai Ndombe)
Discussion of key uncertainties for this parameter:	Sample size (see below) Actual measurements (see above)
Estimation of accuracy, precision, and/or confidence level, as applicable and an explanation of assumptions/methodology in the	Confidence interval of ±0.19-030 at the 90% confidence level. Source: Calculated based on sampled data.

estimation:	

Description of the parameter including the time period covered:	Average length of secondary roads per unit area of exploited concession area for the reference period 2004-2014
Explanation for which sources or sinks the parameter is used:	Planned forest degradation
Data unit (e.g. ha/yr):	m/ha
Value for the parameter:	See 20150827_REL_MaiNdombe_ExcelTool_AjustementConservatif.xlsx
Source of data:	• Landsat 7 (ETM+) and Landsat 8 (OLI/TIRS) • Name and dates of images are presented in the table below

	181/61	181/62	180/61	180/62	179/62	179/63
2002	12/05/2002	12/05/2002	09/08/2002	05/05/2002	04/05/2002	14/05/2002
2003	24/02/2003	08/02/2003		05/03/2003	14/03/2003 et 17/05/2003	
2004				13/07/2004		22/07/2004
2005			05/01/2005 et 16/07/2005	02/09/2005		
2006	10/07/2006				02/02/2006	14/06/2006
2007		02/01/2007	29/12/2007	29/12/2007	12/05/2007	
2008				26/09/2008	01/07/2008	
2009	07/01/2009	07/01/2009	29/09/2009	05/03/2009	25/11/2009	02/06/2009
2010	18/05/2010	06/08/2010		03/01/2010		
2011				01/07/2011		
2012	11/08/2012	27/08/2012	25/01/2012	30/04/2012	30/09/2012	02/06/2009
2013	18/05/2013	07/03/2013				
2014	29/11/2014	31/12/2014	08/12/2014	05/10/2014	12/09/2014	12/09/2014

- Using bands 4, 5 and 7 (Landsat 7) or bands 5, 6 and 7 (Landsat 8), forestry roads were digitized and classified into permanent roads (between 2 villages), primary roads (long single roads) and secondary roads (smaller branching roads).
- Length per unit area was then calculated by dividing road length by annual harvesting area

Spatial level (local, regional, national or international):	Sub-national (Mai-Ndombe)
Discussion of key	Resolution of Landsat imagery

uncertainties for this parameter:	
Estimation of accuracy, precision, and/or confidence level, as applicable and an explanation of assumptions/methodology in the estimation:	Confidence interval of ±5% at the 90% confidence level. Source: Expert judgement by FRM. Explanation: Since secondary roads may be shorter then a kilometre, the digitization based on Landsat imagery was compared with a digitization based on rapid eye imagery (resolution of 5m). The comparison showed a deviation of 5%.

Description of the parameter including the time period covered:	Average width of solar strips along secondary roads
Explanation for which sources or sinks the parameter is used (e.g deforestation or forest degradation):	Planned forest degradation
Data unit (e.g. ha/yr):	m
Value for the parameter:	See 20150827_REL_MaiNdombe_ExcelTool_AjustementConservatif.xlsx
Source of data:	Field data Based on 100 measurements in 2013, 2014 and 2015 across 3 forestry concessions in Mai-Ndombe Width was systematically measured at an interval of 200 metres using a measuring tape, always rounding down to the next decimetre.
Spatial level (local, regional, national or international):	Local/sub-national (Mai Ndombe)
Discussion of key uncertainties for this parameter:	Sample size (see below) Actual e.g. end of the solar strip hard to detect on older roads because of regrowth. Field data collection protocol was designed to be conservative measurements (see above).
Estimation of accuracy, precision, and/or confidence level, as applicable and an explanation of assumptions/methodology in the estimation:	Confidence interval of ±0.95-2.03 (depending on concession) at the 90% confidence level. Source: Calculated based on sampled data.

Description of the parameter including the time period covered:	Average width of sub-canopy roads
Explanation for which sources or sinks the parameter is used:	Planned forest degradation
Data unit (e.g. ha/yr):	m
Value for the parameter:	See 20150827_REL_MaiNdombe_ExcelTool_AjustementConservatif.xlsx
Source of data:	Field data

	Based on 29 measurements in 2015 in one forestry concessions in Mai-Ndombe Width was systematically measured at an interval of 200 metres using a measuring tape, always rounding down to the next decimetre.
Spatial level (local, regional, national or international):	Local/sub-national (Mai Ndombe)
Discussion of key uncertainties for this parameter:	Low sampling intensity
Estimation of accuracy, precision, and/or confidence level, as applicable and an explanation of assumptions/methodology in the estimation:	Confidence interval of ± 0.52 at the 90% confidence level. Source: Calculated based on sampled data.

Description of the parameter including the time period covered:	Average length of sub-canopy roads per unit area of exploited concession area for the reference period 2004-2014
Explanation for which sources or sinks the parameter is used:	Planned forest degradation
Data unit (e.g. ha/yr):	m/ha
Value for the parameter:	See 20150827_REL_MaiNdombe_ExcelTool_AjustementConservatif.xlsx
Source of data:	• GPS-recorded track data for 200 ha in one forestry concession (NBK) in Mai-Ndombe • Length per unit area was then calculated by dividing road length by measured harvested area
Spatial level (local, regional, national or international):	Sub-national (Mai-Ndombe)
Discussion of key uncertainties for this parameter:	Low sampling intensity
Estimation of accuracy, precision, and/or confidence level, as applicable and an explanation of assumptions/methodology in the estimation:	Confidence interval of ±15% at the 90% confidence level. Source: Expert judgement by FRM Explanation: The length of sub-canopy roads was measured in the field using GPS units and then related to the harvesting area to attain road length per unit area. Based on the accuracy of the GPS unit and harvesting area, a confidence interval of 15% is an estimate.

Description of the parameter including the time period covered:	Average width of skidtrails
Explanation for which sources or sinks the parameter is used:	Planned forest degradation
Data unit (e.g. ha/yr):	m

Value for the parameter:	See 20150827_REL_MaiNdombe_ExcelTool_AjustementConservatif.xlsx
Source of data:	Expert's estimation
Spatial level (local, regional, national or international):	Local/sub-national (Mai Ndombe)
Discussion of key uncertainties for this parameter:	Sample size (see below) Actual measurements (see above)
Estimation of accuracy, precision, and/or confidence level, as applicable and an explanation of assumptions/methodology in the estimation:	Confidence interval of ±0.18 at the 90% confidence level. Source: Calculated based on sampled data.

Description of the parameter including the time period covered:	Average length of skidtrails per unit area of exploited concession area for the reference period 2004-2014
Explanation for which sources or sinks the parameter is used:	Planned forest degradation
Data unit (e.g. ha/yr):	m/ha
Value for the parameter:	See 20150827_REL_MaiNdombe_ExcelTool_AjustementConservatif.xlsx
Source of data:	▪ GPS-recorded track data for three forestry concession in Mai-Ndombe ▪ Length per unit area was then calculated by dividing skidtrail length by measured harvested area
Spatial level (local, regional, national or international):	Local/Subnational (Mai-Ndombe)
Discussion of key uncertainties for this parameter:	Low sampling intensity
Estimation of accuracy, precision, and/or confidence level, as applicable and an explanation of assumptions/methodology in the estimation:	Confidence interval of ±15% at the 90% confidence level. Source: Expert judgement by FRM Explanation: The length of skidtrails was measured in the field using GPS units and then related to the harvesting area to attain skidtrail length per unit area. Based on the accuracy of the GPS unit and harvesting area, a confidence interval of 15% is an estimate.

Description of the parameter including the time period covered:	Average area of log landings
Explanation for which sources or sinks the parameter is used:	Planned forest degradation
Data unit (e.g. ha/yr):	m^2
Value for the parameter:	See 20150827_REL_MaiNdombe_ExcelTool_AjustementConservatif.xlsx
Source of data:	• Field measurements across 3 forestry concessions in 2015

	• Measurements were made using a measuring tape and by dividing the log landing into a number of rectangles.
Spatial level (local, regional, national or international):	Local/subnational (Mai-Ndombe)
Discussion of key uncertainties for this parameter:	Low sampling intensity
Estimation of accuracy, precision, and/or confidence level, as applicable and an explanation of assumptions/methodology in the estimation:	Confidence interval of ±255-775 at the 90% confidence level. Source: Calculated based on sampled data.

Description of the parameter including the time period covered:	Average number of log landings per unit area of exploited concession area
Explanation for which sources or sinks the parameter is used:	Planned forest degradation
Data unit (e.g. ha/yr):	N°/ha
Value for the parameter:	See 20150827_REL_MaiNdombe_ExcelTool_AjustementConservatif.xlsx
Source of data:	• Field measurements across 3 forestry concessions in 2015 • Log landings were counted for a given area (subunit of an annual harvesting area) and then divided by the size of this area
Spatial level (local, regional, national or international):	Local/subnational (Mai-Ndombe)
Discussion of key uncertainties for this parameter:	Low sampling intensity
Estimation of accuracy, precision, and/or confidence level, as applicable and an explanation of assumptions/methodology in the estimation:	Confidence interval of ±10% at the 90% confidence level. Source: Expert judgement by FRM

Description of the parameter including the time period covered:	Volume harvested in year y of the reference period For years 2004-2014
Explanation for which sources or sinks the parameter is used:	Planned forest degradation
Data unit (e.g. ha/yr):	m^3
Value for the parameter:	See 20150827_REL_MaiNdombe_ExcelTool_AjustementConservatif.xlsx

Source of data:	• Past records from (Interim) Management Plans (Plans de Gestions / Plans d'amenagement) • Quarterly declarations by forestry concessionaires (Declarations Trimestrielles) • Forestry concessionaire records
Spatial level (local, regional, national or international):	Local/sub-national (Mai-Ndombe)
Discussion of key uncertainties for this parameter:	n.a.
Estimation of accuracy, precision, and/or confidence level, as applicable and an explanation of assumptions/methodology in the estimation:	Confidence interval of ±1% at the 90% confidence level. Source: Expert judgement by FRM Explanation: SODEFOR (incl. La Forestière du Lac) and SIFORCO, which account for approx. 75% of harvested timber during the reference period, have very robust internal timber tracking systems. Length and diameters of each stem are measured several times during extraction and carefully recorded. Reported volumes are usually very accurate (estimated to be less than 1%). For the remaining companies, the quality of the reported volume figures is likely to vary and may have changed over the reference period (change in ownership). However, the forestry companies have no reason (e.g. no taxation on volume) to over or underreport the volume logged. Actual harvesting intensities are significantly below the harvesting potential, so it is very unlikely that volumes have been underreported for such reasons.

Description of the parameter including the time period covered:	Volume harvested in year y of the program period For years 2017-2021
Explanation for which sources or sinks the parameter is used:	Planned forest degradation (adjusted)
Data unit (e.g. ha/yr):	m^3
Value for the parameter:	See 20150827_REL_MaiNdombe_ExcelTool_AjustementConservatif.xlsx
Source of data:	• (Interim) Management Plans (Plans de Gestions / Plans d'amenagement) • Historical harvesting intensity
Spatial level (local, regional, national or international):	Local/sub-national (Mai-Ndombe)
Discussion of key uncertainties for this parameter:	Harvesting volumes may fluctuate as a result of market demand. Forecasted volumes have not been based directly on the (interim) forest management plans but rather on areas to be harvested and the historical harvesting intensity to be conservative. Nevertheless, in order to account for the possibility of high fluctuation in timber production, we significantly increase the confidence interval.
Estimation of accuracy, precision,	Confidence interval of ±50% at the 90% confidence level.

and/or confidence level, as applicable and an explanation of assumptions/methodology in the estimation:	Source: Expert judgement by FRM

Description of the parameter including the time period covered:	Factor for abandoned timber
Explanation for which sources or sinks the parameter is used:	Planned forest degradation
Data unit (e.g. ha/yr):	Dimensionless
Value for the parameter:	0.009 for concession 40/11; 0,054 for all other concessions
Source of data:	• Factor based on forestry records (SODEFOR for 1,000 ha, and SIFORCO for the concession N° 040/11) • Abandoned timber volume was calculated by subtracting volume that reached the port from the volume that was felled (Schmidt, 2014)
Spatial level (local, regional, national or international):	Local/subnational (Mai-Ndombe)
Discussion of key uncertainties for this parameter:	Low sampling intensity
Estimation of accuracy, precision, and/or confidence level, as applicable and an explanation of assumptions/methodology in the estimation:	Confidence interval of ±100% at the 90% confidence level. Expert judgement by FRM Explanation: The factor for abandoned timber for the majority of concessions was derived from a case study in a SODEFOR concession (Schmidt2014) that quantified abandoned timber based on extraction records of approx. 1,000 trees in an area of approx. 1,000 ha. An uncertainty of 25% was chosen to take into account that the study was carried out in a more advanced concession (in terms of harvesting practices). However, concessionaires will always aim to keep this value as low as possible as high amount of abandoned timber will reduce the profit margin.

Description of the parameter including the time period covered:	Proportion of other industrial roundwood out of total wood products
Explanation for which sources or sinks the parameter is used:	Planned forest degradation
Data unit (e.g. ha/yr):	%
Value for the parameter:	0

Source of data:	n.a. (parameter set to zero)
Spatial level (local, regional, national or international):	Local/sub-national (Mai-Ndombe)
Discussion of key uncertainties for this parameter:	n.a.
Estimation of accuracy, precision, and/or confidence level, as applicable and an explanation of assumptions/methodology in the estimation:	n.a.

Description of the parameter including the time period covered:	Fraction of wood waste from other industrial roundwood products
Explanation for which sources or sinks the parameter is used:	Planned forest degradation
Data unit (e.g. ha/yr):	%
Value for the parameter:	24
Source of data:	Winjum et al. (1998)
Spatial level (local, regional, national or international):	International
Discussion of key uncertainties for this parameter:	n.a,
Estimation of accuracy, precision, and/or confidence level, as applicable and an explanation of assumptions/methodology in the estimation:	Confidence interval of ±10% at the 90% confidence level. Source: Expert judgement by FRM Explanation: Arbitrarily judged value in the absence of any data.

Description of the parameter including the time period covered:	Proportion of sawnwood out of total wood products
Explanation for which sources or sinks the parameter is used:	Planned forest degradation
Data unit (e.g. ha/yr):	%
Value for the parameter:	90
Source of data:	Expert assessment
Spatial level (local, regional, national or international):	Local/sub-national (Mai-Ndombe)
Discussion of key uncertainties for	

this parameter:	Lack of reliable records
Estimation of accuracy, precision, and/or confidence level, as applicable and an explanation of assumptions/methodology in the estimation:	Confidence interval of ±15% at the 90% confidence level. Source: Expert judgement by FRM Explanation: Based on FRM's long-standing experience in the forestry / timber sector in DRC

Description of the parameter including the time period covered:	Fraction of wood waste from sawnwood products
Explanation for which sources or sinks the parameter is used:	Planned forest degradation
Data unit (e.g. ha/yr):	%
Value for the parameter:	24
Source of data:	Winjum et al. (1998)
Spatial level (local, regional, national or international):	International
Discussion of key uncertainties for this parameter:	n.a.
Estimation of accuracy, precision, and/or confidence level, as applicable and an explanation of assumptions/methodology in the estimation:	Confidence interval of ±10% at the 90% confidence level. Source: Expert judgement by FRM Explanation: Arbitrarily judged value in the absence of any data.

Description of the parameter including the time period covered:	Proportion of wood-based panels out of total wood products
Explanation for which sources or sinks the parameter is used:	Planned forest degradation
Data unit (e.g. ha/yr):	%
Value for the parameter:	10
Source of data:	Expert assessment
Spatial level (local, regional, national or international):	Local/sub-national (Mai-Ndombe)
Discussion of key uncertainties for this parameter:	Lack of records
Estimation of accuracy, precision, and/or confidence level, as applicable and an explanation of assumptions/methodology in the estimation:	Confidence interval of ±15% at the 90% confidence level. Source: Expert judgement by FRM Explanation: Based on FRM's long-standing experience in the forestry / timber

	sector in DRC

Description of the parameter including the time period covered:	Fraction of wood waste from production of wood-based panels
Explanation for which sources or sinks the parameter is used:	Planned forest degradation
Data unit (e.g. ha/yr):	%
Value for the parameter:	24
Source of data:	Winjum et al. (1998)
Spatial level (local, regional, national or international):	International
Discussion of key uncertainties for this parameter:	n.a.
Estimation of accuracy, precision, and/or confidence level, as applicable and an explanation of assumptions/methodology in the estimation:	Confidence interval of ±10% at the 90% confidence level. Source: Expert judgement by FRM Explanation: Arbitrarily judged value in the absence of any data.

Description of the parameter including the time period covered:	Fraction of short-lived fractions in other industrial roundwood products
Explanation for which sources or sinks the parameter is used:	Planned forest degradation
Data unit (e.g. ha/yr):	%
Value for the parameter:	18
Source of data:	Winjum et al. (1998)
Spatial level (local, regional, national or international):	International
Discussion of key uncertainties for this parameter:	n.a.
Estimation of accuracy, precision, and/or confidence level, as applicable and an explanation of assumptions/methodology in the estimation:	Confidence interval of ±10% at the 90% confidence level. Source: Expert judgement by FRM Explanation: Arbitrarily judged value in the absence of any data.

Description of the parameter including the time period covered:	Fraction of short-lived fractions in sawnwood products
Explanation for which sources or	Planned forest degradation

sinks the parameter is used:	
Data unit (e.g. ha/yr):	%
Value for the parameter:	12
Source of data:	Winjum et al. (1998)
Spatial level (local, regional, national or international):	International
Discussion of key uncertainties for this parameter:	n.a.
Estimation of accuracy, precision, and/or confidence level, as applicable and an explanation of assumptions/methodology in the estimation:	Confidence interval of ±10% at the 90% confidence level. Source: Expert judgement by FRM Explanation: Arbitrarily judged value in the absence of any data.

Description of the parameter including the time period covered:	Fraction of short-lived fractions in wood-based panels products
Explanation for which sources or sinks the parameter is used:	Planned forest degradation
Data unit (e.g. ha/yr):	%
Value for the parameter:	6
Source of data:	Winjum et al. (1998)
Spatial level (local, regional, national or international):	International
Discussion of key uncertainties for this parameter:	n.a.
Estimation of accuracy, precision, and/or confidence level, as applicable and an explanation of assumptions/methodology in the estimation:	Confidence interval of ±10% at the 90% confidence level. Source: Expert judgement by FRM Explanation: Arbitrarily judged value in the absence of any data.

Description of the parameter including the time period covered:	Fraction of additional oxidized fractions in other industrial roundwood products
Explanation for which sources or sinks the parameter is used:	Planned forest degradation
Data unit (e.g. ha/yr):	%
Value for the parameter:	99
Source of data:	Winjum et al. (1998)
Spatial level (local, regional, national or international):	International

Discussion of key uncertainties for this parameter:	n.a.
Estimation of accuracy, precision, and/or confidence level, as applicable and an explanation of assumptions/methodology in the estimation:	Confidence interval of ±10% at the 90% confidence level. Source: Expert judgement by FRM Explanation: Arbitrarily judged value in the absence of any data.

Description of the parameter including the time period covered:	Fraction of additional oxidized fractions in sawnwood products
Explanation for which sources or sinks the parameter is used:	Planned forest degradation
Data unit (e.g. ha/yr):	%
Value for the parameter:	86
Source of data:	Winjum et al. (1998)
Spatial level (local, regional, national or international):	International
Discussion of key uncertainties for this parameter:	n.a.
Estimation of accuracy, precision, and/or confidence level, as applicable and an explanation of assumptions/methodology in the estimation:	Confidence interval of ±10% at the 90% confidence level. Source: Expert judgement by FRM Explanation: Arbitrarily judged value in the absence of any data.

Description of the parameter including the time period covered:	Fraction of additional oxidized fractions in wood-based panels products
Explanation for which sources or sinks the parameter is used:	Planned forest degradation
Data unit (e.g. ha/yr):	%
Value for the parameter:	98
Source of data:	Winjum et al. (1998)
Spatial level (local, regional, national or international):	International
Discussion of key uncertainties for this parameter:	n.a.
Estimation of accuracy, precision, and/or confidence level, as applicable and an explanation of assumptions/methodology in the estimation:	Confidence interval of ±10% at the 90% confidence level. Source: Expert judgement by FRM Explanation: Arbitrarily judged value in the absence of any data.

Description of the parameter including the time period covered:	Average area of felling sites
Explanation for which sources or sinks the parameter is:	Planned forest degradation
Data unit (e.g. ha/yr):	m²
Value for the parameter:	See 20150827_REL_MaiNdombe_ExcelTool_AjustementConservatif.xlsx
Source of data:	• Field data collected across 4 forestry concessions in 2014 and 2015 in Mai-Ndombe • Area was measured by walking with a GPS unit around the felling site (in the residual forest stand) • The GPS track was exported and loaded in ArcGIS to determine the area.
Spatial level (local, regional, national or international):	Local/sub-national (Mai-Ndombe)
Discussion of key uncertainties for this parameter:	GPS accuracy between 3-5m. This was countered by walking around the actual felling site. This will overestimate the area of felling sites which is conservative, as it is used to calculated removals (which will be deducted from emissions).
Estimation of accuracy, precision, and/or confidence level, as applicable and an explanation of assumptions/methodology in the estimation:	Confidence interval of ±70-282 at the 90% confidence level. Explanation: Calculated based on sampled data.

Description of the parameter including the time period covered:	Average number of trees per felling site
Explanation for which sources or sinks the parameter is used (e.g deforestation or forest degradation):	Planned forest degradation
Data unit (e.g. ha/yr):	N°/felling site
Value for the parameter:	See 20150827_REL_MaiNdombe_ExcelTool_AjustementConservatif.xlsx
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):	• Field data collected across 4 forestry concessions in 2014 and 2015 in Mai-Ndombe
Spatial level (local, regional, national or international):	Local/subnational (Mai-Ndombe)
Discussion of key uncertainties for	Sample size

this parameter:	
Estimation of accuracy, precision, and/or confidence level, as applicable and an explanation of assumptions/methodology in the estimation:	Confidence interval of ±15% at the 90% confidence level. Source: Expert judgement by FRM Explanation: Based on FRM's practical experience in supervising forestry operations in DRC

Description of the parameter including the time period:	Average volume per harvested tree
Explanation for which sources or sinks the parameter is used:	Planned forest degradation
Data unit (e.g. ha/yr):	m^3
Value for the parameter:	5.156
Source of data:	• Forestry inventory data in concession CCF n° 038/11: example of Wenge
Spatial level (local, regional, national or international):	Local/subnational (Mai-Ndombe)
Discussion of key uncertainties for this parameter:	Low sampling intensity
Estimation of accuracy, precision, and/or confidence level, as applicable and an explanation of assumptions/methodology in the estimation:	Confidence interval of ±10% at the 90% confidence level. Source: Expert judgement by FRM Explanation: Based on harvesting statistics.

Description of the parameter including the time period:	Average wood density of harvested trees
Explanation for which sources or sinks the parameter is used:	Planned forest degradation
Data unit (e.g. ha/yr):	t/m^3
Value for the parameter:	0,65
Source of data:	• Volume-weighted average based on 782 harvested trees (on 1,000 ha) in SODEFOR concession 39/11 (Bonkita/Nteno; Schmidt 2014)

Wood densities of tree species harvested (from Schmidt, 2014)			
Wood type /trade name (in DRC)	**Botanical name(s)**	**Wood density (range)**	**Wood density value used**
Aiele	*Canarium schweinfurthii*	0.36 - 0.46	0.36
Ako	*Antiaris africana, A. toxicaria, A. welwitschii*	0.38 – 0.45	0.38
Bosse	*Guarea cedrata, Guarea laurentii, Guarea thompsonii*	0.54 – 0.60	0.54
Dibetou	*Lovoa trichilioides*	0.41 - 0.45	0.41
Etimoe	*Copaifera salikounda*	0.7	0.7
Iroko	*Milicia excelsa (= Chlorophora excelsa) Milicia regia (= Chlorophora regia)*	0.55 – 0.65	0.55
Padouk	*Pterocarpus soyauxii*	0.60 – 0.80	0.6
Sapelli	*Entandophragma cylindricum*	0.63	0.63
Sipo	*Entandophragma utile*	0.53 – 0.63	0.53
Tali	*Erythrophleum suaveolens (= Erythrophleum guineense) Erythrophleum ivorense (= Erythrophleum micranthum*	0.72 – 1.07	0.72
Tchitola	*Oxystigma oxyphyllum*	0.53 – 0.64	0.53
Tiama	*Entandrophragma angolense*	0.50 – 0.55	0.50
Tola	*Gossweilerodendron balsamiferum*	0.40 – 0.56	0.40
Wenge	*Millettia laurentii*	0.79	0.79

Sources:

http://www.worldagroforestry.org/sea/Products/AFDbases/WD/

http://www.fao.org/docrep/W4095E/w4095e0c.htm

IPCC 2006, 2006 IPCC Guidelines for National Greenhouse Gas Inventories; Volume 4 AFOLU, Prepared by the National Greenhouse Gas Inventories Programme; Eggleston H.S., Buendia L., Miwa K., Ngara T. and Tanabe K. (eds). Published: IGES, Japan.

http://www.holzhandel.de

http://www.holzwurm-page.de/

http://www.holzlexikon.modellskipper.de/Holzarten_Abschnitt_A/Holzarten_in_alphabetischer_Reihenfolge

Spatial level (local, regional, national or international):	Local/sub-national (Mai-Ndombe)
Discussion of key uncertainties for this parameter:	Uncertainty was reduced to zero by taking the lowest available value.
Estimation of accuracy, precision, and/or confidence level, as applicable and an explanation of assumptions/methodology in the estimation:	n.a.

Description of the parameter including the time period:	Biomass expansion factor
Explanation for which sources or sinks the parameter is used:	Planned forest degradation
Data unit (e.g. ha/yr):	dimensionless
Value for the parameter:	2.27
Source of data:	GOFC-GOLD, 2015, A sourcebook of methods and procedures for monitoring and reporting anthropogenic greenhouse gas emissions and removals associated with deforestation, gains and losses of carbon stocks in forests remaining forests, and forestation. GOFC-GOLD Report version COP21-1, (GOFC-GOLD Land Cover Project Office, Wageningen University, The Netherlands). Section 2.3.5.2.2, page 77
Spatial level (local, regional, national or international):	Globally / pantropically applicable formula used with local data (growing stock)
Discussion of key uncertainties for this parameter:	n.a.
Estimation of accuracy, precision, and/or confidence level, as applicable and an explanation of assumptions/methodology in the estimation:	Confidence interval of ±14.14% at the 90% confidence level. Source: Inventory error (10%, FRM personal comm.) and error of allometric equation (10%) from Chave et al. (2014)

Description of the parameter including the time period:	Residual stand damage factor
Explanation for which sources or sinks the parameter is used:	Planned forest degradation
Data unit (e.g. ha/yr):	Dimensionless
Value for the parameter:	1.77
Source of data:	Calculation based on: - FAO (1995) FOREST HARVESTING IN NATURAL FORESTS OF THE CONGO. FOREST HARVESTING CASE STUDY 7. Food and Agriculture Organization of the United Nations, Viale delle Terme di Caracalla, 00100 Rome, Italy. Available online at: http://www.fao.org/docrep/w5796E/w5796e00.htm#TopOfPage - Volume tables for Southern ROC
Spatial level (local, regional, national or international):	Regional (from Republic of Congo)
Discussion of key uncertainties for this parameter:	Number of damaged trees that will die in the short-term (5-10 years).
Estimation of accuracy, precision, and/or confidence level, as applicable and an explanation of assumptions/methodology in the estimation:	Confidence interval of ±50% at the 90% confidence level. Source: Expert judgement by FRM (for the time being). Factor will be updated based on a local model.

Annex 24 Emission factors for Planned Degradation

Description of the parameter including the forest class if applicable:	Fraction of average carbon stock of trees of trees with a DBH <50 cm in total aboveground biomass
Data unit (e.g. t CO_2/ha):	%
Value for the parameter:	55
Source of data:	Forest inventory data from 7 forestry concessions in Mai-Ndombe
Spatial level (local, regional, national or international):	Local/sub-national (Mai-Ndombe)
Discussion of key uncertainties for this parameter:	n.a.
Estimation of accuracy, precision, and/or confidence level, as applicable and an explanation of assumptions/methodology in the estimation:	Confidence interval of ±5% at the 90% confidence level. Expert judgement by FRM based on uncertainty of inventory data and allometric equations of Chave et al. 2005

Description of the parameter including the forest class if applicable:	Root-shoot ratio (RSR)
Data unit (e.g. t CO_2/ha):	Dimensionless
Value for the parameter:	0.20 (AGB<120 t.d.m./ha), 0.24 (AGB>120 t.d.m./ha) and 0.40
Source of data:	Mokany, K., Raison, J.R. and Prokushkin, A.S. (2006). Critical analysis of root:shoot ratios in terrestrial biomes. Global Change Biology 12: 84-962006 as cited in the IPCC Guidelines for National Greenhouse Gas Inventories. TABLE 4.4 RATIO OF BELOW-GROUND BIOMASS TO ABOVE-GROUND BIOMASS (R)
Spatial level (local, regional, national or international):	International
Discussion of key uncertainties for this parameter:	n.a.
Estimation of accuracy, precision, and/or confidence level, as applicable and an explanation of assumptions/methodology in the estimation:	For RSR = 0.20: Confidence interval of ±7.2% at the 90% confidence level. For RSR = 0.24: Confidence interval of ±2.2% at the 90% confidence level. Source: Mokany et al. (2006)

Description of the parameter including the forest class if applicable:	Fraction of average carbon stock of trees of trees with a DBH > 30 cm in total aboveground biomass
Data unit (e.g. t CO_2/ha):	%

Value for the parameter:	76
Source of data :	Forest inventory data from 7 forestry concessions in Mai-Ndombe
Spatial level (local, regional, national or international):	Local/sub-national (Mai-Ndombe)
Discussion of key uncertainties for this parameter:	n.a.
Estimation of accuracy, precision, and/or confidence level, as applicable and an explanation of assumptions/methodology in the estimation:	Confidence interval of ±5% at the 90% confidence level. Expert judgment by FRM based on uncertainty of inventory data and allometric equations of Chave et al. 2005

Description of the parameter including the forest class if applicable:	Average carbon stock in above ground biomass per unit area of exploited concession area
Data unit (e.g. t CO_2/ha):	tC/ha
Value for the parameter:	See 20150827_REL_MaiNdombe_ExcelTool_AjustementConservatif.xlsx
Source of data:	LiDaR-based biomass map (Saatchi et al.2015).
Spatial level (local, regional, national or international):	Local/subnational (Mai-Ndombe)
Discussion of key uncertainties for this parameter:	
Estimation of accuracy, precision, and/or confidence level, as applicable and an explanation of assumptions/methodology in the estimation:	Confidence interval of ±0.47-0.59% at the 90% confidence level. Source: Calculated based on Saatchi et al. (2015)

Description of the parameter including the forest class if applicable:	Fraction of average carbon stock of trees of trees with a DBH < 20 cm in total aboveground biomass
Data unit (e.g. t CO_2/ha):	%
Value for the parameter:	11
Source of data:	Forest inventory data from 7 forestry concessions in Mai-Ndombe
Spatial level (local, regional, national or international):	Local/sub-national (Mai-Ndombe)
Discussion of key uncertainties for this parameter:	n.a.
Estimation of accuracy, precision, and/or confidence level, as applicable and an explanation of assumptions/methodology in the estimation:	Confidence interval of ±5% at the 90% confidence level. Expert judgment by FRM based on uncertainty of inventory data and allometric equations of Chave et al. 2005

Description of the parameter including the forest class if applicable:	Carbon fraction in woody biomass
Data unit (e.g. t CO_2/ha):	tC/t
Value for the parameter:	0.47
Source of data:	IPCC AFOLU guidelines 2006, Table 4.3
Spatial level (local, regional, national or international):	International
Discussion of key uncertainties for this parameter:	Uncertainty reduced to zero by taking the lowest available value
Estimation of accuracy, precision, and/or confidence level, as applicable and an explanation of assumptions/methodology in the estimation:	n.a.

Description of the parameter including the forest class if applicable:	Average annual increment
Data unit (e.g. t CO_2/ha):	t.d.m/ha/year
Value for the parameter:	2.24
Source of data:	Calculated as the difference between natural and post-logging regrowth based on: Gourlet-Fleury S, Mortier F,Fayolle A, Baya F, Ouédraogo D, Benedet F,Picard N. 2013 Tropical forest recovery from logging: a 24 year silvicultural experiment from Central Africa. Phil Trans R Soc B 368: 20120302
Spatial level (local, regional, national or international):	Regional (from tropical moist decidious forests in the Central African Republic)
Discussion of key uncertainties for this parameter:	n.a.
Estimation of accuracy, precision, and/or confidence level, as applicable and an explanation of assumptions/methodology in the estimation:	Confidence interval of ±60% at the 90% confidence level (calculated based on Gourlet-Fleury et al. 2013)

Annex 25 Regression analysis input parameters and outputs coefficient and variables

Table 51: Selected Input Parameter for the Regression Analysis

Category		Population		Economic	Agricultural Productivitiy						
Year	Deforestation (in ha/yr)	MNDP Economic Population (in 1000 persons)	MNDP Rural Population (in 1000 persons)	GDP (in FC at 2005 prices)	MNDP Cassava Production (in t)	Agriculture PIN	Food PIN	Livestock PIN	Cereals (in t)	Wood Fuel (in t)	Oilpalm Production (in t)
2004	107,132	416	760	5,342,300	5,149,667	3,730,022	3,665,571	409,905	260,488	69,777,400	76,135
2005	107,132	428	777	5,670,100	5,157,917	3,750,446	3,680,296	412,454	260,680	71,066,400	76,135
2006	107,132	440	794	5,971,800	5,163,073	3,765,672	3,699,799	413,194	260,867	72,126,004	76,135
2007	85,915	451	811	6,345,500	5,168,236	3,800,261	3,727,821	413,481	261,052	73,208,800	79,180
2008	85,915	463	828	6,740,700	5,171,357	3,831,827	3,759,538	415,322	261,230	74,315,257	79,180
2009	72,786	476	845	6,933,100	5,185,466	3,868,136	3,799,071	423,507	261,429	75,446,134	80,486
2010	72,786	489	861	7,425,900	5,171,433	3,991,364	3,922,579	477,071	261,813	76,602,030	81,356
2011	172,592	502	878	7,936,300	5,175,036	4,144,204	4,073,311	492,462	262,064	77,735,602	121,816
2012	172,592	515	895	8,498,800	5,511,158	4,338,591	4,266,536	496,533	303,716	78,894,151	128,559
2013	183,910	529	912	9,219,700	5,683,381	4,385,109	4,315,588	498,963	304,873	80,078,338	130,517
2014	183,910	544	929	9,607,440	5,736,753	4,450,618	4,380,589	507,869	309,312	81,288,841	135,955
Increase	172%	131%	122%	180%	111%	119%	120%	124%	119%	116%	179%

The table below presents the regression analysis output for the coefficients for oil palm and rural population.

Table 52: Regression Analysis - Output for Coefficients

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	90,0% Confidence Interval for B		Correlations			Collinearity Statistics	
		B	Std. Error	Beta			Lower Bound	Upper Bound	Zero-order	Partial	Part	Tolerance	VIF
2	(Constant)	318877.049	58686.797		5.434	.001	209746.131	428007.968					
	Oilpalm_DRC	2.694	.190	1.527	14.182	.000	2.341	3.047	.941	.981	.710	.216	4.629
	Rural_Pop	-541.050	87.990	-.662	-6.149	.000	-704.671	-377.429	.690	-.908	-.308	.216	4.629

The table below presents the findings for those parameters that were excluded:

Table 53: Regression Analysis – Output for Excluded Variables

Model		Beta In	t	Sig.	Partial Correlation	Collinearity Statistics		
						Tolerance	VIF	Minimum Tolerance
2	Economic_Pop	1,598[b]	.962	.368	.342	.001	1092.435	.001
	GDP	,530[b]	1.059	.325	.372	.010	101.423	.010
	Maize_production	,073[b]	.790	.456	.286	.306	3.263	.165
	Cassava_production	,051[b]	.485	.642	.180	.253	3.959	.154
	Agriculture_PIN_DRC	,046[b]	.124	.905	.047	.021	47.400	.021
	Food_PIN_DRC	,061[b]	.171	.869	.065	.022	44.992	.022
	Crops_PIN_DRC	,024[b]	.072	.945	.027	.025	40.464	.025
	Livestock_PIN_DRC	,029[b]	.171	.869	.064	.100	9.985	.100
	Cereals	,003[b]	.026	.980	.010	.235	4.253	.138

b. Predictors in the Model: (Constant), Oilpalm_DRC, Rural_Pop
c. Dependent Variable: WWC_DEF_year

Annex 26 Emissions from PDEG for all concessions (2004-2014) – Historic emissions

Table 12: Emissions from planned degradation for all forestry concessions over the reference period 2004-2014

N° GA	N° CCF	Leaseholder	Area (ha)	Emissions (tCO2/year)													
				2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	TOTAL 2004-2014	Annual Average (all years)	Annual average (only years of exploitation)
022/03	022/03	SODEFOR	120 281	0	0	0	0	0	0	0	0	0	0	0	0	0	0
046/04	056/14	RIBA CONGO	37 367	0	27 961	24 339	27 964	27 665	27 354	-1 220	-1 241	-1 241	-1 241	9 089	139 428	12 675	24 062
019/03	061/14	SODEFOR	246 411	50 517	49 777	49 036	-2 222	-2 223	293 944	-7 928	-7 944	29 654	28 641	27 532	508 783	46 253	75 586
026/03	065/14	SODEFOR	186 477	20 809	112 882	90 271	75 283	74 300	73 317	-5 377	-5 378	-5 380	-5 381	-5 383	419 963	38 178	74 477
030/03	030/03	SODEFOR	234 895	0	60 218	59 834	115 389	113 755	112 066	106 367	17 301	-7 582	-7 595	88 635	658 387	59 853	84 196
024/03	062/14	SODEFOR	36 084	0	0	0	0	0	0	0	0	0	0	0	0	0	0
018/00	040/11	SIFORCO	194 636	0	0	0	0	0	0	0	0	30 994	61 919	61 129	154 042	14 004	51 347
064/00	038/11	SODEFOR	173 921	54 531	-1 080	-1 088	-1 088	-1 118	-1 148	-1 148	-1 148	-1 148	-1 148	-1 148	43 273	3 934	54 531
004/91	055/14	ONATRA	121 214	10 594	19 539	17 781	872	-300	-300	-300	-300	-300	-300	12 407	59 395	5 400	12 239
021/03	035/11	SODEFOR	200 144	119 462	117 635	115 768	131 038	128 914	126 753	132 384	131 434	130 506	73 261	70 647	1 277 802	116 164	116 164
041/05	049/14	MAISON NBK SERVICE	79 730	0	0	0	2 858	5 692	1 619	4 892	-90	-90	9 078	15 021	38 979	3 544	6 620
031/03	034/11	SODEFOR	194 346	0	0	0	0	0	0	0	0	0	0	0	0	0	0
029/03	063/14	SODEFOR	298 276	0	0	0	0	0	0	0	0	0	0	0	0	0	0
028/03	039/11	SODEFOR	238 896	181 599	176 899	-9 501	-9 602	55 947	55 399	36 989	36 600	36 214	96 646	94 202	751 392	68 308	85 611
024/05	048/12	LA FORESTIERE DU LAC	185 171	0	0	211 640	57 868	57 394	56 990	55 987	54 626	53 266	80 694	78 216	706 681	64 244	78 520
002/01	005/11	ITB	127 719	0	0	124 053	82 820	82 294	81 794	40 364	39 002	37 661	-8 905	-8 923	470 159	42 742	69 712
018/95	021/11	COMPAGNIE DES BOIS	148 081	0	15 420	15 299	16 022	14 912	16 421	-454	37 018	37 350	37 569	36 968	226 524	20 593	25 220
003/04	050/14	TALA TINA	40 040	0	38 934	38 746	32 977	32 790	-750	-750	-750	-750	2 161	2 949	145 556	13 232	25 061
032/03	045/11	SODEFOR	336 916	81 598	80 955	80 312	113 880	111 487	109 066	75 494	74 636	73 780	25 498	57 550	884 255	80 387	80 387
034/97	052/14	SOMICONGO	294 014	0	0	214 144	-2 576	-2 630	245 556	-5 616	-5 713	27 329	-6 111	104 848	569 231	51 748	147 969
			TOTAL	519 110	699 140	1 030 634	641 483	698 878	1 198 081	429 684	368 052	440 265	384 786	643 740	7 053 852	641 259	1 011 701
			Average	25 956	34 957	51 532	32 074	34 944	59 904	21 484	18 403	22 013	19 239	32 187	352 693	32 063	50 585

Annex 27 Emissions from PDEG for all concessions (2017-2021) – Adjusted emissions

Table 17: Emissions from planned degradation for all Concessions (2017-2021)

N° de la Garantie d'approvisionnement	N° du contrat de la concession forestière	Nom de la société attributaire	Superficie (ha)	Total des émissions annuelles (tCO_2/an)						
				2017	2018	2019	2020	2021	TOTAL 2017-2021	MOYENNE ANNUELLE
022/03	022/03	SODEFOR	120 281	208,995	206,941	204,840	202,739	200,639	1,024,154	204,831
046/04	056/14	RIBA CONGO	37 367	16,831	16,687	16,539	16,391	16,243	82,690	16,538
019/03	061/14	SODEFOR	246 411	59,283	58,433	57,569	56,704	55,840	287,828	57,566
026/03	065/14	SODEFOR	186 477	203,775	201,658	199,497	197,336	195,175	997,441	199,488
030/03	030/03	SODEFOR	234 895	387,640	383,869	380,011	376,153	372,294	1,899,967	379,993
024/03	062/14	SODEFOR	36 084	45,806	45,268	44,723	44,178	43,633	223,609	44,722
018/00	040/11	SIFORCO	194 636	64,045	63,406	62,752	62,099	61,445	313,747	62,749
064/00	038/11	SODEFOR	173 921	116,708	115,358	113,989	112,619	111,250	569,924	113,985
004/91	055/14	ONATRA	121 214	157,997	156,935	155,838	154,742	153,645	779,157	155,831
021/03	035/11	SODEFOR	200 144	134,119	132,597	131,041	129,485	127,930	655,172	131,034
041/05	049/14	MAISON NBK SERVICE	79 730	32,952	32,702	32,444	32,185	31,927	162,211	32,442
031/03	034/11	SODEFOR	194 346	261,887	259,349	256,755	254,161	251,566	1,283,718	256,744
029/03	063/14	SODEFOR	298 276	158,023	156,175	154,299	152,424	150,549	771,470	154,294
028/03	039/11	SODEFOR	238 896	229,567	227,073	224,534	221,995	219,456	1,122,624	224,525
024/05	048/12	LA FORESTIERE DU LAC	185 171	164,830	162,863	160,855	158,847	156,839	804,233	160,847
002/01	005/11	ITB	127 719	197,682	195,720	193,710	191,701	189,691	968,504	193,701
018/95	021/11	COMPAGNIE DES BOIS	148 081	304,968	302,848	300,661	298,474	296,287	1,503,239	300,648
003/04	050/14	TALA TINA	40 040	29,500	29,286	29,064	28,842	28,620	145,311	29,062
032/03	045/11	SODEFOR	336 916	360,922	356,942	352,869	348,795	344,721	1,764,248	352,850
034/97	052/14	SOMICONGO	294 014	78,997	78,057	77,097	76,137	75,178	385,466	77,093
			TOTAL	3,214,527	3,182,166	3,149,086	3,116,006	3,082,927	15,744,712	3,148,942
			Average	160,726	159,108	157,454	155,800	154,146	787,236	157,447

Annex 28 UNDEF/UNDEG monitoring parameters

Parameter	Area deforested, per land use /cover stratum
Measurement Unit	Ha
Sampling size	N.A.
Measurement Interval	Analysis will be conducted on an annual basis.
Data source:	The following data sources will be used : ▪ Global Forest Watch for the pre-identification of potential areas of change; ▪ Landsat 8 (OLI) and 7 (ETM +) for the development of forest area benchmark maps; ▪ High resolution imagery for the conduction of QA/QCs.
Responsibility	DIAF with support from OSFAC
Quality assurances and control procedures	▪ Identification of high resolution samples for each stratum; ▪ Comparison of samples with the forest area benchmark map; ▪ Development of a change matrix to determine the accuracy of each stratum; ▪ Correction of the forest area benchmark map by the 90% confidence interval.

Parameter	Area degraded, per land use /cover stratum
Measurement Unit	Ha
Sampling size	N.A.
Measurement Interval	Analysis will be conducted on an annual basis.
Data source:	The following data sources will be used : ▪ Global Forest Watch for the pre-identification of potential areas of change; ▪ Landsat 8 (OLI) and 7 (ETM +) for the development of forest area benchmark maps; ▪ High resolution imagery for the conduction of QA/QCs.
Responsibility	DIAF with support from OSFAC
Quality assurances and control procedures	▪ Identification of high resolution samples for each stratum; ▪ Comparison of samples with the forest area benchmark map; ▪ Development of a change matrix to determine the accuracy of each stratum; ▪ Correction of the forest area benchmark map by the 90% confidence interval.

Annex 29 PDEG monitoring parameters

Parameter:	$A_{h,y}$
Description:	Area harvested in year y during the programme period
Data unit:	Ha
Source of data:	*Part of regular reporting requirements of forestry concessions*
Frequency of monitoring/recording:	Every 3 months
Monitoring equipment:	*n.a.*
Quality Assurance/Quality Control procedures to be applied:	Data will be checked for plausibility, i.e. that the harvesting area is within the range of the (interim) management plan and that the harvesting intensity is within the range observed in Mai-Ndombe. Where the area harvested in deemed not plausible, it will be checked against the road network visible on satellite imagery provided by the UNDEF/UNDEG monitoring system.
Identification of sources of uncertainty for this parameter	None
Process for managing and reducing uncertainty associated with this parameter	None
Any comment:	Concession specific

Parameter:	$V_{h,y}$
Description:	Volume harvested in year y during the programme period
Data unit:	m^3
Source of data:	*Part of regular reporting requirements of forestry concessions*
Frequency of monitoring/recording:	Every 3 months
Monitoring equipment:	*n.a.*
Quality Assurance/Quality Control procedures to be applied:	Data will be checked for plausibility, i.e. that the volume is within the range of the (interim) management plan and that the harvesting intensity is within the range observed in Mai-Ndombe. Where the volume harvested in deemed not plausible and the concessionaire can offer no feasible explanation, it will be reduced based on a predefined harvesting intensity.
Identification of sources of uncertainty for this parameter	None
Process for managing and reducing uncertainty associated with this parameter	None
Any comment:	Concession specific

Parameter:	L_{PmR}
Description:	Length of permanent roads
Data unit:	M
Source of data:	*ER Program UNDEF/UNDEG monitoring system. Will be digitized based on Landsat 7/8 imagery.*
Frequency of monitoring/recording:	Annually
Monitoring equipment:	*Computer with GIS software, satellite imagery*
Quality Assurance/Quality Control procedures to be applied:	Use of trained RS experts
Identification of sources of uncertainty for this parameter	Misinterpretation of satellite imagery
Process for managing and reducing uncertainty associated with this parameter	Uncertainty assessment
Any comment:	Concession specific

Parameter:	L_{PR}
Description:	Length of primary roads
Data unit:	M
Source of data:	*ER Program UNDEF/UNDEG monitoring system. Will be digitized based on Landsat 7/8 imagery.*
Frequency of monitoring/recording:	Annually
Monitoring equipment:	*Computer with GIS software, satellite imagery*
Quality Assurance/Quality Control procedures to be applied:	Use of trained RS experts
Identification of sources of uncertainty for this parameter	Misinterpretation of satellite imagery
Process for managing and reducing uncertainty associated with this parameter	Uncertainty assessment
Any comment:	Concession specific

Parameter:	L_{SR}
Description:	Length of secondary roads
Data unit:	m
Source of data:	*ER Program UNDEF/UNDEG monitoring system. Will be digitized based on Landsat 7/8 imagery.*
Frequency of monitoring/recording:	Annually
Monitoring equipment:	*Computer with GIS software, satellite imagery*
Quality Assurance/Quality Control	Use of trained RS experts

procedures to be applied:	
Identification of sources of uncertainty for this parameter	Misinterpretation of satellite imagery
Process for managing and reducing uncertainty associated with this parameter	Uncertainty assessment
Any comment:	Concession specific

Parameter:	L_{SCR}
Description:	Length of sub-canopy roads
Data unit:	M
Source of data:	Field sampling or remote sensing using high resolution imagery
Frequency of monitoring/recording:	Annually
Monitoring equipment:	*GPS or computer with GIS software, satellite imagery*
Quality Assurance/Quality Control procedures to be applied:	For non-participating concessions:Tendered to qualified firm For participating concessions: Training to forestry staff
Identification of sources of uncertainty for this parameter	GPS Misinterpretation of satellite imagery
Process for managing and reducing uncertainty associated with this parameter	Appropriate sample size Uncertainty assessment
Any comment:	For non-participating concessions:Sampling of several concessions, not concession specific For participating concessions: Concession specific

Parameter:	L_{SKID}
Description:	Length of skidtrails
Data unit:	m
Source of data:	Field sampling or remote sensing using high resolution imagery
Frequency of monitoring/recording:	Annually
Monitoring equipment:	*GPS or computer with GIS software, satellite imagery*
Quality Assurance/Quality Control procedures to be applied:	For non-participating concessions:Tendered to qualified firm For participating concessions: Training to forestry staff
Identification of sources of uncertainty for this parameter	GPS Misinterpretation of satellite imagery
Process for managing and reducing uncertainty associated with this parameter	Appropriate sample size Uncertainty assessment
Any comment:	For non-participating concessions: Sampling of several concessions, not concession specific

	For participating concessions: Concession specific

Parameter:	W_{PmR}
Description:	Average width of permanent roads
Data unit:	m
Source of data:	Field sampling by forestry concessionaire
Frequency of monitoring/recording:	Annually
Monitoring equipment:	*GPS and measurement tape*
Quality Assurance/Quality Control procedures to be applied:	Training to forestry staff Precise measurement protocols
Identification of sources of uncertainty for this parameter	GPS Measurement mistakes
Process for managing and reducing uncertainty associated with this parameter	Appropriate sample size Uncertainty assessment
Any comment:	Concession-specific

Parameter:	W_{PR}
Description:	Average width of primary roads
Data unit:	m
Source of data:	Field sampling by forestry concessionaire
Frequency of monitoring/recording:	Annually
Monitoring equipment:	*GPS and measurement tape*
Quality Assurance/Quality Control procedures to be applied:	Training to forestry staff Precise measurement protocols
Identification of sources of uncertainty for this parameter	GPS Measurement mistakes
Process for managing and reducing uncertainty associated with this parameter	Appropriate sample size Uncertainty assessment
Any comment:	Concession-specific

Parameter:	W_{SR}
Description:	Average width of secondary roads
Data unit:	m
Source of data:	Field sampling by forestry concessionaire
Frequency of monitoring/recording:	Annually

Monitoring equipment:	*GPS and measurement tape*
Quality Assurance/Quality Control procedures to be applied:	Training to forestry staff Precise measurement protocols
Identification of sources of uncertainty for this parameter	GPS Measurement mistakes
Process for managing and reducing uncertainty associated with this parameter	Appropriate sample size Uncertainty assessment
Any comment:	Concession-specific

Parameter:	W_{SCR}
Description:	Average width of sub-canopy roads
Data unit:	m
Source of data:	Field sampling by forestry concessionaire
Frequency of monitoring/recording:	Annually
Monitoring equipment:	*GPS and measurement tape*
Quality Assurance/Quality Control procedures to be applied:	Training to forestry staff Precise measurement protocols
Identification of sources of uncertainty for this parameter	GPS Measurement mistakes
Process for managing and reducing uncertainty associated with this parameter	Appropriate sample size Uncertainty assessment
Any comment:	Concession-specific

Parameter:	W_{SKID}
Description:	Average width of skidtrails
Data unit:	m
Source of data:	Field sampling by forestry concessionaire
Frequency of monitoring/recording:	Annually
Monitoring equipment:	*GPS and measurement tape*
Quality Assurance/Quality Control procedures to be applied:	Training to forestry staff Precise measurement protocols
Identification of sources of uncertainty for this parameter	GPS Measurement mistakes
Process for managing and reducing uncertainty associated with this parameter	Appropriate sample size Uncertainty assessment
Any comment:	Concession-specific

Parameter:	W_{SS-PR}
Description:	Average width of solar strips along primary roads
Data unit:	m
Source of data:	Field sampling by forestry concessionaire
Frequency of monitoring/recording:	Annually
Monitoring equipment:	*GPS and measurement tape*
Quality Assurance/Quality Control procedures to be applied:	Training to forestry staff Precise measurement protocols
Identification of sources of uncertainty for this parameter	GPS Measurement mistakes
Process for managing and reducing uncertainty associated with this parameter	Appropriate sample size Uncertainty assessment
Any comment:	Concession-specific

Parameter:	W_{SS-SR}
Description:	Average width of solar strips along secondary roads
Data unit:	m
Source of data:	Field sampling by forestry concessionaire
Frequency of monitoring/recording:	Annually
Monitoring equipment:	*GPS and measurement tape*
Quality Assurance/Quality Control procedures to be applied:	Training to forestry staff Precise measurement protocols
Identification of sources of uncertainty for this parameter	GPS Measurement mistakes
Process for managing and reducing uncertainty associated with this parameter	Appropriate sample size Uncertainty assessment
Any comment:	Concession-specific

Parameter:	$P_{trees,DBH>30cm}$
Description:	Fraction of trees with a DBH>30 cm remaining on solar strips per unit area of exploited concession area
Data unit:	%
Source of data:	Field sampling by forestry concessionaire
Frequency of monitoring/recording:	Annually
Monitoring equipment:	*Measurement tape*
Quality Assurance/Quality Control	Training to forestry staff

procedures to be applied:	Precise measurement protocols
Identification of sources of uncertainty for this parameter	Measurement mistakes
Process for managing and reducing uncertainty associated with this parameter	Appropriate sample size Uncertainty assessment
Any comment:	Concession-specific

Parameter:	A_{LL}
Description:	Average area of log landings
Data unit:	m²
Source of data:	Field sampling by forestry concessionaire
Frequency of monitoring/recording:	Annually
Monitoring equipment:	*Measurement tape or GPS*
Quality Assurance/Quality Control procedures to be applied:	Training to forestry staff Precise measurement protocols
Identification of sources of uncertainty for this parameter	GPS Measurement mistakes
Process for managing and reducing uncertainty associated with this parameter	Appropriate sample size Uncertainty assessment
Any comment:	Concession-specific

Parameter:	N_{LL}
Description:	Average number of log landings per unit area of exploited concession area
Data unit:	N°/ha
Source of data:	Field sampling by forestry concessionaire
Frequency of monitoring/recording:	Annually
Monitoring equipment:	*None*
Quality Assurance/Quality Control procedures to be applied:	Training to forestry staff Precise measurement protocols
Identification of sources of uncertainty for this parameter	Measurement mistakes
Process for managing and reducing uncertainty associated with this parameter	Appropriate sample size Uncertainty assessment
Any comment:	Concession-specific

Parameter:	F_{RSD}

Description:	Residual stand damage factor
Data unit:	dimensionless
Source of data:	Field sampling by third party, supported through forestry concessionaire
Frequency of monitoring/recording:	Annually
Monitoring equipment:	*None*
Quality Assurance/Quality Control procedures to be applied:	Tendering to qualified firm Precise measurement protocols
Identification of sources of uncertainty for this parameter	Measurement mistakes
Process for managing and reducing uncertainty associated with this parameter	Appropriate sample size Uncertainty assessment
Any comment:	Concession-specific

Parameter:	F_{AT}
Description:	Factor for abandoned timber
Data unit:	dimensionless
Source of data:	Records of forestry concessionaire
Frequency of monitoring/recording:	Annually
Monitoring equipment:	*None*
Quality Assurance/Quality Control procedures to be applied:	
Identification of sources of uncertainty for this parameter	Measurement mistakes
Process for managing and reducing uncertainty associated with this parameter	Uncertainty assessment
Any comment:	Concession-specific

Annex 30 A/R monitoring parameters

Parameter:	$b_{TREE,i}$
Description:	Tree biomass per hectare in plot p of stratum i;
Data unit:	T d.m./ha
Source of data:	The biomass stock will be measured in accordance with the standards and procedures stipulated in CDM EB75, Annex 26, Appendix 1 (p24ff)
Frequency of monitoring/recording:	For each issuance, after the A/R sites qualify as forest
Monitoring equipment:	
Quality Assurance/Quality Control procedures to be applied:	The A/R areas will be monitored through remote sensing techniques. The carbon stocks will only be measured if the remote sensing analysis qualifies the A/R site as forest in compliance with DRC's definition of forest.
Identification of sources of uncertainty for this parameter	Variance of mean biomass stock in stratum I;
Process for managing and reducing uncertainty associated with this parameter	▪ Biomass plots of strata will be measured following CDM AR-tool 14, 'Estimation of Carbon Stocks and Change in Carbon Stocks of Trees and Shrubs in A/R CDM Project Activities'; ▪ Monitoring activities will be guided by a training manual.

Parameter:	A_i
Description:	Area of the Afforestation/ Reforestation Stratum i;
Data unit:	In hectare
Source of data:	The areas are identified in the course of community land use planning processes and are determined using GPS tracking devices. The resulting polygons will be submitted by communities/supporting NGOs to the Program.
Frequency of monitoring/recording:	Once
Monitoring equipment:	GPS tracking device
Quality Assurance/Quality Control procedures to be applied:	The following QA/QC procedures apply: ▪ The A/R area shall be approved as such through the TA ▪ Prior to accepting the A/R area for carbon stock removals, the ER program will verify that the area does not qualify as forest with reference to the forest area benchmark map. ▪ Prior to accepting the A/R area for carbon stock removals, the ER Program will verify that the area does not qualify as wetland.
Identification of sources of uncertainty for this parameter	N.A.
Process for managing and reducing uncertainty associated with this parameter	N.A.

Annex 31 UNDEF Adjustment monitoring parameters

Parameter:	Rural Population
Description:	Rural population in the Main Ndombe Province
Data unit:	in 1,000 persons
Source of data:	FAOSTAT, Rodriguez et al. 2014
Frequency of monitoring/recording:	Biennale
Monitoring equipment:	N.a.
Quality Assurance/Quality Control procedures to be applied:	N.a.
Identification of sources of uncertainty for this parameter	N.A.
Process for managing and reducing uncertainty associated with this parameter	N.A.
Any comment:	N.a.

Parameter:	Oil palm production
Description:	Oil palm production
Data unit:	in t
Source of data:	FAOSTAT, Rodriguez et al. 2014
Frequency of monitoring/recording:	biennale
Monitoring equipment:	n.a.
Quality Assurance/Quality Control procedures to be applied:	n.a.
Identification of sources of uncertainty for this parameter	N.A.
Process for managing and reducing uncertainty associated with this parameter	N.A.
Any comment:	n.a.

Annex 32 Uncertainty analysis of UNDEF/UNDEG

OSFAC's accuracy assessment provided the results summarized in the table below.

Table 54 Confusion Matrix established by OSFAC (2015)

	DEG	NC	PREG	SREG	PDEF	SDEF	Total	User's accuracy	Area (ha)	Proportion of Map Area by Class W_i
DEG	27	17	1	1	1	3	50	54,0%	2 635 060	21,54%
NC	1	44	2	1	0	2	50	88,0%	7 074 198	57,82%
PREG	2	14	29	1	1	3	50	58,0%	806 290	6,59%
SREG	4	33	1	11	0	1	50	22,0%	176 665	1,44%
PDEF	10	8	0	0	28	4	50	56,0%	397 690	3,25%
SDEF	2	10	0	0	2	36	50	72,0%	1 144 050	9,35%
Total	46	126	33	14	32	49	300		12 233 953	100,00%
Producer's accuracy	58,7%	35%	88%	79%	88%	73%				

Table 55 : Calculation of the Stratified Estimator (pij) and area based on the reference classification

	DEG	NC	PREG	SREG	PDEF	SDEF	Total	User's accuracy	
DEG	11,63%	7,32%	0,43%	0,43%	0,43%	1,29%	21,54%	54,0%	
NC	1,16%	50,89%	2,31%	1,16%	0,00%	2,31%	57,82%	88,0%	
PREG	0,26%	1,85%	3,82%	0,13%	0,13%	0,40%	6,59%	58,0%	
SREG	0,12%	0,95%	0,03%	0,32%	0,00%	0,03%	1,44%	22,0%	
PDEF	0,65%	0,52%	0,00%	0,00%	1,82%	0,26%	3,25%	56,0%	
SDEF	0,37%	1,87%	0,00%	0,00%	0,37%	6,73%	9,35%	72,0%	
Total	14,19%	63,40%	6,60%	2,04%	2,76%	11,02%	100,00%		
Producer's accuracy	82,0%	80%	58%	16%	66%	61%			
Area based on the reference classification (Aj)	1 736 101	7 756 015	806 851	249 177	337 295	1 348 513		Overall accuracy	75%

Table 56: Calculation of the standard error and 90% confidence interval

Standard Error S(pj)							
	DEG	NC	PREG	SREG	PDEF	SDEF	Total
DEG	0,024%	0,021%	0,002%	0,002%	0,002%	0,005%	0,06%
NC	0,013%	0,072%	0,026%	0,013%	0,000%	0,026%	0,15%
PREG	0,000%	0,002%	0,002%	0,000%	0,000%	0,000%	0,01%
SREG	0,000%	0,000%	0,000%	0,000%	0,000%	0,000%	0,00%
PDEF	0,000%	0,000%	0,000%	0,000%	0,001%	0,000%	0,00%
SDEF	0,001%	0,003%	0,000%	0,000%	0,001%	0,004%	0,01%
Standard Error of Area Estimate S(pj)	1,96%	3,14%	1,74%	1,24%	0,57%	1,89%	4,71%
Standard error of the error-adjusted estimated (Aj)	239 407	383 633	212 697	152 199	69 703	231 503	
90% Confidence Interval	± 395 009	± 632 975	± 350 940	± 251 120	± 115 006	± 381 969	
Adjusted area (ha)	1 736 101	7 756 015	806 851	249 177	337 295	#######	
Relative uncertainty (U)	23%	8%	43%	101%	34%	28%	
Estimated area (ha)	2 635 060	7 074 198	806 290	176 665	397 690	1 144 050	
Within Confidence Interval?	NO	NO	YES	YES	YES	YES	

	z value
CI 90%	1,650

Annex 33 Uncertainty analysis of PDEG

This Annex present the aggregated relative uncertainty for the major emission and removal categories related to the historical $PDEG_{REL}$ as well as the relative importance of each category in terms of % of total emissions and removals. The table is color-coded to highlight where the ER Program could invest to reduce uncertainty, provided the cost-benefit is positive.

The coding was attributed as follows:

- An emission / removal category marked in white indicates that no action is required, as the contribution to emissions / removals of the category is either <5% and/or the relative uncertainty is <15%.
- An emission / removal category marked in yellow indicates that action to improve the estimate should be considered, as the contribution to emissions / removals is >5% <10% and the relative uncertainty is >15%<25%.
- An emission / removal category marked in orange indicates that action to improve the estimate should be taken, as the contribution to emissions / removals is >10% and the relative uncertainty is >25%.

Following this logic, the ER Program will strive to improve the uncertainty related to emissions from solar strips along secondary roads and log landings, as well as removals from regrowth at felling sites.

. Total uncertainty for the total adjusted REL_{PDEG} is estimated at ± 991,764 tCO_2 or ± 6.30%

Table 57: Relative uncertainty and relative importance of each emissions / removal category for the historical REL_{PDEG}

Emission / Removal category	Relative importance [% of total Emissions]	Relative uncertainty
Permanent Roads	0.4%	18%
Solar strips permanent roads	0.6%	57%
Primary roads	2.1%	19%
Solar strips primary roads	4.0%	21%
Secondary roads	4.2%	19%
Solar strips secondary roads	7.1%	19%
Subcanopy roads	0.7%	23%
Skidtrails	4.4%	24%
Log landings	10.9%	48%
Logging slash	27.1%	9%
Residual stand damage	32.7%	50%
Abandoned timber	2.2%	101%
Wood waste	3.6%	18%
Short-lived fraction in HWP	5.3%	10%
Additional oxidized fractions in HWP	8.4%	13%
Regrowth primary roads	0.0%	62%
Regrowth secondary roads	0.1%	62%
Regrowth solar strips primary roads	0.3%	63%
Regrowth solar strips secondary roads	0.4%	62%
Regrowth solar strips permanent roads	0.0%	86%

Regrowth skidtrails	1.9%	63%
Regrowth Subcanopy roads	0.0%	63%
Regrowth log landings	0.5%	77%
Regrowth felling sites	6.6%	67%

Total uncertainty for the total historical REL_{PDEG} (2004-2014) is estimated at ± 424,079 tCO_2 or ± 6.02%

For the adjusted REL_{PDEG}, the picture looks slightly different, , see the table below

Table 58: Relative uncertainty and relative importance of each emissions / removal category for the adjusted REL_{PDEG}

Emission / Removal category	Relative importance [% of total Emissions]	Relative uncertainty
Permanent Roads	0.3%	52%
Solar strips permanent roads	0.4%	79%
Primary roads	3.7%	53%
Solar strips primary roads	7.1%	53%
Secondary roads	3.5%	53%
Solar strips secondary roads	5.5%	53%
Subcanopy roads	0.0%	54%
Skidtrails	3.7%	55%
Log landings	10.4%	70%
Logging slash	24.6%	41%
Residual stand damage	29.7%	71%
Abandoned timber	2.0%	113%
Wood waste	3.2%	53%
Short-lived fraction in HWP	1.5%	36%
Additional oxidized fractions in HWP	7.6%	38%
Regrowth primary roads	0.0%	79%
Regrowth secondary roads	0.0%	79%
Regrowth solar strips primary roads	0.1%	79%
Regrowth solar strips secondary roads	0.2%	79%
Regrowth solar strips permanent roads	0.0%	99%
Regrowth skidtrails	0.6%	80%
Regrowth Subcanopy roads	0.0%	80%
Regrowth log landings	0.2%	92%
Regrowth felling sites	1.9%	83%